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SUMMARY

Final Supplemental Environmental Impact Statement

Deep Vegetation Management Project

Paulina Ranger District, Ochoco National Forest
Crook and Wheeler Counties, Oregon

Deep Vegetation Management Project
Final Enviornmental Impact Statement
Crook and Wheeler Counties, Oregon

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Abstract: This Final Supplement to the Environmental Impact Statement F(SEIS) has been prepared in response to the need to manage vegetation in the Deep Creek Watershed in a manner that improves vegetative diversity, reduces the current fire hazard, improves the amount of shade producing vegetation and large woody material for streams, and reduces sedimentation from roads. The FSEIS presents and analyzes four alternatives and discusses the short and long-term environmental effects of each alternative. Alternative C, with an emphasis on improving landscape-level health, resiliency, and diversity of upland forests and riparian communities, while improving water quality conditions, is the preferred alternative. The key issues studied in this FSEIS are impacts to water quality and fish habitat, vegetative diversity, and fire hazard and fuels. Additional issues that are analyzed are based upon public and agency comments received during the scoping process.

Notice:

The SEIS Interdisciplinary Team analyzed information acquired during the review of the Draft SEIS, and updated information is contained in this Final SEIS. Summaries of all substantive comments, as well as responses to those comments, are included in Appendix C of this Final SEIS.

Contents

Summary

Introduction

The Paulina Ranger District-Ochoco National Forest proposes to improve forest conditions by moving the upland forests closer to historic conditions, promoting the development of LOS, reducing stand densities and reducing the risk of fire. The District also proposes to improve riparian conditions and water quality through restoration and enhancement projects in riparian and meadow systems and reduction of sedimentation from existing roads. The project area coincides with the Deep Creek Watershed, located in Crook and Wheeler Counties, Central Oregon (see Figure S-1 Project Location). The project area encompasses approximately 54,546 acres of National Forest System lands, and 822 acres of private land.

A Final Environmental Impact Statement and Record of Decision were issued in September 2001 for the Deep project. That decision was withdrawn. In order to incorporate additional information on the effects of the proposed alternatives and to provide for an additional public comment period, the Forest Supervisor decided to prepare a Supplemental EIS. Based on comments received on the Draft SEIS, numerous corrections and clarifications were made to the Final SEIS.

This Final Supplemental Environmental Impact Statement assesses three action alternatives for meeting the project goals. Alternative C, with an emphasis on addressing watershed concerns while improving forest conditions, is the preferred Alternative.

The Purpose and Need

The need for the proposed action is based on information and conclusions regarding forest and watershed conditions described in the Deep Creek Watershed Analysis. This assessment indicates that a number of vegetation conditions are outside the range of historic variability. The Deep Creek Water Quality Restoration Plan and the Deep Creek Roads Analysis provide more information on the existing situation in the watershed and recommendations for improving riparian conditions and water quality. These watershed-scale assessments show a connection between the road network, stream and riparian network, and the vegetation.

The purpose of the proposed action is to:

- Move the landscape-level diversity of vegetation and associated wildlife habitat closer to the Historic Range of Variability (HRV) in terms of species composition, stand density, and structure.
- Increase the amount of single strata late and old structure (LOS) stands and move the amount of LOS closer to the HRV.
- Reduce the forest’s susceptibility to moderate and high severity fires by reducing fuels levels, lowering stand densities, and re-introducing fire into the watershed.
- Reduce the forest’s susceptibility to insects, diseases, and wildfires by reducing stocking levels.

- Enhance vegetative conditions in the aspen, riparian, upland shrub, and meadow communities.
- Improve water quality and enhance the vegetation aspect of aquatic/riparian areas to provide for long-term sustainability of resident and anadromous fisheries by reducing stream temperatures and lowering sedimentation.

The need for the proposed action is demonstrated by the following conditions and trends:

- **Forest vegetation is outside the historic range of variability for 57% of the seral/structural stages in the watershed.**

  The development of multi-strata stands and increases in late seral species composition has altered the overall appearance and condition of the landscape. The exclusion of fire as a natural disturbance mechanism and past harvest practices have contributed to these changes.

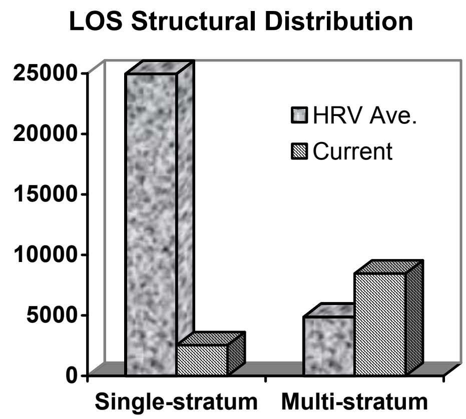

Figure S-2. There is currently a large deficiency in the amount of single-strata LOS stands. The existing LOS is predominately multi-strata, which is above the HRV.

- **Larger areas of the forest are susceptible to stand replacing wildfire where the potential for effects to resources would be outside natural ranges.**

  The amount and arrangement of fuels on nearly 75% of the forested area in the watershed are classified as a medium to high hazard to wildfire. Increased stocking levels, ladder fuels, and fire intolerant species are the result of fire exclusion.

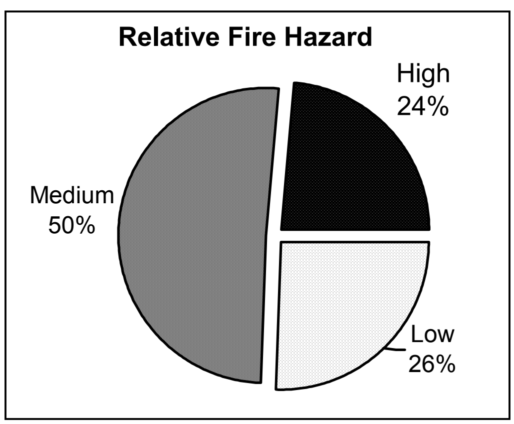

Figure S-3. Nearly 75% of the forested landscape is currently rated as medium to high hazard. Fire hazard is the combination of vegetation type, fuel arrangement, fuel abundance, and location that leads to a relative threat of wildfire ignition, spread, and difficulty to control.

- **Larger areas of the forest are susceptible to insects and diseases.**

  Also as a result of the exclusion of fire, increases in stand density in the watershed have led to 36% of the forested lands to be rated as high priority for density reduction due to the potential for competition-related mortality and mortality due to insects or disease. The risk of stand replacement fire is also higher in these areas because of the density of stems and crowns.

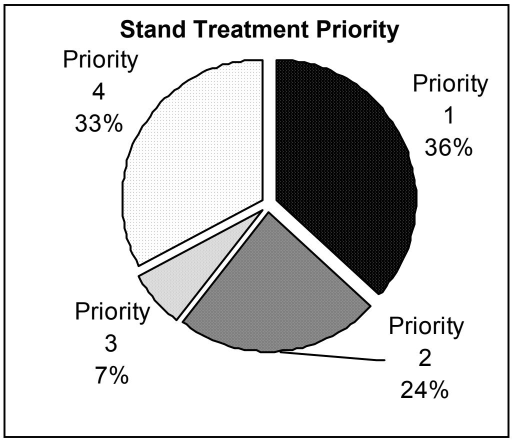

Figure S-4. Approximately 36 % of the forested stands are at densities in the upper third of their site potential. These stands are at an elevated risk of competition-related mortality, increased insect activity, and disease impacts. These are considered Priority 1 for treatment needs.

- **Aspen, riparian, upland shrub, and meadow communities have gradually declined over time.**

  These plant communities were once more abundant across the watershed. Fire suppression, conifer encroachment, changes to the hydrologic patterns, and browsing and grazing have contributed to this trend. These components of the watershed are important to the restoration of forest conditions and water quality, and provide habitat to a host of wildlife species.

- **Water quality and riparian and aquatic habitats have been degraded from conditions that existed in the past.**

  Ten streams within the planning area are considered water-quality impaired by the Oregon Department of Environmental Quality (ODEQ). Stream temperatures are exceeding ODEQ standards and some fish habitat elements are in a state of unsatisfactory condition because of a lack of shade along the streams, large woody material in the streams, and increased width to depth ratios.

  Many roads lack adequate drainage structures and most are native surfaces. Many culverts in the watershed are undersized. Road conditions and some dispersed recreation campsites result in sediment delivery to streams.

The Proposed Action

The proposed action is discussed in detail in ***Chapter 2: Description of Alternatives*** in the FSEIS. It is analyzed throughout the FSEIS as Alternative B. The proposed action includes the following activities:

- Forest vegetation treatment using commercial timber harvest on 7,112 acres, harvesting approximately 16.7 MMBF of timber.
- Activity fuels treatments by underburning (5,104 acres), jackpot burning (875 acres), grapple piling (500 acres), broadcast burning for site preparation (484 acres), and leave tops attached followed by grapple piling or jackpot burning (151 acres).
- Precommercial thinning within harvest units on 6,615 acres; and outside harvest units on 3,550 acres.
- Reintroduction of fire on approximately 20,692 acres by natural fuels reduction (11,661 acres), jackpot burning (692 acres), wildlife burning to increase forage and reduce juniper densities (8,339 acres).
- Riparian planting and seedling protection on 28 miles of stream.
- Large woody material placement along 5.5 miles of stream.
- Riparian protection through closure or rehabilitation of six dispersed recreation sites.
- Aspen enhancement on 77 acres.
- Reduction of conifer encroachment in 825 acres of meadow habitat.
- Replacement of 7 culverts.
- Construction of 1.8 miles of road; reconstruction or betterment of 24.4 miles, temporary construction of 9.3 miles; inactivation of 9.2 miles, and decommissioning of 11.7 miles.

The Issues

In determining the relevant issues relating to the proposed action, the Interdisciplinary Team reviewed public and agency comments generated during the scoping process. Pertinent comments from these sources, information from past environmental documents, and internal scoping were used to develop the list of key issues to be studies in detail. The key issues were used to formulate the alternatives to the proposed action. This information is summarized from ***Chapter 1: Purpose and Need, and Chapter 3: Affected environment.***

Water Quality and Fish Habitat

Ten streams within the Deep Creek Watershed are listed as impaired under section 303(d) of the Clean Water Act because they exceed stream temperature standards. Eight of these are also listed because of habitat modification. Factors that affect stream temperatures include shading, channel form, and water table interaction. Management actions have the potential to exhibit some positive or negative effect on water quality and subsequently affect associated fish habitat.

Vegetative Diversity

The Deep Planning Area has gone a gradual shift in species composition, stand structure, canopy density, and understory species diversity. Active fire suppression has contributed to increased stand densities, loss of grasses and forbs in the understory, increases of grand fir in understories, and the expansion of juniper and pine composition in transition zones. Management activities can change the processes and structural components contributing to both stand-level and landscape-level diversity.

Fire Hazard and Fuels

The amount of area that is currently susceptible to higher severity fire has increased as a result of changes in the abundance and continuity of fuels. Fire hazard and fuel levels are at moderate to high levels on 75% of the planning area. The proposed action includes mechanical vegetation treatments, activity fuels reduction, and prescribed burning to emulate the natural disturbance of fire and its influence on vegetation, while reducing the risk of potential wildfire effects.

The Alternatives

This section describes each of the four alternatives that were analyzed in detail. This provides a summary of the information contained in ***Chapter 2: Description of Alternatives*** of the FSEIS. Table S-1 displays the management activities proposed under each alternative. Alternatives were developed to provide the decision maker a range of options for meeting the purpose and need while addressing the key issues.

Alternative A (No Action)

This alternative is required by regulation and provides a baseline against which impacts of the various action alternatives can be measured and compared. Under this alternative, no management activities proposed in this document would occur. Ongoing activities such as recreation, normal road maintenance, and fire suppression would continue. Management activities resulting from previous environmental documents would still occur.

Alternative B (Proposed Action)

The Proposed Action is a mix of vegetation and fuel treatments. Thinning treatments will focus on stands with dense, small-sized trees and relatively high percentages of mid and late seral species. Stand densities will be reduced while the composition of species and quality of tree are improved. Prescribed burning of natural fuels is proposed over large areas of the watershed to reduce fuel levels and to move the watershed closer to historic fire regimes.

Alternative C

This Alternative was developed to respond to comments and concerns received on the Preferred Alternative identified in the DEIS issued in April of 2001. It incorporates actions that are designed to address the key issues of water quality and fish habitat. It further reduces the potential for effects from sedimentation and peak flows by not entering some units and adjusting the boundaries of others. The amount of prescribed fire for natural fuels reduction and forage enhancement is greatly reduced from the proposed action. Additional road closures and decommissioning are included. More placement of large woody material, and another culvert replacement are included in this alternative to address the water quality issue and improve watershed conditions.

Alternative D

This alternative emphasizes limiting the potential for effects to streams. The amount, location, and access to proposed activities in relation to streams were reviewed, and the following changes made to the proposed action: no commercial harvest within the Riparian Habitat

Conservation Areas (RHCAs) would take place (24 acres of commercial harvest are proposed in Alternatives B and C); this alternative treats the fewest individual units and acres, proposes the least PCT, modifies proposed boundaries of treatment areas, has less treatment adjacent to RHCA habitat, and has less road development than the other alternatives.

Table S-1 Summary of Proposed Management Activities for all Alternatives

Treatments	Alternative A	Alternative B	Alternative C	Alternative D
Timber Harvest				
Acres Treated by Silvicultural Prescription				
Improvement Harvest[1]	0	5,906	5,688	4,120
Commercial Thinning	0	713	562	779
Group Selection[2]	0	327	58	184
Clearcut w/Reserves[2]	0	86	60	59
Shelterwood[2]	0	69	14	14
Sanitation[3]	0	11	11	11
Total Acres Timber Harvest	0	7,112	6,393	5,167
Logging System (acres)				
Tractor	0	4,206	3,754	3,244
Winter Logging	0	1,601	1,329	1,031
Helicopter	0	1,050	1,310	892
Skyline	0	255	0	0
Harvest Volume by Logging System (MMBF)				
Tractor	0	8.4	8.1	7.3
Tractor – Winter	0	5.2	2.9	2.4
Helicopter	0	2.5	2.8	1.8
Skyline	0	0.6	0	0
Total Harvest Volume (MMBF)	0	16.7	13.8	11.5
Precommercial Thinning				
Inside harvest units	0	6,615	6,285	4,895
Outside harvest units	0	3,550	3,757	2,007
RHCA Conifer Treatments				
Commercial Harvest (acres)	0	24	24	0
Precommercial Thinning	0	354	354	202
Road Management				
Road Construction (miles)	0	1.8	1.1	0
Road Reconstruction	0	24.4	23.9	22.7
Temporary Roads	0	9.3	5.9	7.8
Road Closure	0	9.2	16.2	9.2
Road Decommissioning	0	11.7	15.2	11.7

Treatments	Alternative A	Alternative B	Alternative C	Alternative D
Fuels Reduction				
Fuel Treatment within Harvest Areas (acres):				
Broadcast Burn	0	482	132	257
Grapple Pile	0	500	768	665
Jackpot Burn	0	875	1,534	1,284
Leave-tops-attached/Grapple	0	141	10	10
Leave-tops-attached/Jackpot	0	10	0	0
Underburn	0	5,104	3,067	2,951
Total Fuels Treatment within Harvest Units	0	7,112	5,511	5,167
Prescribed Fire Objectives (acres)				
Natural Fuels Burning	0	11,661	4,192	3,293
Forage Enhancement/Juniper Encroachment	0	8,339	4,549	5,183
Jackpot Burning for Fuel Break	0	692	0	0
Total Prescribed Fire	0	20,692	8,741	8,476
Vegetation & Watershed Enhancement				
Riparian Planting (miles)	0	28	28	28
Meadow Enhancement (acres)	0	825	825	825
Dispersed Rec. Site Rehabilitation (sites)	0	6	6	6
Aspen Stand Enhancement (acres)	0	77	81	77
Large Woody Material Placement (miles)	0	5.5	7.4	5.5
Culvert Replacement	0	7	8	7
Willow Protection (sites)	0	1	1	1
Willow Enhancement (sites)	0	0	1	0
Mountain Mahogany Enhancement (acres)	0	0	16	0
Road Closure (miles)	0	9.2	16.2	9.2
Road Decommissioning (miles)	0	11.7	15.2	11.7

[1] Improvement cutting is considered an intermediate thinning treatment.
[2] Regeneration harvest treatment.
[3] Sanitation harvest is for the purpose of reducing the spread of damaging insects and protecting the residual stand.

Alternatives Considered But Not Given Detailed Study

An alternative was considered that would not have included any commercial harvest activity. Upland vegetation management activities would have been accomplished primarily through precommercial thinning and prescribed burning. Watershed improvement projects would be included. This alternative meets only a portion of the objectives. It would not do enough to address the overstocking in high priority stands. It would do little to promote additional LOS development, would not address the need to reduce insect and disease risk, would do little in terms of developing single strata LOS stands and would not meet he objective of providing timber to the local economy. See FSEIS Chapter 1, pages 1-3 through 1-7 for discussion of the purpose and need of the project.

The Preferred Alternative

Alternative C is the Agency preferred alternative.

Comparison of the Effects of the Alternatives

Summary of Effects

The following table summarizes the information from ***Chapter 4: Environmental Consequences***, and displays the effects of each alternative in relation to the key issues.

Table S-2. Summary of Effects by Key Issue and Alternative

Key Issue	Alternative A No Action	Alternative B Proposed Action	Alternative C	Alternative D
WATER QUALITY & FISH HABITAT				
Stream Temperature	Increase in large woody material (LWM) due to mortality in streamside stands. Higher potential for catastrophic wildfire potentially resulting in loss of stream shading. Current temperature regimes expected to be maintained. Long-term (decades). Movement toward water quality standards or site potential would be minimal or on small localized scales.	Thinning prescriptions in RHCAs would promote future shade and LWM recruitment to streams. No-treatment buffers within RHCAs will prevent loss of existing shade. 24 acres commercial thinning in RHCAs; 354 acres PCT in RHCAs. Natural fuels treatments on 1,684 acres of RHCAs. Increased stream shading, fish habitat, and bank stability through riparian planting (28 miles) and LWM placement (5.5 miles). Enhanced stream shading in the long term would result from aspen stand treatments on 77 acres Most risk of reducing stream shade on localized stream reaches from aspen, precommercial thinning, and prescribed fire. Design elements will reduce this risk. This alternative does the most for reducing the risk of catastrophic fire effects to riparian habitats. Monitoring would ensure meeting objective of maintaining existing shade. ***Stream temperatures are not expected to increase over the long term (1-5 years).***	Thinning prescriptions in RHCAs would promote future shade and LWM recruitment to streams. No-treatment buffers within RHCAs will prevent loss of existing shade. 24 acres commercial thinning in RHCAs; 354 acres PCT in RHCAs. Natural fuels treatments on 612 acres of RHCAs. Increased stream shading, fish habitat, and bank stability through riparian planting (28 miles) and LWM placement (7.4 miles). Enhanced stream shading in the long term would result from aspen stand treatments on 81 acres. Less risk of reducing stream shade from aspen, precommercial thinning and prescribed fire than Alt. B. Fewer acres treated to reduce the risk of catastrophic fire effects to riparian habitats. Monitoring would ensure meeting objective of maintaining existing shade. ***Stream temperatures are not expected to increase over the long term (1-5 years).***	No commercial thinning in RHCAs except for aspen treatments; 354 acres PCT in RHCAs. Precommercial thinning prescriptions would promote future shade and LWM recruitment to streams. No-treatment buffers within RHCAs will prevent loss of existing shade. Natural fuels treatments on 587 acres of RHCAs. Increased stream shading, fish habitat, and bank stability through riparian planting (28 miles) and LWM placement (5.5 miles). Enhanced stream shading in the long term would result from aspen stand treatments on 77 acres. Similar to Alt. C for risk of reducing stream shade on localized stream reaches from aspen, precommercial thinning, and prescribed fire. Alt. C does the least to reduce the risk of catastrophic fire effects to riparian habitat. Monitoring would ensure meeting objective of maintaining existing shade. ***Stream temperatures are not expected to increase over the long term (1-5 years).***
Sedimentation	No direct increase in sediment input from any vegetation, fuels, or roading actions. Higher potential for catastrophic wildfire, which could result in an increase in sediment.	Prescribed burning on 2,163 acres of RHCA would lower the risk of sedimentation effects from moderate to high intensity fires. Riparian planting (28 miles) would increase root strength and improve bank stability. LWM placement on 5.5 miles would improve bank stability. Aspen treatments (77 acres) would improve channel stability and enhance	Prescribed burning on 612 acres of RHCA would lower the risk of sedimentation effects from moderate to high intensity fires. Riparian planting (28 miles) would increase root strength and improve bank stability. LWM placement on 7.4 miles would improve bank stability. Aspen treatments (81 acres) would improve channel stability	Prescribed burning on 776 acres of RHCA would lower the risk of sedimentation effects from moderate to high intensity fires. Riparian planting (28 miles) would increase root strength and improve bank stability. LWM placement on 5.5 miles would improve bank stability. Aspen treatments (77 acres) would improve channel stability

Table S-2. Summary of Effects by Key Issue and Alternative

Key Issue	Alternative A No Action	Alternative B Proposed Action	Alternative C	Alternative D
	Continued sediment delivery from existing roads and stream crossings, past harvest practices, and livestock in riparian zones.	water table interactions. Meadow enhancement on 825 acres would increase water table interaction, stimulate grasses, sedges, and rushes to improve bank stability. Dispersed recreation site restoration at six sites would reduce compaction, sediment, and runoff. Road obliteration and inactivation on 20.9 miles. Road restoration would reduce sediment production and delivery to streams. Road construction (1.8 miles), reconstruction (24.4 miles) and temporary roads (9.3) miles may increase sedimentation in the short-term. Design elements and BMPs will minimize sediment. 7 culvert replacements will have short-term moderate increase in local sedimentation. ***Overall potential for higher levels of sediment to be produced from timber harvest, roads, and prescribed fire. Least likely to meet State Water Quality Standards and INFISH direction.***	and enhance water table interactions. Meadow enhancement on 825 acres would increase water table interaction, stimulate grasses, sedges, and rushes to improve bank stability. Dispersed recreation site restoration at six sites would reduce compaction, sediment, and runoff. Road obliteration and inactivation on 31.4 miles. Road restoration would reduce sediment production and delivery to streams more than Alts. B and D. Road construction (1.1 miles), reconstruction (23.9 miles) and temporary roads (5.9) miles may increase sedimentation in the short-term. Design elements and BMPs will minimize sediment. 8 culvert replacements will have short-term moderate increase in local sedimentation. ***Less overall potential for sediment production than Alt. B. would meet State Water Quality Standards and INFISH direction.***	and enhance water table interactions. Meadow enhancement on 825 acres would increase water table interaction, stimulate grasses, sedges, and rushes to improve bank stability. Dispersed recreation site restoration at six sites would reduce compaction, sediment, and runoff. Road obliteration and inactivation on 20.9 miles. Road restoration would reduce sediment production and delivery to streams the same amount as Alt. B. No new road construction. Road reconstruction (22.7 miles), and temporary roads (7.8) miles may increase sedimentation in the short-term. Design elements and BMPs will minimize sediment. 7 culvert replacements will have short-term moderate increase in local sedimentation. ***The least overall potential for sediment production. Would meet State Water Quality Standards and INFISH direction.***
Peak Flows	Continued decline in EHA values. Current range utilization, roads, and potential wildfire effects would offset hydrologic recovery.	Equivalent Harvest Acres (EHA) values remain below Forest Plan threshold levels for Deep Cr. Watershed. Potential for further negative adjustments in channel form (increased turbidity, loss of pools, increased width to depth ratios). Reduced effectiveness of watershed improvement projects. ***Highest risk to fish and aquatic habitats for a 5-year period between 2004 and 2009.***	Equivalent Harvest Acres (EHA) values remain below Forest Plan threshold levels. No measurable increases in peak flows are expected. Timing of sales will better address risk of increased flows. No expected acceleration channel degradation, low potential for undesired adjustments in width to depth ratios. Improved effectiveness of watershed improvement projects. ***Lowest risk to the fish and aquatic habitats.***	Equivalent Harvest Acres (EHA) values remain below Forest Plan threshold levels. Low potential for further negative adjustments in channel form (increased turbidity, loss of pools, increased width to depth ratios). Watershed improvement projects will be more effective than in Alt. B and are expected to offset this potential. ***Higher risk to fish and aquatic habitats than Alt. C, but lower than Alt. B.***

Table S-2. Summary of Effects by Key Issue and Alternative

Key Issue	Alternative A No Action	Alternative B Proposed Action	Alternative C	Alternative D
VEGETATIVE DIVERSITY				
Post-Treatment Seral/Structural Stage Distributions Relative to HRV	Continuation of current vegetation trends moving outside the HRV. Seral conditions would continue to move toward late seral stages; structural stages would continue to develop additional multi-canopy stands from single-story stands as understories continue to develop. ***43% of watershed within HRV. Proportion of the landscape outside HRV would continue to increase.***	482 acres regeneration harvest would change stand structure to open conditions and species to early seral. 6,630 acres intermediate harvest would move stands toward historic seral and structural conditions, favoring a greater abundance of early seral species and sing-story conditions. Precommercial thinning on 3,550 acres to reduce stand density and manage species composition. ***54% of the watershed within HRV. Increase the proportion of the watershed within HRV by 11%.***	131 acres regeneration harvest would change stand structure to open conditions and species to early seral. 6,620 acres intermediate harvest that would move stands toward historic seral and structural conditions, favoring a greater abundance of early seral species and sing-story conditions. Precommercial thinning on 3,757 acres to reduce stand density and manage species composition. ***52% of the watershed within HRV. Increases the proportion of the watershed within HRV by 9%.***	257 acres regeneration harvest would change stand structure to open conditions and species to early seral. 4,910 acres intermediate harvest to move stands toward historic seral and structural conditions, favoring a greater abundance of early seral species and single-story conditions. Precommercial thinning on 2,007 acres will reduce stand density and manage species composition. ***50% of the watershed within HRV. Increases the proportion of the watershed within HRV by*** 7%.
LOS Development	No treatments to promote accelerated LOS development or move current imbalance in LOS structure toward single-stratum conditions. Continued loss of single-stratum LOS. ***11,595 acres LOS projected in the watershed after 50 years.***	4,293 acres of LOS treated to reduce canopy layers, decrease ladder fuels, and reduce inter-tree competition. Susceptibility to wildfire, insects, and disease reduced and conditions moved towards HRV for single-stratum stands. 2,957 acres of high priority LOS treated. Reduction of fire hazard on 3,718 acres LOS. ***13,817 acres LOS projected in the watershed after 50 years.*** ***3,424 acres of multi-stratum LOS moved to single-stratum LOS, and towards HRV levels.***	3,315 acres of LOS treated to reduce canopy layers, decrease ladder fuels, and reduce inter-tree competition. Susceptibility to wildfire, insects, and disease reduced and conditions moved towards HRV for single-stratum stands. 1,792 acres of high priority LOS treated. Reduction of fire hazard on 2,909 acres LOS. ***14,050 acres LOS projected in the watershed after 50 years.*** ***2,365 acres of multi-stratum LOS moved to single-stratum LOS, and towards HRV levels.***	2,819 acres of LOS treated to reduce canopy layers, decrease ladder fuels, and reduce inter-tree competition. Susceptibility to wildfire, insects, and disease reduced and conditions moved towards HRV for single-stratum stands. 1,814 acres of high priority LOS stands treated. Reduction of fire hazard on 2,582 acres LOS. ***13,355 acres LOS project in the watershed after 50 years.*** ***2,191 acres of multi-stratum LOS moved to single-stratum LOS, and towards HRV levels.***
Treatment of High Risk Stands	No treatment of stands at high risk to mortality from competition-induced stress. Continuation of trends would lead to increased stand densities, eventually resulting	4,519 acres of high risk stands treated to reduce densities levels at a low to moderately low risk. 2,957 acres of high risk LOS stands treated to reduce susceptibility to insects,	3,134 acres of high risk stands treated to reduce densities levels at a low to moderately low risk. 1,792 acres of high risk LOS stands treated to reduce susceptibility to	2,842 acres of high risk stands treated to reduce densities levels at a low to moderately low risk. 1,814 acres of high risk LOS stands treated to reduce susceptibility to

Table S-2. Summary of Effects by Key Issue and Alternative

Key Issue	Alternative A No Action	Alternative B Proposed Action	Alternative C	Alternative D
	in higher levels of mortality. Increased mortality in high risk LOS stands. Long-term decline in large diameter ponderosa pine. Higher risk of stand-replacement fire events. ***No reduction in the amount of high risk stands.***	disease, and fire impacts. ***Largest reduction of acres of high-risk stands (32%).***	insects, disease, and fire impacts. ***Second greatest reduction of high-risk stands (22%)***	insects, disease, and fire impacts. ***Smallest reduction of high-risk stands (20%).***
Protection and Enhancement of Riparian and Upland Shrub Communities	No conifer treatments would be undertaken with RHCAs. Decline and degradation of riparian communities would continue. Conifer encroachment would increase and browsing would continue to hinder juvenile plant establishment. Continued degradation of upland shrub and hardwood habitat. Risk of catastrophic fire within RHCA would increase.	8 acres of commercial treatments within RHCAs will decrease adverse impacts from potential wildfire. 4 acres of commercial treatment to increase shade and LWM recruitment. 12 acres of commercial treatment to increase understory development and promote channel stability. Precommercial thinning on 354 acres to promote RMOs. No treatment of upland shrub communities. 1,760 acres treatment within potential upland shrub habitat. 77 acres of aspen treatments and 28 miles riparian hardwood planting. Meadow enhancement on 825 acres would increase understory riparian/wetland species.	8 acres of commercial treatments within RHCAs will decrease adverse impacts from potential wildfire. 4 acres of commercial treatment to increase shade and LWM recruitment. 12 acres of commercial treatment to increase understory development and promote channel stability. Precommercial thinning on 354 acres to promote RMOs. 16 acres of treatment of western juniper to maintain a healthy condition. 1,470 acres of treatment within potential upland shrub habitat. 81 acres of aspen treatments and 28 miles of riparian hardwood planting. Meadow enhancement on 825 acres would increase understory riparian/wetland species	No commercial treatments within RHCAs to decrease adverse impacts from potential wildfire, increase shade, or promote channel stability. Precommercial thinning on 202 acres to promote RMOs. No treatment of upland shrub communities. 1,470 acres of treatment within potential shrub habitat. 77 acres of aspen treatment and 28 miles of riparian hardwood planting. Meadow enhancement on 825 acres would increase understory riparian/wetland species
FIRE HAZARD AND FUELS				
Re-introduction of Fire	No prescribed burning would result from this Alternative. Continued accumulation of natural fuel levels. Increase in overall fuel abundance and continuity. ***No prescribed fire to reduce natural fuel concentrations, enhance forage or reduce***	Increased stand vigor, reduced fuel loading, and reduced risk of higher severity fire effects through prescribed burning on 20,692 acres. Prescribed burning for fuel reduction on 11,661 acres. Fuel continuity burning (jackpot) on 692 acres in north end of planning area to reduce intensity and spread of potential	Increased stand vigor, reduced fuel loading, and reduced risk of higher severity fire effects through prescribed burning on 8,741 acres. Prescribed burning for fuel reduction on 4,192 acres. No fuel continuity burning. 4,549 acres of forage enhancement/juniper encroachment burning.	Increased stand vigor, reduced fuel loading, and reduced risk of higher severity fire effects through prescribed burning on 8,476 acres. Prescribed burning for fuel reduction on 3,293 acres. No fuel continuity burning. 5,183 acres forage enhancement/juniper encroachment burning.

Table S-2. Summary of Effects by Key Issue and Alternative

Key Issue	Alternative A No Action	Alternative B Proposed Action	Alternative C	Alternative D
	juniper encroachment.	wildfire. ***Alt. B reduces natural fuel concentrations on more than twice the acres of Alts. C or D.***	***Slightly more prescribed burning than Alt. D, less than half the burning prescribed in Alt. B.***	***Least amount of treatments to address current fuel conditions and risk of wildfire.***
Reduction of Fire Hazard	No reduction in overall fire hazard or crown fire initiation. No reduction in ladder fuels.	Commercial harvest (5,525 acres), precommercial thinning (3,550 acres), aspen (77 acres) and meadow (825 acres) treatments, and natural fuels burning (20,692 acres) would all reduce the overall fire hazard within the watershed. Thinning from below will reduce vertical continuity of the fuels. Short-term increase in horizontal fuels. Jackpot burning would reduce larger concentrations of fuel. ***Greatest potential to reduce overall fire hazard in the long term.***	Commercial harvest (5,696 acres), precommercial thinning (3,757 acres), aspen (81 acres) and meadow (825 acres) treatments, and natural fuels burning (8,741 acres) would all reduce the overall fire hazard within the watershed, but at a smaller scale than Alt. B. Thinning from below will reduce vertical continuity of the fuels. Short-term increase in horizontal fuels. No jackpot burning to reduce larger concentrations of fuel. ***Second highest potential to reduce fire hazard across the landscape.***	Commercial harvest (5,525 acres), precommercial thinning (3,550 acres), aspen (77 acres) and meadow (825 acres) treatments, and natural fuels burning (8,476 acres) would all reduce the overall fire hazard within the watershed. Thinning from below will reduce vertical continuity of the fuels. Short-term increase in horizontal fuels. No jackpot burning to reduce larger concentrations of fuel. ***Slightly lower potential to reduce fire hazard across the landscape than Alt. C.***
Expected Fire Effects	No reduction in stand-replacement conditions that are outside HRV. Anticipated fire effects would be higher severity over more area than in B, C, or D.	Moves the planning area closer to the historic range of variability for potential fire effects. 4,475 acres are moved to the non-lethal category. ***Reduces stand-replacement conditions by 1,777 acres.***	2,718 acres are moved to the non-lethal category. ***Reduces stand-replacement conditions by 571 acres.***	2,558 acres are moved to the non-lethal category. ***Reduces stand-replacement conditions by 538 acres.***

Mitigation Measures

Numerous mitigation measures were proposed to minimize, avoid, or eliminate potentially significant impacts on the resources that would be affected by the alternatives, or rectifying the impact by restoring the affected environment. See ***Chapter 2: Description of Alternatives*** in the FSEIS for a detailed list of mitigation measures and design elements.

Monitoring

The Deep Vegetation Management Project includes a monitoring plan that contains implementation, effectiveness, and validation monitoring for site-specific projects described in the FSEIS. The monitoring plan is fully described in ***Appendix B*** to the FSEIS. Many of the monitoring items are intended to be conducted to meet Forest Plan monitoring needs, and are not necessarily required as implementation of the project.

Chapter 1

PURPOSE OF AND NEED FOR ACTION

Document Structure

The Forest Service has prepared this Environmental Impact Statement in compliance with the National Environmental Policy Act (NEPA) and other relevant Federal and state laws and regulations. This document discusses the short and long-term environmental effects of the proposed action and each alternative. The focus is on vegetation management proposals and the watershed improvement projects that are connected to them.

The document is organized into four chapters:

- *Chapter 1. Purpose and Need for Action*: Includes information on the history of the project proposal, the purpose of and need for the project, and the agency's proposal for achieving that purpose and need. This section also details how the Forest Service informed the public of the proposal and how the public responded.
- *Chapter 2. Alternatives, including the Proposed Action:* This chapter provides a more detailed description of the agency's proposed action as well as alternative methods for achieving the stated purpose. These alternatives were developed based on significant issues raised by the public and other agencies. This discussion also includes design elements and mitigation measures. Finally, this section provides a summary table of the environmental consequences associated with each alternative.
- *Chapter 3. Affected Environment:* This chapter describes aspects of the environment that could be affected by alternatives.
- *Chapter 4. Environmental Consequences:* The environmental effects of implementing the proposed action and other alternatives are described. This analysis is organized by issues.
- *Chapter 5. Consultation and Coordination:* Provides a list of preparers and agencies consulted during development of the FSEIS.
- *References*
- *Index*
- *Glossary of acronyms and terms*
- *Appendices:* Appendices A through I provide more detailed information to support the analyses presented in the environmental impact statement.

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

Background

This Final Supplemental Environmental Impact Statement (FSEIS) provides an analysis of vegetation management treatments, including commercial timber harvest, in the Deep Creek Watershed, Paulina Ranger District, in the Ochoco National Forest.

The Deep Planning Area is located in the western portion of the Paulina Ranger District, approximately 60 miles east of Prineville, Oregon. The planning area boundary coincides with the watershed boundary. It lies entirely within Crook and Wheeler Counties (See Figure 1-1), encompassing 55,368 acres and four subwatersheds. Elevation ranges from 4,500 feet (Deep Creek at the southwest corner of the planning area) to 6,314 feet (Broadway Lava at the northwest corner).

The purpose of this Final SEIS is to inform the public of the alternatives considered, disclose the direct, indirect, and cumulative environmental effects of the alternatives, and indicate any irreversible or irretrievable commitment of resources that would result from each alternative proposed.

Figure 1-1 Project Area Location

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In September of 2001, the Ochoco National Forest Supervisor signed a Record of Decision (ROD) and issued a Final Environmental Impact Statement (FEIS) for the Deep Vegetation Management Project. On April 25, 2002, the Forest Supervisor withdrew that decision and decided to prepare a supplement to incorporate additional information on the effects of the proposed alternatives and to provide for an additional public comment period. A Draft Supplemental Environmental Impact Statement (DSEIS) was made available to the public, agencies, and tribes for review on May 8, 2002. Following a 90-day comment period, the Interdisciplinary Team considered the comments, utilized new information, and subsequently prepared this Final SEIS.

Future efforts will address a comprehensive stream restoration plan for the watershed and grazing allotment management plan updates.

Purpose and Need

The purpose and need for action is based on the analysis and conclusions regarding the conditions described in the Deep Creek Watershed Analysis (USDA Forest Service 1999), as updated throughout subsequent field seasons, from the Deep Creek Water Quality Restoration Plan (USDA Forest Service 2002a) and from the Deep Creek Watershed Roads Analysis (USDA Forest Service 2002b). These analyses contains recommendations for the restoration and management of vegetation, fuels, roads, and dispersed recreation sites.

Specifically, the following statements address the Purpose and Need:

1. **There is a need to move the landscape-level diversity of vegetation and associated wildlife habitat closer to that which occurred historically by modifying seral and structural stage distributions in the forested areas.**

   The Ochoco National Forest's Viable Ecosystem Management Guide (VEMG) (USDA Forest Service 1994) contains a forest vegetation model describing upland vegetation in terms of species composition and structure. Vegetation has been described by ninety-six seral/structural stages in the Moist Grand Fir, Dry Grand Fir, Douglas-fir, Mesic Ponderosa Pine, and Xeric Ponderosa Pine plant association groups (PAGs). These PAGs dominate the forested landscape within the Deep Creek Watershed. Seral and structural stages are used to describe stands of forested vegetation by species composition, size, and canopy layers or crown closure.

   According to VEMG, forest vegetation is outside the historic range of variability (HRV) for 57% of the seral/structural stages. Twenty-six percent of the seral/structural stages are below HRV and 32% are above HRV across the landscape. Of the 39,674 acres of forestland within the Deep Planning Area, only 17,000 acres, or 43% fall within seral/structural stages that are within the historic range of variability.

   When viewing seral and structural stages separately, 72% percent of the seral stages and 70% of the structural stages are outside of HRV. Closer review of the seral/structural stages that are above or below HRV indicates the development of multi-strata stands and increases in late seral species composition has altered the overall appearance and condition of the landscape. Historically, single strata stands dominated by large trees were more prevalent. These stands contained a higher percentage of early seral species, such as ponderosa pine and western larch, and had open understory conditions. The exclusion of fire as a natural disturbance mechanism and past harvest practices have contributed to these changes.

   The upland shrub communities of bitterbrush and mountain mahogany have declined from historic levels, primarily because the lack of fire on the landscape has allowed the encroachment of juniper and conifer species that crowd out shrubs and perennial grasses.

2. **There is a need to increase the amount of single strata late and old structure (LOS) stands within the Deep Planning Area and to bring the overall abundance of LOS closer to the**

historic range of variability by modifying seral and structural stages and shortening the time needed for trees to grow into larger diameter classes.

The area on the landscape dominated by stands with a large structure component (late/old structure or LOS) is approximately 11,002 acres. Historically, these types of stands occurred on between 20,659 and 39,052 acres. The current condition is far below the HR V.

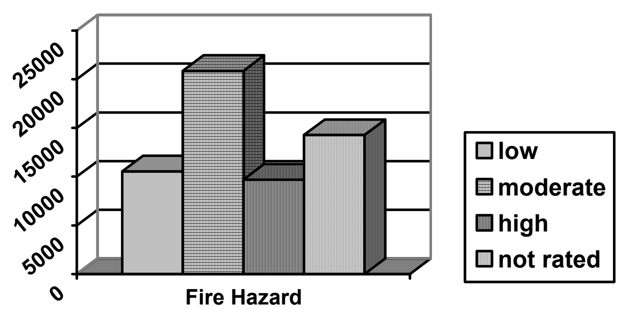
Large structure stands can be either multi-strata or single strata. Nearly 77% (8,457 acres) of the existing acreage dominated by large structure stands is of the multi-strata type, which is above the HRV of 2,434 to 7,326 acres. The HRV for the single strata type is 18,225 to 31,726 acres, but only 2,545 acres currently exist within Deep Creek Watershed. A large deficiency of single-strata LOS currently exists.

3. **There is a need to reduce the forest's susceptibility to moderate and high severity fires and bring the area's fuels closer to levels expected under natural fire disturbance regimes by lowering stand densities, increasing the relative abundance of fire tolerant species, treating existing fuels, and re-introducing fire into the watershed.**

Historically, nearly 80% of the Deep Planning Area was influenced by frequent, low intensity fire of non-lethal effects. Higher intensity fires that resulted in mixed or stand replacement conditions were expected to occur along the main drainages (reference Chapter 3, Figure 3-2) and in higher elevations north of Road 30 in the northern portion of the watershed.

The exclusion of fire through time has contributed to changes in the amount and arrangement of fuels associated with the existing forest vegetation. Nearly 75% of the forested area within the watershed is now classified as a medium to high hazard to wildfire (USDA Forest Service 1999c, Reinarz 1999).

Figure 1-2 Acres of Fire Hazard Ratings within Planning Area



Forested stands have developed multi-canopy conditions with less available forage for wildlife and increased stocking levels, ladder fuels, and fire intolerant species (see statement 2., above). This has resulted in a larger area being susceptible to a stand replacing wildfire where the potential for effects to resources (e.g. water quality, soils, wildlife habitat) would be outside natural ranges.

In Addition, the plant communities have been altered by the exclusion of fire. Conifer and juniper densities have increased at the expense of perennial grasses and shrubs such as bitterbrush and mountain mahogany, which historically occupied larger areas on non-forested sites.

4. **There is a need to reduce the susceptibility of forested stands to insects, diseases, and wildfires by reducing their stocking levels.**

The exclusion of fire over the last 80-90 years has resulted in increases in stand densities within the Deep Creek Watershed. Currently, 14,369 acres or 37% of the forested lands within the watershed are rated as high priority for density reduction due to the potential for competition-related mortality and mortality due to insects or disease. Expand this to include moderately high-risk categories, and over 60 percent of the forested stands in the watershed are involved. Trees are crowded and compete for water, nutrients, growing space, and sunlight. Similar to the conditions described in number 3, the risk of stand replacement fire events is also higher for these areas due to the density of tree stems and crowns. Stands carrying higher densities are under increased risk of having these stand replacement disturbances occur.

5. **There is a need to enhance the vegetative conditions of aspen, riparian, upland shrub, and meadow communities by increasing the vigor of existing plants, increasing their abundance, reducing conifer encroachment, and re-introducing fire.**

Aspen, riparian, upland shrub, and meadow communities have gradually declined over time. Aspen stands were distributed in the watershed in small groves along most drainages. Most of the existing clones are exhibiting decline in vigor and many have been lost. Aspen habitat in general has been reduced to some isolated clones consisting of decadent overstory with little healthy reproduction. Aspen decline has primarily been a result of conifer encroachment due to changes in hydrological patterns resulting in loss of floodplain interaction, lack of natural wildfire, browsing from big game, and grazing from cattle. Replacement stand development has been inhibited primarily from big game that browse seedlings and damage stems by rubbing against the boles of young trees.

Upland shrub communities, specifically bitterbrush and mountain mahogany, were once more abundant on non-forested sites and transition zones between forest and scablands. Conifers are encroaching upon these forest-steppe ecotones and scablands, where the density of the overstory is precluding the shade intolerant shrubs. Plant communities have been altered through juniper and pine encroachment. The natural disturbance of fire that is necessary for hardwood expansion and regeneration has been removed. Tree densities have increased resulting in reduced light to the forest floor and the loss of shrubs and perennial grasses that can help provide wildlife forage.

Similar to aspen, riparian communities such as willow, cottonwood, mock orange, red-osier dogwood, elderberry, hawthorn, and alder are less abundant today. This is a result of a number of factors including fire suppression, conifer competition, browsing of young plants by deer, elk and cattle, and loss of floodplain interaction. Unregulated grazing practices at around the turn of the century led to over-utilization of the riparian vegetation reduced the density and diversity of riparian vegetation. Browsing increased populations of big game has retarded the recovery of riparian plant communities. The Deep Creek Water Quality Restoration Plan (USFS 2002c) identifies the improvement of riparian conditions as an objective and necessary component of a restoration plan to improve water quality in the watershed.

The Deep Watershed contains numerous meadow complexes that are currently experiencing conifer encroachment. A combination of channel downcutting and fire exclusion has resulted in conifers encroaching in former meadow areas. This tree encroachment has contributed to the lowering of water tables. This has resulted in the loss of some wetter meadow habitat and the quality of habitat to a host of wildlife species that use these riparian habitats.

6. **There is a need to a) reduce stream temperature by improving shade producing vegetation; b) lower sedimentation by recruiting large woody material (LWM) to improve energy dissipation during runoff events; and c) reduce sedimentation delivery from existing roads and dispersed recreation sites.**

Water quality and riparian and aquatic habitat have changed from the conditions that existed in the past. Stream water temperatures were cooler than current conditions due in part to decreases in water table interaction and loss of riparian hardwoods. All of the perennial streams within the Deep Creek Watershed are listed as water quality limited due to elevated summer water temperatures and/or habitat modification. There is a need to improve shade-producing vegetation to move towards site potential shade.

Inadequate streamside riparian vegetation (willow, alder, aspen, cottonwood, and conifers) and large woody material (LWM) have contributed to a reduction in streambank stability. In combination with existing road densities and exposed cutbanks, this is contributing to sedimentation levels above historic levels. The loss of LWM has also contributed to the degradation and reduction of pool habitat.

Many roads in the analysis area were not constructed with adequate drainage structures. Most of the roads are unsurfaced and lack armoring on fill slopes, and do not have water-bars, or drain dips to protect against erosion and failures. During storm events, high-energy runoff is often concentrated into rills that transport sediment into streams. Where roads cross streams, many of the culverts are undersized causing channel erosion and headcutting, and causing fish passage barriers.

Some dispersed recreation campsites in the analysis area are causing compaction of the floodplains, bank erosion, and loss of riparian hardwoods. This is resulting in sediment delivery to the streams.

The purpose of the Deep Project is to implement actions on a landscape-level that will move the area closer to the range of historic conditions for the project landscape. The purpose of the actions is to move the existing vegetation and hydrology toward conditions that are sustainable, provide habitat diversity, and contribute to Riparian Management Objectives (RMOs). Specific purposes include:

- Maintain or move the vegetative components of the landscape-level ecosystem closer to the historic range of variability (Forest Plan, p. 4-3, Regional Forester's Forest Plan Amendment #2) through a variety of silviculture treatments such as precommercial thinning, commercial harvest, and planting.

- Adjust stand densities and species composition so the overall abundance of multi and single strata large structure stands (LOS) are moved closer to historic ranges (Regional Forester's Forest Plan Amendment #2) with treatments such as commercial harvest and precommercial thinning.

- Use silvicultural treatments to promote landscape and stand-level diversity to approximate the pattern and scale that occurred under natural disturbance regimes (Regional Forester's Forest Plan Amendment #2).

- Reduce stocking levels in forested stands to reduce the overall susceptibility to insect, disease, and wildfire (Forest Plan, p. 4-12) through silviculture treatments and prescribed fire.

- Provide long-term sustainable habitat for wildlife species (Forest Plan, p. 4-37) through a wide variety of treatments such as prescribed fire, commercial harvest, precommercial thinning, riparian planting, meadow enhancement, reducing road densities, and improving upland shrub and riparian shrub habitats.

- Modify the amount and arrangement of forest fuels to lower the risk of moderate to high severity wildfire (Forest Plan, p. 4-9 to 4-10) through prescribed fire, commercial harvest, and precommercial thinning.

- Enhance the vegetation aspect of aquatic/riparian areas to provide for long-term sustainability of resident and anadromous fisheries. Maintain or enhance aquatic/riparian areas in accordance with the Forest Plan (p. 4-37), as amended by the Inland Native Fish Strategy (USDA 1995a, "INFISH") through vegetation and other treatments such as riparian planting, aspen and meadow enhancement, large woody material placement, precommercial thinning, commercial harvest, road closure/decommissioning, culvert replacement and dispersed recreation rehabilitation.

- Ensure the success of riparian plantings and aspen enhancement activities by protecting areas from big game or livestock browse, or dispersed recreation activities.

- Provide timber to contribute to the health of the local and regional economies (Forest Plan, p. 4-31 to 4-32) through a variety of actions, such as timber sales and service contracts that will provide opportunities for employment and income.

This project is tiered to the Final Environmental Impact Statement (FEIS) for the Ochoco National Forest Land and Resource Management Plan (Forest Plan), as amended, and its applicable Record of Decision (ROD). The management direction, along with standards and guidelines, for activities proposed are based, in part, on these documents.

Proposed Action

Project implementation is proposed to commence in fiscal year 2003 and is likely to continue over a five to seven year period. The following actions are proposed by the Forest Service to meet the needs identified on pages 1-2 to 1-5. All acreage and mileage figures are approximate.

1. Forest vegetation treatment would be conducted using commercial timber harvest techniques on approximately 7,112 acres within the Deep Planning Area. Timber harvest would include 5,906 acres of improvement cutting (HIM), 713 acres of commercial thinning (HTH), 327 acres of group selection (HSG), 86 acres of clearcut with reserve trees (HCR), 69 acres of shelterwood harvest (HSH) and 11 acres of sanitation harvest (HSN). These silvicultural treatments are further described on page 2-52 and 2-53.

2. Timber harvest methods include using tractor (4,206 acres), winter logging (1,601 acres), helicopter (1,050 acres), and skyline (255 acres) logging systems. An estimated 16.7 MMBF of timber would be harvested.

3. Activity fuels associated with the timber harvest will be treated by underburning (5,104 acres), jackpot burning slash concentrations (875 acres), grapple piling from existing roads and trails (500 acres), broadcast burning for site preparation (482 acres), and leave top attached followed by grapple piling or jackpot burning (151 acres).

4. Precommercial thinning of stands overstocked with small diameter trees will occur within harvest units on 6,615 acres and 3,550 acres outside of harvest units. This generally involves trees less than 7 inches in diameter.

5. Re-introduction of fire on approximately 20,692 acres. Treatment objectives include natural fuels reduction on 11,661 acres, jackpot burning to reduce large fuel concentrations on 692 acres, and wildlife burning to increase forage and reduce juniper densities on 8,339 acres (juniper trees up to 10 inches diameter may be mechanically cut prior to the prescribed fire). These are gross acreage figures. Within these large blocks, there are areas that are not intended or expected to carry fire: Riparian Habitat Conservation Areas (RHCA), non-forestland, and areas that are proposed for vegetation treatments that include activity fuel treatments. Appendix E contains information on smoke management requirements and unit-specific objectives for prescribed fire and fuel treatments.

6. Riparian and watershed restoration activities that include:

    - Riparian planting and associated seedling protection from big game and cattle (tubing, cages, fencing, and/or high density planting) along reaches of 14 streams (28 miles).

    - Large woody material placement along 7 streams (5.5 miles) where existing levels are low, in main stems and tributaries of Happy Camp, Double Corral, Jackson, Crazy, Little Summit, and Deep Creeks.

- Riparian protection in the form of closure or rehabilitation of dispersed recreation sites (6 locations).

- Aspen enhancement (77 acres) by removing competing conifers and protection from big game and cattle (fencing or brush barriers). Protection of a willow species that is uncommon on the forest.

- Meadow enhancement (825 acres) to reduce conifer encroachment into meadows by cutting trees up to 9 inches in diameter within the meadows, followed by treatment of the fuels.

- Replacement of seven road culverts associated with the vegetation management projects listed above.

7. Road management would consist of construction of 1.8 miles, reconstruction or betterment of 24.4 miles, and temporary construction of 9.3 miles. These actions are necessary for implementation of the vegetation management. Inactivation of 9.2 miles and decommissioning of 11.7 miles of roads are proposed for mitigating the potential impacts from the vegetation treatments. Decommissioning involves rehabilitation of a road segment that is not needed currently or in the foreseeable future.

Legal Description

The legal description of the Deep Planning Area is described below:

- **Crook County**:

  T.13S., R.22E., Sections 23 through 26, 35 and 36;
  T.14S., R.22E., Sections 1, 2, 11 through 14, 23 through 27, 35 and 36;
  T.14S., R.23E., Sections 1 through 36;
  T.15S., R.22E., Sections 1 and 2;
  T.15S., R.23E., Section 6; Willamette Meridian.

- **Wheeler County:**

  T.13S., R.22E., Sections 11, 13 and 14;
  T.13S., R.23E., Sections 7 through 36;
  T.13S., R.24E., Sections 7, 18, 19, 29 through 32;
  T.14S., R.24E., Sections 5 through 8, 16 through 21, 28 through 32; Willamette Meridian.

Decision To Be Made

The Forest Supervisor of the Ochoco National Forest is the Responsible Official for this Environmental Impact Statement. Specifically, the decision to be made is whether the Deep Planning Area is to be entered at this time for vegetation management and other proposed treatments. The decision will focus on which alternative to select based on the analysis presented in this Supplemental Environmental Impact Statement for the Deep Vegetation Management Project. The Responsible Official will consider factors relating to the purpose and need, public comments, issues, and the environmental consequences when making the decision. Specific questions that will be considered when evaluating the alternatives include:

- How well does the alternative move the landscape-level diversity of vegetation and associated wildlife habitat closer to sustainable conditions? Does the alternative move the area closer to conditions that are expected under natural disturbance regimes as defined by the historic range of variability?

- How well does the alternative address the need to encourage the development of large structure in the watershed? Is the large deficit of single strata LOS improved? Is the overall amount of LOS maintained or increased?

- Are the amount of acres that are under high risk and susceptible to insect, disease, and high intensity wildfire reduced? How well does the alternative reduce fire hazard? Are fuel conditions within the watershed moving closer to that which occurred under natural fire disturbance regimes?

- How well does the alternative address the need to enhance aspen, riparian, upland shrub, and meadow communities in the watershed? Are the vegetation management treatments in riparian zones meeting riparian management objective and helping to maintain or improve water quality and fish habitat?

- Does the alternative provide opportunities for communities to benefit through jobs and income? Are commercial wood products provided?

- What management requirements and design elements would be necessary to meet Forest Plan standards and guidelines for all resources? What monitoring would be appropriate to evaluate project implementation and effectiveness?

It has been suggested that changes to livestock grazing regimes be incorporated into this analysis, and its associated decision, based on the opinion that the purpose and need objectives cannot be met nor can the resource issues be addressed without doing so. Consideration of the effects of ongoing grazing will be considered in this decision; however, this decision will not incorporate modifications of grazing regimes for the following reasons:

- In 1999, the Ochoco National Forest initiated the Grazing Implementation Monitoring Module (GIMM). This monitoring effort, coupled with project design criteria identified in the Joint Aquatic and Terrestrial Programmatic Biological Assessment for Federal lands with the Deschutes Basin (USFS 2000) are designed and being implemented to help to ensure compliance with the Endangered Species Act (ESA) and the Biological Opinions from the National Marine Fisheries Service and the U. S. Fish and Wildlife Service. Stubble heights, bank alteration, and riparian shrub use are reviewed annually for consistency with the Biological Opinions and modifications of grazing regimes can be made on an annual basis to address resource concerns.

- Permitted livestock use is currently occurring in the Deep Watershed based on approved Allotment Management Plans and is being monitored as discussed above. Livestock numbers, pasture rotations, pasture rest, livestock distribution, water development needs, and the length of season of use are reviewed annually during the development of annual operating plans. Adjustments are identified and implemented prior to turning livestock on the forest to meet resource objectives. Reference Chapter 3 – Range to see grazing management adjustments that have been incorporated into the annual operating plans for the Deep Allotments and range improvements that have been implemented in recent history.

- Allotment Management Plan updates for the Deep, Roba, Little Summit, Derr and Happy Camp Allotments were initiated in 2002 and alternative grazing regimes will be developed and considered under a separate environmental analysis and decision that is scheduled for completion in 2004.

- In formulating the decision on this vegetation management project, consideration will be given to the cumulative effects of current grazing schemes, the effect that grazing may have on the success of treatments identified in the alternatives, and how well an alternative meets the purpose and need objectives.

Direction from the Forest Plan and Area Assessments

Ochoco National Forest LRMP (1991)

There are nine Forest Plan management areas in the 55,368-acre Deep Watershed. A management area consists of lands with similar capabilities or characteristics. Each Management Area has specific goals, desired future conditions, and standards and guidelines. The location of these management areas is depicted on Figure 1-3, Management Areas. The emphasis for each of the management areas is briefly described below.

Old Growth (MA-F6) – (*1,267 acres or about 2% of the planning area*). Provide habitat for wildlife species dependent on old growth stands (Forest Plan, p. 4-56).

Summit National Historic Trail (**MA-F7)** - (*1,634 acres or about 3% of the planning area*). Protect the existing integrity of the Summit Trail. Enhance and interpret significant segments for public enjoyment and education. Pristine segments would be managed to protect, interpret, and preserve their historic qualities (Forest Plan, p. 4-60).

Developed Recreation (MA-F13) – (*1,634 acres or about 3% of the planning area*). Provide safe, healthful, and aesthetic facilities for people to utilize while they are pursuing a variety of recreational experiences within a relatively natural outdoor setting (Forest Plan, p. 4-71).

Dispersed Recreation (MA-F14) - (*Approximately 30 acres or less than 1% of the planning area*). Provide and maintain a near-natural setting for people to utilize while pursuing outdoor recreation experiences (Forest Plan, p. 4-72).

Riparian (MA-F15) – (See RHCA Riparian Habitat Conservation Area). Manage streamside vegetation and habitat to maintain or improve water quality. Meet temperature and turbidity levels as required by state standards under the Clean Water Act (Forest Plan, p. 4-74).

Deep Creek Recreation Area (MA-F19) – (873 acres or about *2% of the planning area*). Provide a near-natural setting for recreational pursuits within the area where management activities are not visually evident (Forest Plan, p. 4-81).

General Forest (MA-F22) - (*48,666 acres or about 88% of the planning area*). Produce timber and forage while meeting the Forest-wide Standards and Guidelines for all resources. In ponderosa pine stands, management will emphasize production of high value (quality) timber (Forest Plan, p. 4-86).

North Fork Crooked River Scenic Corridor (MA-F24) – *46 acres or less than 1% of the planning area*). Management would maintain and enhance the natural appearing landscape and protect the scenic river designation (Forest Plan, p. 4-91).

Visual Management Corridors (MA-F26) - (*1,987 acres or approximately 4% of the planning area*). Maintain the natural appearing character of the Forest along major travel routes, where management activities are not evident, or are visually subordinate to the surrounding landscape (Forest Plan, p. 4-95).

RHCA Riparian Habitat Conservation Areas – (*6,332 acres or approximately 11% of the planning area).* RHCAs are portions of watersheds that have been delineated through the Inland Native Fish Strategy (INFISH) and overlap with some of the Forest Plan Management Areas listed above. Riparian-dependent resources receive primary emphasis in these areas. RHCAs include riparian corridors, wetlands, intermittent streams, and other areas that help maintain the integrity of aquatic ecosystems.

Private Land - There are 822 acres of private land within the Deep Planning Area.

Eastside Screens

The Revised Continuation of Interim Management Direction Establishing Riparian, Ecosystem, and Wildlife Standards for Timber Sales, or Eastside Screens, amended the Forest Plan in 1995. It applies to the design and preparation of timber sales on eastside Forests, is often referred to as "Regional Forester's Forest Plan Amendment #2" or as the "Eastside Screens." This interim direction requires Forests to characterize watersheds for stand structure and seral stages, and compare that to the Historic Range of Variability (HRV). The HRV analysis is included in Chapter 3, under Vegetative Diversity. Standards are outlined that must be adhered to when designing timber sales.

Inland Native Fish Strategy

In 1995, the Decision Notice for the Inland Native Fish Strategy (INFISH) amended the Ochoco LRMP with direction for protecting habitat and populations of resident native fish outside of anadromous fish habitat in eastern Oregon, eastern Washing, Idaho, western Montana, and portions of Nevada. The direction is in the form of Riparian Management Objectives (RMOs), Standards and Guidelines, and monitoring requirements. INFISH established Riparian Habitat Conservation Areas (RHCAs) primarily to reduce the risk of loss of inland resident native fish populations and the negative impacts to their habitat on National Forest System lands. They were delineated because of their influence on 1) the delivery of coarse sediment, organic matter, and woody material to streams; 2) root strength for channel stability; 3) shading of streams; and 4) the protection of water quality. RHCAs generally parallel the stream network, widths varying by stream type. There are 6,332 acres of RHCAs within the planning area.

Riparian Habitat Conservation Areas

Fish-bearing streams	300 feet slope distance on both sides of streams (600 feet total).
Permanently flowing, non-fish bearing streams, ponds, lakes, reservoirs and wetlands greater than 1 acre	150 feet slope distance on both sides of streams or other water bodies (300 feet total).
Seasonally flowing or intermittent, non-fish bearing streams, wetlands less than 1 acre, landslides, and landslide prone areas	50 feet slope distance on both sides of streams (100 feet total), or the extent of unstable areas.

Riparian Management Objectives (RMOs)

Water Temperature	No measurable increase in max. water temperature (7-day moving average of daily maximum temperature measured as the average of the maximum daily temperature of the warmest consecutive 7-day period). Maximum water temperatures below 59°F within adult holding habitat and below 48°F within spawning and rearing habitats.
Large Woody Debris (forested systems)	East of Cascade Crest in Oregon: > 20 pieces per mile; > 12 inch diameter; > 35 foot length.
Bank Stability (non-forested systems)	> 80 percent stable.
Lower Bank Angle (non-forested systems)	> 75 percent of banks with < 90 degree angle (i.e. undercut).
Width/depth Ratio (all systems)	< 10, mean wetted width divided by mean depth.

Pool Frequency (varies by channel width):

Wetted Width (ft)	10	20	25	50	75	100	125	150	200
Pools Per Mile	96	56	47	26	23	18	14	12	9

Watershed-Scale Assessments

The various watershed scale assessments that have been completed in the project area show a connection between the road network, stream and riparian network, and the vegetation. These components together describe the condition of the watershed.

Deep Creek Watershed Analysis

Completed in 1999, the Deep Creek Watershed Analysis identified the processes and functions within the watershed that are key to maintaining sustainable and resilient terrestrial and aquatic ecosystems. It documents important findings and trends and includes recommendations for maintenance and restoration of ecosystem processes and functions. Much of the purpose for initiating this project is rooted in the trends documented in this assessment.

Deep Creek Water Quality Restoration Plan

The Water Quality Restoration Plan was completed in 2002 to address the degraded water quality conditions in the Deep Creek Watershed. This document describes why water quality in the watershed is not meeting Oregon Department of Environmental Quality standards, the causes of the current conditions, and provides measurable objectives to meet the primary goal of attaining DEQ water quality standards. Supporting goals for the watershed include: reducing stream temperatures on 303(d) listed streams; maintain and improve RHCAs; improve aquatic habitat potential and bank stabilization through recovery of riparian vegetation and placement of large woody debris; restore channel form and flow regime to mitigate elevated stream temperatures and degraded aquatic habitat.

Roads Analysis Report, Deep Project Area

Pursuant to the latest Road Management Policy, all NEPA decisions that involve certain changes to the transportation system must be informed by a Roads Analysis. An interdisciplinary team completed the Roads Analysis Process and the final report was written in 2002. Using information on watershed and resource trends, and management goals and direction from the Forest plan, INFISH, Watershed Analysis, and the WQRP, issues were identified that related to managing the transportation system in the project area. Each road in the planning area was rated for its benefits and compared to the associated risks to the environment. Road development is identified as the greatest human impact to the aquatic habitats in the watershed, and specific opportunities for meeting goals and objectives found in INFISH, the WQRP, and the Forest Plan. The report ends with recommendations for future road management actions, such as road closures, decommissioning, and culvert replacements.

Figure 1-3 Management Areas

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Scoping and Public Involvement

Scoping, in the context of Forest Service projects, is the process for determining the issues relating to a proposed action. It includes the distribution of information about the project, a review of written comments, and interdisciplinary team (IDT) meetings to review both internal and external knowledge about the project area.

Public involvement is invited in order to obtain input regarding the proposed action and to develop a list of issues to address. Numerous public notices concerning the Proposed Action have been issued through the life of the project:

Spring 1999 – Schedule of Projects (Listed as Deep Timber Sale)
Summer 1999 – Schedule of Projects (Listed as the Deep Vegetation Management Project)
Fall 1999 – Schedule of Projects
October 28, 1999 – Scoping Letter
December 23, 1999 – Notice of Intent to Prepare an EIS, *Federal Register*
Winter 2000 – Schedule of Projects
Spring 2000 – Schedule of Projects
Summer 2000 – Schedule of Projects
Fall 2000 – Schedule of Projects
Winter 2001 – Schedule of Projects
Spring 2001 – Schedule of Projects
April 27,2001 – Notice of Availability of the Draft EIS, *Federal Register*
June 11, 2001 – Public Comment Period ended on the Draft EIS
Summer 2001 – Schedule of Projects
Fall 2001 – Schedule of Projects
Winter 2002 – Schedule of Projects
Spring 2002 – Schedule of Projects
May 28, 2002 – Notice of Intent to Prepare a Draft Supplemental EIS, *Federal Register*
Summer 2002 – Schedule of Projects (Listed as Draft SEIS)

Scoping letters were sent to over 100 stakeholders, elected officials, federal, state and local agency personnel, press and media in local communities, tribal representatives, and other interested individuals and organizations on the Paulina Ranger District mailing list. Seventeen responses were received.

A Notice of Intent to prepare an SEIS was published in the *Federal Re*gister on May 28, 2002. The DSEIS was made available to the public on July 10, 2002. Alternative C was identified as the Preferred Alternative. The public comment period ended on September 3, 2002. Seventeen written responses were received. Responses to these comments are included in Appendix C.

Issue Development

An integral part of scoping is the identification of relevant or key issues. Information from past environmental documents, input from members of the public and other agencies throughout the development of the EIS and Draft SEIS, and internal scoping were used by the IDT to identify issues. The IDT and responsible official considered these issues and have determined which are relevant to the Deep Project.

Three key issues were identified and are described below. Where possible, issues or concerns that were related to one another were combined and addressed under a single key issue. The key issues have been used to drive alternative development and provide criteria by which to measure alternatives. A comparison of the alternatives in relation to these key issues is located at the end of Chapter 2. The effects of the alternatives are described in Chapter 4.

In addition to the identification of the key issues, "Other Issues" were identified through the scoping process, and have been tracked through the analysis process.

Key Issues

Water Quality and Fish Habitat, Vegetative Diversity, and Fire Hazard and Fuels are the three key issues identified for this project.

Water Quality and Fish Habitat

Water quality, as measured by stream temperature, sediment delivery to streams, and flow can be affected by management actions.

Ten streams within the Deep Creek Watershed are included on the Oregon Department of Environmental quality's 303(d) list because they are considered water quality limited for temperature. Eight of these are also listed for habitat modification (see Table 3-2 in Chapter 3 and Appendix D, Deep Creek Water Quality Restoration Plan for 303(d) listed streams and a map of streams within the Planning Area).

Factors that affect stream temperatures include shading, channel form, and water table interaction. Riparian shade trees intercept direct sunlight and help maintain lower stream temperatures by reducing the potential for the heating of surface waters. Increases in sediment loads can result in excessive deposition, thus encouraging lateral scouring and increasing width/depth ratios. Wider channels are likely to have greater surface area and are susceptible to faster heating than narrower, deeper channels. Influxes of cold spring water from spring sources adjacent to open meadow systems help maintain cooler stream temperatures. Decreases in this water table interaction (loss of floodplain) can reduce the ability to maintain lower stream temperatures. There is a concern that the prescribed fire, commercial harvest, and treatment of aspen stands identified in the proposed action may alter the amount of shade on streams and subsequently increase late summer water temperatures.

Sediment loading can be directly affected by erosion from harvest units, roads, fire, and instream project work. The proposed action incorporates commercial timber harvest, culvert replacement, large woody material placement, prescribed fire, and transportation system changes (road construction, reconstruction, closures, and obliteration) which have the ability to contribute to sediment delivery to streams. Sediment loading can be indirectly affected by increased flows that increase bank erosion. Due to their sinuosity, many of the upper reaches of streams within the Deep Watershed are heavily dependent on riparian vegetation. The lack of riparian vegetation and large woody material are the main factors that lead to streambank instability. The proposed action incorporates riparian vegetation treatments (hardwood planting and aspen enhancement) and LWM placement that can help to improve streambank stability.

Reduction in stand densities can reduce interception and evapotranspiration and increase snow accumulation. During snowmelt, accelerated surface saturation and overland flow can lead to higher peak flows within a shorter period of time. This may elevate the risk of detrimental impacts to the hydrologic character and water quality. Reduced stand densities can also stimulate growth and development of the grass, herb and shrub layers, and also improve vegetation diversity, stream shading and stream channel stability. The proposed actions incorporates timber harvest, precommercial thinning, prescribed fire, and riparian hardwood treatments which will reduce stand densities that may lead to higher flows.

The Proposed Action in the Deep Planning Area has the potential to affect the water quality parameters discussed above and subsequently affect associated fish habitat. Changes to riparian vegetation, stream flows, and sediment delivery resulting from management actions, all have the potential to exhibit some positive or negative effect on water quality and riparian habitat.

The effects of the alternatives on this issue will be evaluated by the following criteria:

- Comparison of alternatives and the proposed actions in relation to their relative potential to affect stream temperatures.

- Discussion of sedimentation potential from proposed treatments. The Relative Erosion Rate (RER) model will be used to help compare the relative potential of sediment delivery to streams. This model includes factors for estimating sediment production such as ground disturbance, slope, erosion hazard, and disturbance to stream channels.

- Equivalent Harvest Area (EHA) will be used to make an assessment of the relative risk of increased peak flows.

Vegetative Diversity

Management activities could change the processes and structural components contributing to both stand-level and landscape-level diversity. Management actions could alter ecosystem components such as species composition, structure, canopy density, snag levels, down wood, and connectivity. Wildlife habitat is directly related to these ecosystem components. Effects on wildlife habitat are discussed under other issues.

Historically, natural disturbances such as fire, insects, and diseases contributed to the natural vegetation mosaic at both the stand and landscape level. Moisture regimes, topography, elevation, and geology defined the potential for the vegetation in this watershed and have also contributed to the vegetative mosaic as evidenced by the amount of natural opening (scabs and meadows) occurring within the planning area.

The Deep Planning Area has undergone a gradual shift in species composition, stand structure, canopy density, and understory species diversity. Active fire suppression has contributed to increased stand densities, loss of grasses and forbs in the understory, the increase of grand fir in the understory, and the expansion of juniper and pine composition in transition zones between forestlands and scablands. As a result, understory species diversity has diminished within stands. Management activities could directly alter these ecosystem components.

The landscape-level vegetation pattern is important to meet diversity objectives for the area. Elements of these diversity objectives include the role natural disturbance regimes played in the evolution of the landscape pattern through time, the spatial arrangement of vegetation seral/structural components in relation to amounts, patch sizes, and shapes on the landscape, connectivity of late and old structural components, the protection of diversity enhancing landscape elements; and quality of habitat for a diversity of wildlife species. The proposed action incorporates a variety of treatments that can alter the current ecosystem patterns and components. Some members of the public feel that leaving things alone is the best management approach, while others believe that treatments identified in the proposed action will help restore the area to a more sustainable condition.

The effects of the alternatives on this issue will be evaluated by the following criteria:

- Discussion of the post treatment seral/structural stage distributions in relation to historic ranges of variability.

- Comparison of the acres of late and old structure developed through time as compared with historic conditions.

- Comparison of the vegetation on the landscape that is at high risk to fire, insects, and disease due to stand densities.

- Protection and enhancement of vegetative habitats associated with riparian and upland communities.

Fire Hazard and Fuels

Currently, fire hazard and fuel levels in the Deep Planning Area are at moderate to high levels. Aggressive fire suppression has resulted in changed vegetative conditions and has increased the potential for higher severity fires. The proposed action includes mechanical vegetation treatments, activity fuels reduction, and the re-introduction of fire. This will emulate the natural disturbance of fire and its influence on vegetation while reducing the risk of wildfire effects. Some public comments characterized the area as higher, moister elevations and questioned the role that fire historically played in the area.

Fire historically has played an important role as a disturbance factor in the development of stand and landscape structure through time. Since European settlement, fire suppression has reduced the natural role of fire on the landscape. As a result, stand composition has been altered, leaving the planning area with higher stocked stands with a fir understory. The amount of area that is currently susceptible to higher severity fire has increased as a result of changes in the abundance and continuity of fuels within the planning area.

The effects of the alternatives on this issue will be evaluated by the following criteria:

- Acres where prescribed fire has been re-introduced to emulate natural disturbance processes.
- Comparison of acres treated where fire hazard has been reduced.
- Comparison of acres susceptible to elevated fire severity and effects as compared to historic conditions.

Other Issues

The following "Other Issues" or concerns were identified through the scoping process. They were determined to be important, but are either not significant to the proposed action, are elements of the key issues discussed above, have been addressed through alternative design criteria, or there is little difference between alternatives on how that issue could be addressed. Effects of the alternatives on these resources are discussed in Chapter 4 of this document.

Air Quality

Public comments were related to smoke management and timing of the 20,692 acres of prescribed fire that is included in the proposed action. A primary concern was related to health standards for particulate matter from smoke emissions and the effect on visibility, the public, and Class I airsheds such as Wilderness areas.

Cultural Resources

Comments were related to the protection of prehistoric and historic sites.

Noxious Weeds

Comments received centered around the potential of management activities to disturb ground and to spread existing weeds and introduce additional weeds into the area. Additional questions were raised concerning any proposals to use herbicides to control existing populations. Herbicide use is not proposed under this environmental analysis. Noxious weed treatments are addressed under a separate environmental assessment.

Recreation Experience and Scenic Quality

Comments received centered around the maintenance of trails and the effects of alternatives on hunting, dispersed camping, and wildlife viewing.

Threatened, Endangered and Sensitive Species

Comments received included concerns over potential effects to plants, animals, and fish species. A comment was received related to the resident redband trout population in the Wild and Scenic River south of the planning area and the potential for effects to this population.

Soils

Concerns raised included the potential effect of timber harvest and prescribed burning on soils.

Social/Economics

Comments received were related to using harvest as a tool to reduce stand densities, prevent additional tree mortality, and provide a variety of special forest products. Concerns were expressed about the need to support the social and economic health of the local communities by providing opportunities for jobs and income.

Wildlife and Wildlife Habitat

Numerous comments were received regarding the effects of alternatives on wildlife habitat and species, including old growth related species. A wide variety of wildlife species are found within the Deep Creek Watershed and Ochoco National Forest. The effects on wildlife species are discussed in detail in Chapter 4 by focusing on how proposed actions can affect the habitat of individual species.

Transportation

Comments ranged from concerns on road density and access, road development, and hydrological effects of new and existing roads.

Range

Issues raised that are associated with livestock grazing and range management include:

- What effects do the proposed actions (e.g. prescribed burning) have on the existing range allotments, such as the ability to graze livestock?
- How will the proposed actions affect the range condition?
- Cattle grazing has contributed to stream bank instability, loss of shade, and increased water temperatures. How will continued grazing affect the ability to meet purpose and need objectives? What are the cumulative effects of such actions?

Roadless Areas

No roadless areas are located within or immediately adjacent to the planning area. Comments were received regarding roadless areas in response to the Draft EIS. As a result, additional information has been added in Chapter 3 of this Draft SEIS.

Through the scoping process it was determined there is no potential for effects to the following resource elements or that they are outside of the scope of the Proposed Action. The actions proposed for the Deep

Planning Area would not affect these resources or uses. Therefore, these resources will not be addressed further in this analysis:

Wilderness – No wilderness areas are found within or immediately adjacent to the planning area.

Facilities - No effect is expected on the Developed Recreation site within the planning area.

Lands - The proposed actions would not affect any existing special uses, utility corridors, electronic sites, or land adjustment needs within the Deep Planning Area.

Minerals and Energy – There are no mining claims or oil and gas leases in the project area. The existing mineral sources will meet the needs for all the action alternatives. There are no active mining claims in the Bureau of Land Management records in the planning area at this time.

CHAPTER 2

DESCRIPTION OF ALTERNATIVES

Introduction

This chapter describes and compares the alternatives considered for the Deep Project. It includes a description and maps of each alternative considered. This section also presents the alternatives in comparative form, defining the differences between each alternative and providing a basis for choice among options by the decision maker and the public.

Development of Alternatives

The alternative development process began with a review of the purpose and need for action by the IDT, goals and objectives of the Deep Creek Watershed Analysis (August 1999), comments received during public scoping, and applicable direction from the Ochoco National Forest Plan. Based on the comments received during scoping and on the DEIS, alternatives were developed by an interdisciplinary team to display a range of options that meet the purpose and need and respond in various ways to the key issues.

Federal law (National Environmental Policy Act of 1970) requires the development of the No Action Alternative. The No Action Alternative provides a baseline alternative from which effects of the other alternatives can be compared and measured. Several alternatives were considered but eliminated from detailed study.

Alternatives Considered But Eliminated From Detailed Study

Numerous alternatives were considered by the IDT as the analysis process progressed. Some of the alternatives were dropped from detailed study for the reasons summarized below:

- No Commercial Harvest Activities - An alternative was considered that would eliminate all commercial harvest activities. Upland vegetation management activities would have been accomplished primarily through precommercial thinning and prescribed burning. Watershed improvement projects such as road management, meadow system enhancement, riparian and upland hardwood community enhancement, dispersed recreation site rehabilitation, and large woody material placement would be incorporated.

  This alternative would meet the objectives, in part, by improving riparian and upland hardwood plant communities, reducing natural fuel levels through prescribed burning, helping attain some Riparian Management Objectives (RMOs), and reducing ladder fuels. However, this alternative would not meet a major portion of the purpose and need for vegetation diversity in the high priority stands most in need of treatment. Stands that are a priority for treatment would have only a portion of the stand conditions modified through understory thinning of the small diameter trees. Overstocking by late seral trees that are greater than 7" diameter at breast height size would not be addressed. The degree of reduction of stand densities in high priority stands would result in a partial treatment that would not create conditions for increased tree growth over sustained periods and would do little to promote additional LOS development. This type of vegetation treatment would only result in short-term, incremental changes to a part of the stand conditions currently outside HRV. Small tree reductions would not address the need to reduce the risk of insect and disease impacts. It would do little in terms of developing single strata LOS stands for old growth related wildlife species. Large acreages of precommercial thinning to reduce stand densities would exacerbate the amount and arrangement of activity fuels on these acres and would do little to reduce the risk of stand replacement fire in a large portion of the planning area. It would not meet the objective of providing timber in support of the local economy. The watershed restoration treatments, proposed within this alternative, have been identified and incorporated into all of the action alternatives.

- Maximize Timber Sale Value - An alternative to maximize net sale value through commercial timber harvest was discussed but dropped from consideration. This alternative would have included substantial amounts of regeneration harvest and would not meet the purpose and need described in Chapter 1. This level of regeneration harvest would greatly increase the amount of the grass, forb, and shrub seral/structural stage. Further, lower cost conventional logging systems would require additional road construction. Ground-based logging systems would be emphasized to maximize value and would lead to a higher potential for increased sedimentation. The alternative would do little to address concerns associated with water quality, fish habitat and soils.

- Salvage Only - Salvage of only dead material was considered, however, it would not meet the purpose and need. The removal of snags across the watershed would result in little improvement in overall upland forest conditions and would propose the harvest of snags in a subwatershed that is currently deficit in snags. Removal of hazard trees along the haul routes has been incorporated into all action alternatives considered in detail.

- Minimize Road Construction - Consideration was also given to developing alternatives minimizing road construction, emphasizing wildlife habitat improvement projects, and/or minimizing soil disturbance by emphasizing helicopter or winter logging. Elements of these objectives have been incorporated in alternatives considered in detail to better meet the purpose and need and project objectives as described in Chapter 1.

Alternatives Considered In Detail

Four alternatives are discussed and analyzed in detail in this Final SEIS. With the exception of Alternative A (No Action), all alternatives meet the objectives (to differing degrees) described in the purpose and need section of Chapter 1 and address the Key Issues. Refer to page 2-52 for a description of the various treatments proposed in the alternative descriptions.

Alternative A (No Action)

This alternative is the “No Action” alternative. No activities would result from implementation of this alternative. None of the activities referred to in the other (“Action”) alternatives would occur. Access for public transportation and administrative purposes would continue to be provided by the existing transportation system. Resource protection activities (such as road/trail maintenance and fire suppression) and other actions approved under separate decisions would continue.

This alternative does not provide an opportunity to improve landscape-level health and diversity through vegetation management activities. Fire hazard and fuel levels would not be reduced through silvicultural treatments and prescribed burning. Watershed restoration work such as road closures and decommissioning, culvert replacement, dispersed recreation site rehabilitation or protection, riparian planting, meadow enhancement, large woody material placement, and aspen stand restoration would not occur. No timber output would be provided.

Alternative B (Proposed Action)

Proposed activities were designed to meet the purpose of and need for action. This alternative was designed specifically to move the upland forests closer to conditions that existed historically, promote the development of LOS, reduce stand densities, and reduce the risk of fire through natural fuels underburning and wildlife habitat enhancement. Alternative B would be consistent with the Ochoco National Forest Plan and is consistent with the FY 2001- 2003 Biological Opinion. Consultation requirements have been completed. Activities included in this alternative are listed below. All figures are approximate.

Alternative B Summary:

Silvicultural treatments that include timber harvest are proposed as follows:

Improvement Cutting (HIM)	5,906
Commercial Thinning (HTH)	713
Group Selection Harvest (HSG)	327
Clearcut with Reserve Trees (HCR)	86
Shelterwood Harvest with Reserve Trees (HSH)	69
Sanitation Harvest (HSN)	11
Total	7,112

Other activities include:

Post Harvest Precommercial Thinning (PCT) - 6,615 acres

Post Harvest Fuels Treatments include the following:

- Broadcast Burning for Site Preparation - 482 acres
- Grapple Piling from Existing Trails - 500 acres
- Jackpot Burning Fuel Concentrations - 875 acres
- Leave Top Attached/Grapple Piling from Existing Trails - 141 acres
- Leave Top Attached/Jackpot Burning Fuel Concentrations - 10 acres
- Underburn - 5,104 acres

PCT outside of harvest units - 3,550 acres (354 acres within RHCAs).
Natural Fuels Underburn - 11,661 acres
Wildlife/Juniper Reduction Underburn - 8,339 acres
Fuel Break Jackpot Burn - 692 acres
Riparian Planting - 28 miles
Large Woody Material Placement - 5.5 miles
Riparian Protection at Dispersed Recreation Sites - 6 locations
Aspen Enhancement - 77 acres
Willow Protection - 1 Site
Meadow Enhancement - 825 acres
Culvert Replacement - 7 locations
Road Closure - 9.2 miles
Road Decommissioning - 11.7 miles

Alternative B Discussion:

Figures 2-1 through 2-4 on the following pages display the proposed commercial and precommercial thinning proposals, logging system design, watershed enhancement projects, prescribed burning proposal, and road management activities.

SILVICULTURAL TREATMENTS - Based on the analysis of the existing condition of forest vegetation within the Deep Creek Watershed, this alternative includes silvicultural treatments to improve the landscape-level health, resiliency, and diversity of both upland forests and riparian communities. Treatments are intended to reduce stand densities, mimic natural disturbances (fire, insects, and disease), and move the area closer to the historic range of variability for all seral/structural stages, including stands dominated by LOS.

Treatments proposed in this alternative are predominately thinning and improvement harvest in stands of dense, small-sized trees. Regeneration harvest is also proposed. An estimated 16.7 million board feet (MMBF) of timber would be harvested. This alternative treats the most acres and produces the most timber volume. No live trees larger than 21" diameter at breast height (dbh) are proposed to be harvested, except those identified by the Oregon Occupational Safety and Health Code (OSHA) as hazard trees.

Activities through commercial timber harvest would be conducted using tractor, tractor harvest in winter, helicopter, and skyline logging systems. Winter, helicopter, and skyline logging systems were incorporated on a site-specific basis to address a variety of resource concerns. These include, but are not limited to, watershed concerns associated with new road development, creek crossings, re-use of roads in riparian areas, sensitive plants, and soils. Soil tillage is included on approximately 197 acres where needed and feasible to cause no net increase in detrimental soil conditions.

FUELS - Fire is re-introduced over large areas in the watershed to reduce fire hazard and to move the area closer to historic fire regimes. More than twice the amount of acres is treated with prescribed fire than either of the other two action alternatives. Precommercial thinning treatments are proposed to mechanically reduce stand densities, species composition, and reduce ladder fuels. The potential for fire spread is lessened by jackpot burning in areas of high fuel concentrations. Underburning of natural fuels is prescribed to reduce natural fuel loading to reduce the intensity and effects of any subsequent wildfire. Forage enhancement and juniper encroachment burning is designed to remove much of the juniper less than 2” in diameter, create a burned/unburned mosaic, and stimulate forage production. Larger juniper up to 10” diameter would be cut prior to burning.

ROADS - Management would consist of construction of 1.8 miles, reconstruction (improvement of drainage) of 24.4 miles along the haul route, and temporary construction of 9.3 miles. Removal and harvest of hazard trees along the haul routes is also included in Alternative B. Hazard trees within Riparian Habitat Conservation Areas (RHCAs) would be felled and left on site to meet large woody material objectives.

Approximately 9.2 miles of roads are to be closed or re-closed under this alternative to help improve water quality. This includes closing eleven roads for a total of 6.1 miles and correcting ineffective closures on six roads for an additional 3.1 miles. Thirteen roads (11.7 miles) are planned for decommissioning where no long-term need has been identified. Seven road culverts are scheduled for replacement. These activities were recommended in the Roads Analysis and help to meet goals and objectives identified in the Deep Creek Water Quality Restoration Plan (WQRP). They are some of the activities referred to under Section 3, Proposed Management Measures in the WQRP (See Appendix D).

RESTORATION - Management actions seek to manipulate upland conifer vegetation in selected areas through commercial harvest, precommercial thinning, prescribed fire, planting, and seedling protection. Restoration or vegetation enhancement projects are included to maintain or enhance upland, riparian, and meadow systems. Watershed improvement projects include the placement of instream structures, riparian protection, road closures and decommissioning, and road culvert replacement. These activities are identified under Section 3, Proposed Management Measures in the WQRP (See Appendix D).

RHCA treatments included in this alternative are designed to meet Riparian Management Objectives (RMOs) and Timber Management Measures under Section 3 of the WQRP. They include commercial harvest on 24 acres and precommercial thinning on 354 acres of conifer stands to promote WQRP goals and objectives of reducing stream temperatures and improving RHCA vegetation conditions to increase shade values. Aspen enhancement within RHCAs is included on 77 acres. This treatment includes a combination of commercial (50 acres) and precommercial thinning of encroaching conifers within aspen stands, followed by protection of the stand. Meadow enhancement (conifer thinning) is prescribed on 825 acres within or adjacent to RHCA buffers and is designed, in part, to improve wildlife habitat in and around these meadow systems. Prescribed fire would not be set in RHCAs, but would be allowed to back slowly into them leaving a mosaic that would mimic natural fire effects. These restoration activities are consistent with goals and objectives identified in Section 2 and management measures proposed in Section 3 of the WQRP (See Appendix D).

Figure 2- 1 Alternative B Commercial Thinning & Precommercial Thinning

Figure 2- 2 Alternative B Logging Systems

Figure 2- 3 Alternative B Transportation System

Figure 2- 4 Alternative B Prescribed Burning & Watershed Enhancement Projects

Alternative C

This alternative was developed in response to comments and concerns received on the Preferred Alternative identified in the DEIS issued in April of 2001. It incorporates actions that are designed to address the key issues of water quality and fish habitat. It further reduces the potential for effects from sedimentation and peak flows. Adjustments were made to silviculture treatments, logging, transportation systems, prescribed fire treatments, and watershed restoration treatments. Adjustments to the timing of implementation are also included in this alternative, which will delay implementation and spread implementation out over four years in the Little Summit subwatershed.

Alternative C includes vegetation management activities to provide for landscape-level health and diversity and prescribed fire to reduce fire hazard and fuels, but on fewer acres. Some unit boundaries have been adjusted, and some units dropped. Additional road closures and decommissioning are included. More placement of large woody material, and another culvert replacement are included in this alternative to address the water quality issues and improve watershed conditions. Activities to improve water quality under this alternative are consistent with Deep WQRP goals and objectives and management measures (See Sections 2 and 3 of Deep WQRP, Appendix D). Alternative C is consistent with the Ochoco National Forest Plan and is consistent with the FY 2001 - 2003 Biological Opinion. Consultation requirements have been completed. Activities included in this alternative are listed below. This information is provided comparatively with the other alternatives in Table 2-1. All figures are approximate.

Alternative C Summary:

Silvicultural treatments that include timber harvest is proposed as follows:

Improvement Cutting (HIM)	5,688
Commercial Thinning (HTH)	562
Group Selection Harvest (HSG)	58
Clearcut with Reserve Trees (HCR)	60
Shelterwood Harvest with Reserve Trees (HSH)	14
Sanitation Harvest (HSN)	11
Total	6,393

Other activities include:

Post Harvest Precommercial Thinning (PCT) - 6,285
Post Harvest Fuels Treatments include the following:
- Broadcast Burning for Site Preparation - 132
- Grapple Piling from Existing Trails - 768
- Jackpot Burning Fuel Concentrations - 1,534
- Leave Top Attached/Grapple Piling from Existing Trails - 10
- Underburn -3,067

PCT outside of harvest units (354 within RHCAs) - 3,757
Natural Fuels Underburn - 4,192
Wildlife/Juniper Reduction Underburn - 4,549
Riparian Planting - 28 miles
Large Woody Material Placement - 7.4 miles
Riparian Protection at Dispersed Recreation Sites - 6 locations
Aspen Enhancement - 81 acres
Willow Enhancement - 2 sites
Meadow Enhancement - 825 acres
Mountain Mahogany Enhancement - 16 acres
Culvert Replacement - 8 locations
Road Closure - 16.2 miles
Road Decommissioning - 15.2 miles

Alternative C Discussion

Figures 2-5 through 2-8, on the following pages, display the proposed commercial and precommercial thinning proposals, logging system design, watershed enhancement projects, prescribed burning proposals, and road management activities.

SILVICULTURAL TREATMENTS - Like Alternative B, this alternative includes silvicultural treatments to improve the landscape-level health, resiliency, and diversity of both upland forests and riparian communities. Upland vegetation treatments are intended to reduce stand densities, mimic natural disturbance regimes, and move the area closer to the historic range of variability for all seral/structural stages, including stands dominated by LOS. RHCA and riparian vegetation treatments are designed to meet RMOs and Deep Creek WQRP goals and objectives.

Treatments proposed in this alternative are predominately thinning and improvement harvest in stands of dense, small-sized trees. Regeneration harvest is also proposed, however, the amount (132 acres) is less than any action alternative. No live trees larger than 21" dbh are proposed for harvest, except those identified as OSHA hazard trees.

Activities through commercial timber harvest would be done using tractor, winter logging, and helicopter logging systems (see Table 2-1). Winter and helicopter logging systems were incorporated on a site-specific basis to address a variety of resource concerns. Like Alternative B, the logging system design was developed to address watershed concerns associated with new road development, creek crossings, re-use of roads in riparian areas, sensitive plants, and soils. Approximately 182 acres of soil tillage are included as mitigation in areas where needed and feasible to cause no net increase in detrimental soil conditions.

Overall, compared to Alternative B, this alternative treats less individual commercial harvest units, does more precommercial thinning, modifies proposed unit boundaries, reduces roading needs, makes logging system design changes, and modifies the timing of timber sales in the Little Summit Subwatershed. Harvest activities in this subwatershed are to be delayed and will occur under two separate timber sales, commencing in 2004 (winter logging portion) and 2005, respectively, to help address the water quality and fish habitat issue. An estimated 13.8 MMBF of timber would be harvested.

FUELS - Fire is re-introduced within the watershed to reduce fire hazard through natural fuels reduction and to move the area closer to historic fire regimes. Burning is, however, eliminated within much of the dry and moist grand fir sites in the higher elevations (above 5000 feet). This helps maintain a diversity of wildlife habitat by providing a greater area in higher density stands. Jackpot burning is not proposed under this alternative and would maintain additional habitat diversity. This represents a reduction of approximately 11,951 acres from Alternative B and reduces the area treated in the headwaters of much of the watershed. Reductions of burning in Lower Deep subwatershed, and to a lesser extent, Little Summit drainages reduce the potential for impacts associated with sedimentation in these drainages. Similar to Alternative B, precommercial treatments are proposed to mechanically reduce stand densities, species composition, and reduce ladder fuels.

Underburning of natural fuels is prescribed to reduce natural fuel loading. The underburning is designed to remove much of the encroaching juniper less than 2" in diameter while enhancing and stimulating forage production, and creating a mosaic of burned and unburned vegetation. Larger juniper (up to 10" diameter) will be cut prior to burning.

RESTORATION - Additional restoration or vegetation enhancement projects are added to those identified under Alternative B to better maintain or enhance upland, riparian, and meadow systems. Watershed conditions are improved through the placement of instream structures, riparian protection, road closures and decommissioning, and road culvert replacement.

Vegetation treatments are prescribed in RHCAs to address RMOs and WQRP goals and objectives. They include commercial harvest on 24 acres and precommercial thinning on 354 acres of conifer stands. Aspen enhancement within RHCAs is included on 81 acres. This treatment includes a combination of commercial (50 acres) and precommercial thinning of encroaching conifers within aspen clones. As in Alternative B, meadow enhancement (conifer thinning) is prescribed on 825 acres within or adjacent to RHCA buffers and will help improve wildlife habitat in and around these meadow systems. Prescribed fire would not be set in RHCAs; however, it would be allowed to back slowly into them leaving a mosaic that would result in low intensity fire effects that meet the RMOs and WQRP.

ROADS - Management would consist of construction of 1.1 miles, reconstruction (improvement of drainage) of 22.9 miles along the haul route, and temporary construction of 5.9 miles. Removal and harvest of hazard trees along the haul routes is included in Alternative C. Hazard trees within RHCAs would be felled, and then left on site to meet large woody material objectives.

This alternative incorporates additional road closures and decommissioning that were identified in the roads analysis. The closure of approximately 16.2 miles of roads is proposed under this alternative to improve water quality. This includes closing sixteen roads for a total of 11.0 miles and correcting ineffective closures on eight roads for an additional 5.2 miles. Nineteen roads (15.2 miles) are planned for decommissioning (no long term need has been identified). Eight culverts are scheduled for replacement.

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Figure 2- 5 Alternative C Commercial Thinning & Precommercial Thinning

Figure 2- 6 Alternative C Logging Systems

Figure 2- 7 Alternative C Transportation System

Figure 2- 8 Alternative C Prescribed Burning & Watershed Enhancement Projects

Alternative D

Proposed activities in this alternative were developed to address the purpose and need and the objectives outlined in Chapter 1. It incorporates actions that are designed to address water quality and fish habitat issues and to incorporate consideration of wildlife habitats as described below under Fuels. The amount, location and access to proposed activities in relation to streams were reviewed during alternative development. Consideration was given to the amount of area selected adjacent to RHCAs for treatments. Proposed treatments were developed to help limit the potential for effects from increases in sedimentation and peak flows and to lower the risk to stream temperatures. Activities proposed under this alternative are consistent with Deep WQRP goals and objectives and management measures (See Sections 2 and 3 of Deep WQRP, Appendix D). Alternative D would be consistent with the Ochoco National Forest Plan and the FY 2001 - 2003 Biological Opinion. Consultation requirements have been completed. Activities included in this alternative are listed below. All figures are approximate.

Alternative D Summary

Silvicultural treatments that include timber harvest is proposed as follows:

Improvement Cutting (HIM)	4,120
Commercial Thinning (HTH)	779
Group Selection Harvest (HSG)	184
Clearcut with Reserve Trees (HCR)	59
Shelterwood Harvest with Reserve Trees (HSH)	14
Sanitation Harvest (HSN)	11
Total	5,167

Other activities include:

Post Harvest Precommercial Thinning (PCT) - 4,895 acres
Post Harvest Fuels Treatments include the following:

- Broadcast Burning for Site Preparation - 257 acres
- Grapple Piling from Existing Trails - 665 acres
- Jackpot Burning Fuel Concentrations - 1,284 acres
- Leave Top Attached/Grapple Piling from Existing Trails - 10 acres
- Underburn - 2,951 acres.

Precommercial Thinning outside of harvest units - 2,007 acres (202 RHCA acres).
Natural Fuels Underburn - 3,293 acres
Wildlife/Juniper Reduction Underburn - 5,183 acres
Riparian Planting - 28 miles
Large Woody Material Placement - 5.5 miles
Riparian Protection at Dispersed Recreation Sites - 6 locations
Aspen Enhancement - 77 acres
Willow Protection - 1 site
Meadow Enhancement - 825 acres
Culvert Replacement - 7 locations
Road Inactivation - 9.2 miles
Road Decommissioning - 11.7 miles

Alternative D Discussion:

The alternative maps on the following pages display the proposed commercial and precommercial thinning proposals, logging system design, watershed enhancement projects, prescribed burning proposal, and road management activities.

SILVICULTURAL TREATMENTS - Like Alternatives B and C, this alternative includes silvicultural treatments to improve the landscape-level health, resiliency, and diversity of both upland forests and riparian communities. Like other alternatives, treatments are intended to mimic natural disturbances to move the area closer to the historic range of variability for all seral/structural stages, including stands dominated by LOS. Treatments proposed in this alternative are predominately thinning and improvement harvest in stands of dense, small-sized trees. Regeneration harvest is also proposed. No live trees larger than 21” dbh are proposed for harvest, except those identified as OSHA hazard trees.

Timber harvest activities have been prescribed to use tractor, winter logging, and helicopter logging systems. Winter and helicopter logging were incorporated on a site-specific basis to address a variety of resource concerns including soil compaction and disturbance. Additional helicopter and winter logging lower potential for sedimentation effects to water quality. Similar to other alternatives, the logging system design addresses watershed concerns associated with new road development, creek crossings, re-use of roads in riparian areas, sensitive plants, and soils. Approximately 97 acres of soil tillage are included as mitigation in areas where needed and feasible to cause no net increase in detrimental soil conditions.

Overall, this alternative treats the fewest individual units and acres, proposes the least PCT, modifies proposed boundaries of treatment areas, has less road development, and has less treatment area immediately adjacent to RHCA habitat than the other action alternatives. An estimated 11.5 MMBF of timber would be harvested.

FUELS - Like Alternative C, fire is re-introduced within the watershed to reduce fire hazard through natural fuels reduction and to move the area closer to historic fire regimes. However, burning is not prescribed within the higher elevation dry and moist grand fir sites to maintain some fuel concentrations (no jackpot burning) and to create more dense stands providing a variety of wildlife habitats. Burning is reduced adjacent to RHCAs. This alternative proposes 265 acres less of prescribed burning than Alternative C. PCT is proposed to reduce stand densities and ladder fuels and to adjust species composition.

Underburning of natural fuels is prescribed to reduce natural fuel loading. The underburning is designed to remove much of the encroaching juniper less than 2” in diameter while enhancing and stimulating forage production, and creating a mosaic of burned and unburned vegetation. Larger juniper (up to 10” diameter) will be cut before burning.

RESTORATION - Like Alternative B, restoration or vegetation enhancement projects are included to maintain or enhance upland, riparian, and meadow systems. Watershed conditions are improved through the placement of instream structures, riparian protection, road closures and decommissioning, and road culvert replacement. Vegetation treatments are prescribed in RHCAs to address RMOs and goals and objectives identified in the Deep WQRP (See Appendix D).

No commercial harvest is proposed in conifer stands within RHCAs. Precommercial thinning is proposed on 202 acres of conifer stands within RHCAs and is consistent with Deep Creek WQRP and RMOs. Aspen enhancement within RHCAs is included on 77 acres. This treatment includes a combination of commercial (50 acres) and precommercial thinning of encroaching conifers within aspen clones. Meadow enhancement (conifer thinning) is prescribed on 825 acres within or adjacent to RHCA buffers. Prescribed fire would not be set in RHCAs but would be allowed to back into them leaving a mosaic that would produce low intensity fire effects that meet water quality and RHCA vegetation goals and objectives.

ROADS - Management would consist of no new construction, reconstruction (improvement of drainage) of 22.7 miles along the haul route, and temporary construction of 7.8 miles. Removal and harvest of hazard trees along the haul routes is included in Alternative D. Hazard trees within RHCAs would be felled, and left on site to meet large woody material objectives.

Approximately 9.2 miles of roads would be closed under this alternative to improve water quality. This includes closing eleven roads for a total of 6.1 miles and correcting ineffective closures on six roads for an additional 3.1 miles. Thirteen roads (11.7 miles) are planned for decommissioning. Seven culverts are scheduled for replacement.

Figure 2- 9 Alternative D Commercial Thinning & Precommercial Thinning

Figure 2- 10 Alternative D Logging Systems

Figure 2- 11 Alternative D Transportation System

Figure 2- 12 Alternative D Prescribed Burning & Watershed Enhancement Projects

Table 2- 1 Comparison of Alternatives

Treatments	Alternative A	Alternative B	Alternative C	Alternative D
Timber Harvest				
Acres Treated by Silvicultural Prescription				
Improvement Harvest	0	5,906	5,688	4,120
Commercial Thinning	0	713	562	779
Group Selection	0	327	58	184
Clearcut w/Reserves	0	86	60	59
Shelterwood	0	69	14	14
Sanitation	0	11	11	11
Total Acres Timber Harvest	0	7,112	6,393	5,167
Logging System (acres)				
Tractor	0	4,206	3,754	3,244
Winter Logging	0	1,601	1,329	1,031
Helicopter	0	1,050	1,310	892
Skyline	0	255	0	0
Harvest Volume by Logging System (MMBF)				
Tractor	0	8.4	8.1	7.3
Tractor – Winter	0	5.2	2.9	2.4
Helicopter	0	2.5	2.8	1.8
Skyline	0	0.6	0	0
Total Harvest Volume (MMBF)	0	16.7	13.8	11.5
Precommercial Thinning				
Inside harvest units	0	6,615	6,285	4,895
Outside harvest units	0	3,550	3,757	2,007
RHCA Conifer Treatments				
Commercial Harvest (acres)	0	24	24	0
Precommercial Thinning	0	354	354	202
Road Management				
Road Construction (miles)	0	1.8	1.1	0
Road Reconstruction	0	24.4	23.9	22.7
Temporary Roads	0	9.3	5.9	7.8
Road Closure	0	9.2	16.2	9.2
Road Decommissioning	0	11.7	15.2	11.7
Fuels Reduction				
Fuel Treatment within Harvest Areas (acres):				
Broadcast Burn	0	482	132	257

Treatments	Alternative A	Alternative B	Alternative C	Alternative D
Grapple Pile	0	500	768	665
Jackpot Burn	0	875	1,534	1,284
LTA/Grapple	0	141	10	10
LTA/Jackpot	0	10	0	0
Underburn	0	5,104	3,067	2,951
Total Fuels Treatment within Harvest Units	0	7,112	5,511	5,167
Prescribed Fire (acres)				
Natural Fuels Burning	0	11,661	4,192	3,293
Forage Enhancement/Juniper Encroachment	0	8,339	4,549	5,183
Jackpot Burning for Fuel Break	0	692	0	0
Total Prescribed Fire	0	20,692	8,741	8,476
Vegetation & Watershed Enhancement				
Riparian Planting (miles)	0	28	28	28
Meadow Enhancement (acres)	0	825	825	825
Dispersed Rec. Site Rehabilitation (sites)	0	6	6	6
Aspen Stand Enhancement (acres)	0	77	81	77
Large Woody Material Placement (miles)	0	5.5	7.4	5.5
Culvert Replacement	0	7	8	7
Willow Protection (sites)	0	1	1	1
Willow Enhancement (sites)	0	0	1	0
Mountain Mahogany Enhancement (acres)	0	0	16	0
Road Closure (miles)	0	9.2	16.2	9.2
Road Decommissioning (miles)	0	11.7	15.2	11.7

Design Elements Common to All Action Alternatives

Many of the following design elements are expected to reduce, minimize, or eliminate impacts from management activities and meet the requirements set forth in the Forest Plan. They are also designed to meet the requirements for protection of water quality in the State of Oregon through planning, application, and monitoring of Best Management Practices (General Water Quality Best Management Practices, USDA 1988). Design elements for watershed and fisheries resources are consistent with Deep Creek WQRP goals and objectives and incorporate measures to reduce or minimize impacts to the riparian and aquatic resources.

Through an adaptive management approach, district personnel will monitor the effectiveness of design elements and if necessary, adjustments to mitigation measures will be made or additional measures will be incorporated to achieve desired effects.

Certain elements and features of the action alternatives are similar. Where not similar across alternatives, it is noted which alternative and which units the element applies to. The design elements also identify situations where IDT resource specialists will be involved with fieldwork to ensure site-specific measures are incorporated into the project implementation. Following each design element, site-specific information has been included to assist with implementation.

Scenic and Recreation Resources

Visual Corridors

Visual Corridors (MA-F26) exist along portions of Forest Service Roads 4200 and 1200 (12.0 miles). The following measures apply to proposed activities within these visual corridors.

- Locate landings at least 100 feet from roads as feasible. Orient skid trails parallel to roads as feasible. Flagging would be removed and painted boundary trees would be blackened after operations are complete. Timber marked for removal would be marked on the side of trees facing away from visual corridors. Silvicultural prescriptions would be designed to meet visual objectives adjacent to the roads. Stump heights would be 8 inches or less within 100 feet of roads.

  Alternative B: Commercial Harvest Units — 4, 59, 61, 68, 128, 176, 310, 313, 436, 461, 491, 496, 502, 503, 504, 509, 513, 516, 518, 526, 528, and 534.

  Alternative C: Commercial Harvest Units – 4, 59, 59a, 61, 68, 176, 310, 436, 461, 496, 502, 503, 509, 513, 516, 518, 526, 528, and 534.

  Alternative D: Commercial Harvest Units – 4, 59a, 61, 68, 176, 436, 496, 509, 513, 516, 518, 526, 528, and 534.

- Temporary roads associated with these areas would be minimally constructed to a standard necessary for the amount of volume removed. Erosion control measures such as waterbars would be implemented and the roads would be closed after harvest operations are completed.

  Alternative B: Commercial Harvest Units – 4, 78, 143, 149, 247, 436, and 509.

  Alternative C: Commercial Harvest Units – 4, 78a, 149, 436, and 509.

  Alternative D: Commercial Harvest Units – 4, 78, 149, 247, 436, and 509.

- The silvicultural prescriptions for the precommercial thinning would be designed to have irregular spacing and leave a mosaic of thinned and unthinned patches. Stump heights would be 6 inches or less for precommercial thinning within these corridors.

  Alternatives B and C: Precommercial Thinning Units – 5-8, 24, 26, 30, 32, 57, 71, 81, 91, 94, 95, 97, 101, 103, 106-110, 112, 114, and 115.

  Alternative D: Precommercial Thinning Units – 7, 24, 26, 32, 101, 103, 106-110, and 112.

- Slash may be treated by a variety of means such as lop and scatter, hand pile, and/or jackpot burning. No machine piling of slash would occur.

All Commercial Harvest and Precommercial Thinning Units listed above.

Trails

The **Summit National Historic Trail** (MA-F7) is located on portions of Forest Service Roads 2630 and 1200 (10.8 miles). In addition to the above design elements, the following measures apply to treatments proposed adjacent to the Summit Trail. Treatments are designed to provide a natural setting within the most visible foreground. The general border of the area is variable to take advantage of natural topographic features and special scenery areas, but may extend out to 600 feet on each side of the road:

- Timber sale boundaries would be pulled back off the road and minimally posted to meet Regional Accountability Standards. Boundary tags would be removed.

  Alternative B: Commercial Harvest Units – 3, 59, 69, 71, 75, 76, 78-80, 82, 85, 129, 130, 142, 149, 151, and 247.

  Alternative C: Commercial Harvest Units – 3, 59a, 69, 75, 76, 78a, 78b, 78c, 79, 80, 85, 129, 130, 142, 149, 151a, and 151b.

  Alternative D: Commercial Harvest Units – 3, 59a, 69, 75, 76, 78, 80, 85, 129, 130, 142, 149, 151, and 247.

- Landings would be located outside this zone as feasible. Locations will be coordinated with the District Archaeologist for the following units.

  Alternative B: Commercial Harvest Units – 59, 69, 76, 78-80, 129, 130, 149, 151, and 247.

  Alternative C: Commercial Harvest Units – 59a, 69, 76, 78a, 78b, 78c, 79, 80, 129, 130, 149, 151a, and 151b.

  Alternative D: Commercial Harvest Units – 59a, 69, 76, 78, 80, 129, 130, 149, 151, and 247.

- Historic features associated with the Summit Trail would be retained.

  See Cultural Resources section below.

The following design elements apply to the Fry Trail and its trailheads:

- No slash piling would occur on trail beds. Landings would be located at least 100 feet from trails. Skidding operations would be away from trails. Crossings would be minimized with designated crossings. No seeding of grasses would occur. After the timber sale is closed flagging would be removed and painted boundary trees would be blackened. Stump heights would be 8 inches or less within 100 feet of trails. Trailheads and historic blaze trees would be protected. If any damage occurs to the trail during logging, the timber sale contractor will restore the trail tread to forest specifications.

  All Alternatives: Commercial Harvest Unit – 80.

Recreation Sites

Dispersed recreation sites are scattered throughout the area and the use varies through time. The following design elements apply to dispersed camps:

- Silvicultural treatments would be designed to maintain an emphasis on the visual quality in proximity of these areas. Slash would be hand piled within 100 feet of these sites.

All Commercial Harvest Units and Precommercial Thinning Units that contain or are adjacent to dispersed camps. Reference Figure 1-2 (page 1-11) for location of known camps.

- Landings would be located a minimum of 150 feet away from these areas where feasible. Skidding operations would be away from dispersed sites.

All Commercial Harvest Units that contain or are adjacent to dispersed camps. Reference Figure 1-2 (page 1-11) for location of known camps.

Wildlife

Snags and Down Wood

- Snag patches would be identified in helicopter units where patches occur. This would help provide a measure to ensure crew safety and protect snags from felling due to safety considerations. This would not apply to aspen enhancement projects.

Alternative B: Commercial Harvest Units – 2, 50, 51, 178, 183, 186, 188-190, 192-201, 203, 204, 205a, 207a, 213a, 214a, 215a, 216, 217, 219, 220, 222, 223a, 224-226, 237, 341-345, 373-375, 379, 445, 453, 454a, 455a, 473, and 478a.

Alternative C: Commercial Harvest Units – 50, 51, 55, 178, 181, 183, 186-190, 192-201, 204, 205a, 213a, 214a, 215-217, 220, 222, 223a, 224a, 225, 226, 237a, 237b, 315, 316, 317a, 317c, 318a, 338, 341, 343, 373, 374, 375, 379, 397, 445, 453, 454a, 455a, 455b, 473, and 478a.

Alternative D: Commercial Harvest Units – 50, 51, 55, 178, 181, 183, 186-190, 192-199, 204, 205, 214a, 216, 217, 220, 222, 223a, 226, 237, 315, 316, 317a, 341, 343, 367, 375, 379, 397, 453, and 455a.

- Hollow grand fir greater than 21” dbh would be favored to leave over other species in all commercial harvest units. Undesignated snags should be felled only where an unavoidable safety hazard exists. Hollow trees may have the following indicators:
    1. A broken bole with a bayonet top formed over the break.
    2. More than one pileated woodpecker entrance hole.
    3. Fruiting bodies of Indian Paint fungus.
    4. An old injury or bend along the bole where a new leader formed a new trunk.
- Other than safety hazards, no snags would be designated for removal in Little Summit Creek Subwatershed. Snag levels would be maintained at the upper end of the ranges identified in the VEMG for all other subwatersheds. Down wood levels would be maintained in proposed units by using the levels described in the VEMG (Reference Table 3-24, page 3-56). Hazard trees along haul routes and landings may be felled and removed to meet OSHA safety requirements.

All Alternatives.

Raptor Nests and Goshawk Nest Stands and Post Fledgling Areas

- Other than safety hazards, snags would be retained in these known nest sites and in Post Fledgling Areas (PFA).

Alternative B: Commercial Harvest Units – Toggle PFA: 109, 110, 117, and 120.

Haypress PFA: 90 and 163. Little Summit PFA: 388. Summit Camp PFA: 466, 488, 491, 494-496. Happy PFA: 237, 243-245, and 247. Happy Jack Camp PFA: 37, 95, 220, 221, 223, 224, 227, and 228.

Alternative C: Commercial Harvest Units – Toggle PFA: 120. Haypress PFA: 162. Little Summit PFA: 388. Summit Camp PFA: 466, 488, 494-496. Happy PFA: 237a, 237b, and 245. Happy Jack Camp PFA: 37, 220, 221, 223, 223b, 224, 224a, 227, and 228.

Alternative D: Commercial Harvest Units – Toggle PFA: 117, and 120. Haypress PFA: 90, 162, and 163. Little Summit PFA: 388. Summit Camp PFA: 466, 488, 494-496. Happy PFA: 237, 245, and 247. Happy Jack Camp PFA: 37, 220, 221, 223, 224, and 227.

- Seasonal restrictions would apply for units around active raptor nests. Treatments within PFAs would be designed to meet goshawk objectives (see Table 3-21, page 3-45) and a seasonal restriction would apply between March 1 and September 30. The restriction for other raptors would be in accordance with the Forest Plan standards and guidelines.

Alternative B: Commercial Harvest Units – 37, 90, 95, 109, 110, 117, 120, 163, 220, 221, 223, 224, 227, 228, 237, 243-245, 247, 388, 466, 488, 491, and 494-496. Precommercial Thinning Units - 11, 18, 45, 90, and 93. Burning Units - 3, 6, 11, 21, and 27.

Alternative C: Commercial Harvest Units – 37, 120, 162, 220, 221, 223, 223b, 224, 224a, 227, 228, 237a, 237b, 245, 388, 466, 488, and 494-496. Precommercial Thinning Units - 11, 18, 90, 93, 118, and 119. Burning Units: 3, 21, and 27.

Alternative D: Commercial Harvest Units – 37, 90, 117, 120, 162, 163, 220, 221, 223, 224, 227, 237, 245, 247, 388, 466, 488, and 494-496. Precommercial Thinning Units - 11, 90, and 93. Burning Units - 3, 21, and 27.

- Burning within PFAs would be conducted in the fall.

No spring burning is proposed under any of the alternatives.

- No harvest activities would occur in active or historical goshawk nest sites. If additional goshawk nest sites are discovered during future survey efforts or harvest operations, nest stands and PFAs would be identified in accordance with the Regional Forester's Forest Plans Amendment #2. If needed, adjustments would be made to silvicultural treatments within units located within these new PFAs.

All Alternatives: Commercial Harvest Units.

Wolverine:

- Harvest activities, including road construction or reconstruction that is not currently designed for winter logging would not occur between December 1 and May 1. This includes all commercial harvest units ***except*** the following:

Alternative B: Commercial Harvest Units – 176, 310, 313, 314, 326, 327, 351-353, 463, 465, 466, 466a, 467, 472, 485, 488, 499, 500-504, 509, 513, 516, 518, 520, 522, 524, and 534. Aspen Units - 12, 37, 49, 59, 73, and 75.

Alternative C: Commercial Harvest Units – 176, 310, 314, 317, 326, 327, 334, 351-353, 357, 360, 465, 466, 472, 485, 488, 494-496, 500-503, 509, 513, 516, 518, 520, 524, 526, 528, 529, and 534. Aspen Units - 12, 37, 49, 59, 73, and 75.

Alternative D: Commercial Harvest Units – 176, 310, 314, 317, 326, 327, 351-353, 360, 466, 485, 488, 494-496, 499, 500, 509, 513, 516, 518, 520, 524, 526, 528, and 534. Aspen Units - 12, 37, 49, 59, 73, and 75.

Big Game:

- Meadow enhancement, commercial harvest, precommercial thinning, and dispersed recreation site restoration within RHCAs would not occur between May 15 and June 30 to protect the character of elk calving areas and limit human disturbance when evidence of calving is occurring. This applies to all meadow and dispersed recreation site rehabilitation proposals and the following units:

  Alternative B: Commercial Harvest Units – 69, 146, 163, 188, 189, 194, 196, 201, 203, 205, 205a, 206, 208, 215, 215a, 220, 223, 223a, 237, 238, 247, 315, 316, 317, 317a, 341, 343, 360, 388, 416, 461, and 600. Precommercial Thinning Units - 2-5, 7, 8, 10, 12, 14, 15, 17-19, 21, 23, 25, 29, 31-33, 36, 41, 42, 44, 46, 48, 50, 53, 54, 58, 61, 62, 64, 68-71, 73-75, 77-82, 84, 85, 87, 90, 92-94, 96, 97, 100, 103, 108-111, and 113.

  Alternative C: Commercial Harvest Units – 3, 123, 134, 146, 162, 188, 189, 194, 196, 201, 205, 205a, 206, 208, 215, 220, 223a, 223b, 237a, 237b, 238, 315, 316, 317a, 317c, 341, 388, 401, 461, 600, and 602. Precommercial Thinning Units - 2-5, 7, 8, 10, 12, 14, 15, 17-19, 21, 23, 25, 29, 31-33, 36, 41, 42, 44, 46, 48, 50, 53, 54, 58, 61, 62, 64, 68-71, 73-75, 77-82, 84, 85, 87, 90, 92-94, 96, 97, 100, 103, 108-111, and 113.

  Alternative D: Commercial Harvest Units – 3, 134, 146,188, 189, 194, 196, 205, 206, 208, 215, 220, 223, 237, 238, 247, 315, 316, 317a, 341, 388, and 401. Precommercial Thinning Units - 7, 19, 21, 23, 25, 29, 33, 41, 42, 44, 46, 48, 50, 54, 58, 61, 62, 64, 68, 70, 74, 75, 78, 80, 84, 85, 87, 90, 92, 93, 96, 100, 103, and 108-111.

- Wallows found throughout the project implementation would be protected during the rutting season from September 1 and October 15.

  All Alternatives.

In addition, the following design elements are incorporated:

- Trees that may provide potential bat habitat would be left on rock outcroppings within harvest units.

  All Alternatives.

- Proposed vegetation management activities would retain approximately 10% of each harvest and precommercial area in an untreated condition. This would help maintain within-stand diversity. Depending on stand conditions, these patches would coincide with RHCAs, down wood concentrations, snag patches, or multi-strata stand conditions.

  All Alternatives: Commercial Harvest and Precommercial Thinning Units.

- Post harvest monitoring would be conducted in regeneration harvest units to determine if there is a need to control gophers. To avoid effects to non-target species, any gopher baiting would be underground and any spilled bait would be completely removed from the surface and buried.

  Alternative B: Commercial Harvest Units – 42, 71, 78, 79, 82, 83, 90, 95, 117, 123, 128, 163, 168-170, 211, 223, 223a, 224, 228, 229, 231-235, 237, 238, 243, 247, 254, and 500.

  Alternative C: Commercial Harvest Units – 61, 78b, 78c, 151b, 168-170, 211, 224, 233, 235b, 238, 254, and 500.

Alternative D: Commercial Harvest Units – 42, 61, 78, 90, 117, 128, 163, 168-170, 211, 223, 223a, 224, 229, 232-235, 237, 238, 247, 254, and 500.

- Temporary, new or re-opened roads would be used for administrative and operational use only and closed at the end of the operating season. Roads would be designed to ensure they could be effectively closed.

All Alternatives.

Cultural Resources

(The cultural resource sites are sensitive. Information pertaining to their locations is not accessible to the public. The Deep Vegetation Management Project has been developed with the following designs elements. Protection of sites will be accomplished during implementation through the District Archaeologist.)

- A cultural resource planning area survey has been completed and known cultural resource sites would be preserved or protected to achieve a determination of No Effect with the Oregon State Historic Preservation Officer (SHPO).
- Lithic scatters would be protected during prescribed burning through a combination of avoidance and low intensity (low) temperatures.
- Dendroglyph sites associated with aspen stands would be protected from scarring during commercial operations. Protection measures would be coordinated with the District Archaeologist on a site-specific basis during layout and operations.
- Site locations would be identified by the District Archaeologist to ensure protection.
- New road locations would be evaluated once the road surveys are complete to determine if additional archaeological review is needed. This includes site-specific evaluation of road closure and decommissioning work that occurs outside of existing road prisms.
- If cultural resource sites are discovered during the course of operations, operations would stop and further mitigations would be developed as appropriate.

Transportation Management

(Reference Transportation System Maps (Figures 2-3, 2-7, 2-11) for locations of road construction, reconstruction, closure, and decommissioning projects.)

- New road construction would be located and designed to minimize the potential for sediment transport to streams.
- Road construction and reconstruction activities would include maintaining and repairing water bars that disperse runoff from roads.
- Roads would not be constructed along the length of RHCAs. If crossings were needed, they would be designated and designed to be perpendicular, not parallel, to the RHCA.
- No seeding of roads would occur.

- Existing roads across scablands would be re-used under all alternatives. No scarification would occur on these roads. New road locations would avoid scablands. If roads were necessary on scablands they would be rocked and designed with erosion control features.

- After use, temporary roads and roads planned for decommissioning or closure would be scarified and revegetated within the RHCA zones. This would increase infiltration and reduce the potential for sediment delivery to streams in the long term.

- Haul would be prohibited on the following roads because they have been previously closed, decommissioned or are currently revegetated.

  2630-731, 745, and 860.
  3000-652, 653, 700, 704, 710, 712, 713, and 746.
  4250-200, 210, and 215.
  4270-212, 300, and 400.

- Road closure, reconstruction and decommissioning projects would confine equipment to the existing road prism. Any operations that require disturbance outside of the road prism would be coordinated with the Fisheries Biologist, Archaeologist, and Botanist.

- Helicopter log and service landings would be approved by the Forest Service before use by the timber sale purchasers. Approved locations would be coordinated with the Fisheries Biologist, Archaeologist, Wildlife Biologist and Botanist. Approved landings would be located outside of RHCAs and would avoid new landing locations on scablands. The need for post harvest rehabilitation would be identified when operations are complete.

Watershed/Fisheries

- Winter logging would occur during adequate snow and/or frozen conditions defined as:

  6” surface frost;
  4” surface frost and a minimum of 1 foot of snow; or
  2 feet of snow.

  The objective is to avoid surface soil disturbance, compaction, and displacement. Any combination of the above factors would satisfactorily achieve this objective and would be acceptable conditions for this activity.

  Alternative B: Commercial Harvest Units – 176, 310, 313, 314, 326, 327, 351-353, 463, 465, 466, 466a, 467, 472, 485, 488, 499, 500-504, 509, 513, 516, 518, 520, 522, 524, and 534.

  Alternative C: Commercial Harvest Units – 176, 310, 314, 317, 326, 327, 334, 351-353, 357, 360, 465, 466, 472, 485, 488, 494-496, 500-503, 509, 513, 516, 518, 520, 524, 526, 528, 529, and 534.

  Alternative D: Commercial Harvest Units – 176, 310, 314, 317, 326, 327, 351-353, 360, 466, 485, 488, 494-496, 499, 500, 509, 513, 516, 518, 520, 524, 526, 528, and 534.

- Minimize soil movement on tractor units adjacent to or within RHCAs. Slash would be placed at the edge of landings to provide roughness to retard overland flow. Scarification of landings would be considered on a case-by-case basis and coordinated with the Fisheries Biologist/Hydrologist and Soil Scientist.

  All Alternatives: Reference Appendix F for tractor units identified by alternative.

- During operations, erosion control structures would be constructed if necessary at or near road crossings to reduce the amount of sediment reaching streams. Structure placement would depend upon site-specific conditions as identified by the Fisheries Biologist. Ditch line sediment traps may also be used to achieve the same objective. Provide relief culverts on reconstructed roads associated with intermittent or ephemeral stream crossings to provide flood relief.

All Alternatives: Commercial Harvest Units, Culvert Replacements, and Road Closure and Decommissioning.

- Within RHCAs, water bars and drains would be located on roads and skid trails. This would allow the water to disperse on rocky apron areas before flowing downhill through deeper side slope soils. Placement of new skid trails within the RHCA would be avoided. Existing skid trails would be utilized where possible, especially within 50 feet of the scab-conifer interface. No skidding would occur down Class V swales.

All Alternatives: Reference Appendix F for tractor units identified by alternative.

- Best Management Practices (BMP) would be utilized to comply with state water quality standards.

All Alternatives: All activities.

- Streams requiring classification or reclassification would be coordinated through the Fisheries Biologist prior to project implementation and design elements would be incorporated. Additional RHCAs located within harvest or burning units would be addressed by the Fisheries Biologist and RMOs would be reviewed.

All Alternatives: All activities.

- RHCAs have been identified and are the same for all alternatives. These RHCA descriptions are consistent with standards contained in INFISH implementation standards:
  1. Class I and II streams have RHCAs of 300 feet slope distance measured, both sides, from the edge of the riparian influence zone.
  2. Class III streams have RHCAs of 150 feet.
  3. Class IV streams have RHCAs of 50 feet.
  4. Springs, bogs, seeps, and ponds greater than one acre have RHCAs of 150 feet.
  5. Springs, bogs, seeps, and ponds less than one acre have RHCAs of 50 feet.

The following design elements apply to harvest operations within RHCAs:

- Ground based equipment within RHCAs would be restricted to designated crossings that are at least 300 feet apart on Class IV drainages. The District Fisheries Biologist and Botanist would review stream-crossing locations before Forest Service approval of locations.

All Alternatives: Reference Appendix F for tractor units identified by alternative.

- Where possible, full suspension would be required for logs yarded over the no-cut buffers. Cable skylines would be allowed to pass through RHCAs. Skyline settings and cable corridors would be located to minimize damage to conifers that are providing stream shading.

Alternative B: Commercial Harvest Units - 54, 55, 315, 316, 317a, 338, 367, and 397.

- Landings would not be placed in RHCAs or swales (Class V). Exceptions would be evaluated on a case-by-case basis to determine if they would enhance the recovery of the RHCA and meet RMOs. Situations that meet these criteria include, but are not limited to, re-using and rehabilitating an existing disturbed area rather than constructing a new road or landing.

All Alternatives: Commercial Harvest Units.

All action alternatives propose some vegetation management activities within RHCA stands. The following design elements would be applied to mitigate effects and facilitate the accomplishment of riparian treatments to help attain RMOs.

- The Fisheries Biologist would coordinate with the Presale Forester and Silviculturist during implementation on areas where RHCA treatments are identified. Over snow or helicopter logging has been incorporated into alternative design. Ground based equipment may be restricted in periods of use to minimize soil compaction and disturbance within the RHCA. The Fisheries Biologist/Hydrologist would coordinate and monitor on-going operations to minimize any effect. Re-use of an existing road that is currently located in the RHCA would be considered when:
    1. New road construction can be avoided and the existing road can be rehabilitated after use.
    2. The re-use of the existing road would facilitate the rehabilitation of an existing skid trail.
    3. Equipment can be restricted to the existing road and line pulling is feasible.

Alternative B and C: Commercial Harvest Units –3, 69, 134, 189, 201, 310, and 314.

Both PCT and meadow enhancement would occur in RHCAs. The following criteria would apply:

- Prescriptions would be site-specific and designed to meet RMO objectives for the site. No measurable decrease in shade would occur from operations along perennial and/or fish-bearing streams. Vegetation would be left intact within 15 feet of all stream channels and no measurable decrease in shade would occur. Directional fall all PCT into closed roads, temporary roads and skid trails within RHCAs.

    Alternative B and C: Precommercial Thinning Units – 2, 3, 4, 7, 8, 10, 12-15, 17-19, 21, 23, 25, 29, 31, 33, 36, 41, 46, 50, 53, 54, 61, 62, 64, 69, 70, 79, 80, 84, 85, 93, 94, 96, 97, 100, and 108-110.

    Alternative D: Precommercial Thinning Units – 7, 19, 21, 23, 25, 29, 33, 41, 46, 50, 54, 61, 64, 70, 74, 78, 80, 84, 85, 93, 96, 100, and 110.

- Prescribed burning in RHCAs would be designed to improve riparian conditions. No lighting or fire line construction would occur in RHCAs. Fire behavior would be monitored with the Fisheries Biologist and/or hydrologist during burning within the RHCA to ensure RMOs will be met and that no measurable reduction in shade occurs.

    In order to meet INFISH RMOs, the objectives of the Deep Creek WQRP, and Forest Plan Standards and Guidelines, it may be necessary to extinguish fire where unexpected conditions are encountered. Activities that would warrant the suppression of fire include burning of large woody debris within the stream influence, burning of willows, alder, or other riparian hardwood species, and/or long residence burning times around the base of large shade-producing trees. Fire intensities in Class I, II, and III streams would be low and would not result in an overall change in the current vegetation composition or a net loss of large down material within the flood plain and greenline areas.

    All Alternatives: Natural Fuels Burning Units.

The following no-harvest buffers will be applied to RHCA stands proposed for commercial treatment in order to meet shade requirements, root strength and reduce sediment delivery. These buffers would apply to each side of the stream (RHCA treatments apply to Alternatives B and C only). These buffers would not apply to the aspen stand treatments that are prescribed under all alternatives. Post harvest PCT would incorporate the 15-foot buffer described above.

- Cable, Winter Logging, and Helicopter Systems:
    1. Class I & II streams – 100 ft

None identified.

2. Class III streams – 100 ft

   Alternative B and C: Commercial Harvest Unit – 189.

3. Class IV streams – 20 ft

   Alternative B and C: Commercial Harvest Units – 201, 310, and 314.

- Ground based equipment:

1. Class I & II streams – 200 ft

   None identified.

2. Class III streams – 100 ft

   None identified.

3. Class IV streams – 20 ft

   Alternative B and C: Commercial Harvest Units – 3, 69, and 134.

Soils

- All harvest units that are currently less than 20% compacted or displaced would remain so after harvest and rehabilitation where identified. Rehabilitation includes scarification of skid trails, landings and/or temporary roads. See page 2-55 for a description of soil rehabilitation.

  Alternative B: Commercial Harvest Units – 1, 2, 37, 38, 54, 55, 59, 61, 76, 78-83, 90, 95, 109, 110, 116, 117, 120, 123-126, 128, 131, 133, 144, 145, 161, 168, 169, 170, 178, 181, 182, 186, 187, 188, 189, 190, 192, 193, 194, 195, 197, 198, 199, 200, 201, 203, 204, 205, 205a, 207, 207a, 208, 212, 213, 213a, 214, 214a, 215, 215a, 219, 220, 221, 222, 223, 223a, 224, 225, 227, 228, 229, 231, 233, 234, 235, 243, 244, 247, 252, 253, 254, 310, 334, 338, 341, 342, 343, 344, 345, 367, 371, 372, 373, 374, 375, 377, 378, 379, 381, 397, 401, 420, 424, 425, 426, 436, 443, 446, 455, 456, 461, 466a, 467, 473, 445, 447, 477, 478, 478a, 479, 494, 500, 504, 506, 506a, 507, 518, 600, 601, and 602.

  Alternative C: Commercial Harvest Units – 1, 37, 55, 59, 59a, 61, 76, 78a, 78b, 78c, 79, 80, 81, 116, 120, 123, 124, 125, 126, 128, 131, 133, 144, 145, 161, 162, 168, 169, 170, 178, 181, 182, 186, 187, 188, 189, 190, 192, 193, 194, 195, 197, 198, 199, 200, 201, 204, 205, 205a, 207, 208, 212, 213, 213a, 214, 214a, 215, 220, 221, 222, 223, 223a, 223b, 224, 224a, 227, 228, 229, 233, 235a, 235b, 252, 253, 254, 310, 334, 338, 341, 343, 372, 373, 374, 375, 377, 378, 379, 381, 397, 420, 425, 426, 436, 443, 445, 446, 447, 455, 456, 461, 473, 477, 478, 478a, 494, 500, 506, 506a, 507, 518, 600, and 602.

  Alternative D: Commercial Harvest Units – 37, 38, 55, 59a, 61, 76, 78, 80, 81, 90, 116, 117, 120, 124, 125, 128, 131, 133, 144, 145, 161, 162, 168, 169, 170, 178, 181, 182, 186, 187, 188, 189, 190, 192, 193, 194, 195, 197, 198, 199, 204, 205, 208, 213, 214, 214a, 215, 220, 221, 222, 223, 223a, 224, 227, 229, 233, 234, 235, 247, 252, 253, 254, 310, 341, 343, 367, 371, 372, 375, 377, 378, 379, 381, 397, 401, 425, 426, 436, 443, 446, 455, 456, 447, 477, 478, 494, 500, 506, 506a, 507, and 518.

- Where existing soils conditions are above the Forest Plan standard and guideline of 20% detrimental soil conditions, no net increase in detrimental soil conditions would be allowed. The percent of detrimental soil conditions would be reduced to the existing level at a minimum after rehabilitation.

  Alternative B: Commercial Harvest Units – 3, 4, 39, 40, 42, 50, 51, 52, 53, 57, 58, 60, 68, 69, 75, 85, 107, 115, 121, 127, 129, 130, 134, 140, 142, 143, 146, 149, 151, 156, 157, 159,

163, 166, 175, 176, 183, 196, 206, 210, 211, 216, 217, 226, 230, 232, 237, 238, 245, 246, 258, 354, 255, 257, 261, 313, 314, 315, 316, 317, 317a, 318, 326, 327, 351, 352, 353, 356, 357, 360, 387, 388, 400, 416, 453, 454, 454a, 455a, 463, 465, 466, 472, 482, 484, 485, 488, 491, 495, 496, 499, 501, 502, 503, 508, 509, 513, 516, 520, 522, 524, 526, 528, 529, and 534.

Alternative C: Commercial Harvest Units – 3, 4, 38, 39, 40, 42, 50, 51, 52, 53, 57, 60, 68, 69, 75, 85, 107, 115, 127, 129, 130, 134, 140, 142, 143, 146, 149, 151a, 151b, 156, 157, 159, 163, 166, 175, 176, 183, 196, 206, 210, 211, 216, 217, 226, 230, 237a, 237b, 238, 245, 246, 255, 257, 258, 261, 314, 315, 316, 317, 317a, 317c, 318, 318a, 326, 327, 351, 352, 353, 354, 356, 357, 360, 387, 388, 400, 416, 453, 454, 454a, 455a, 455b, 465, 466, 472, 482, 484, 485, 488, 495, 496, 499, 501, 502, 503, 508, 509, 513, 516, 520, 524, 526, 528, 529, and 534.

Alternative D: Commercial Harvest Units – 3, 4, 39, 40, 42, 50, 51, 52, 53, 57, 58, 60, 68, 69, 75, 85, 107, 115, 127, 129, 130, 134, 140, 142, 143, 146, 149, 151, 156, 157, 159, 163, 166, 175, 176, 183, 196, 206, 210, 211, 216, 217, 226, 230, 232, 237, 238, 245, 246, 255, 257, 258, 261, 314, 315, 316, 317, 317a, 326, 327, 351, 352, 353, 354, 356, 360, 387, 388, 416, 453, 454, 455a, 466, 472, 482, 485, 488, 495, 496, 499, 508, 509, 513, 516, 520, 524, 526, 528, and 534.

- Scarification of soils is prescribed to rehabilitate soils after harvest and to meet soil and watershed objectives.

Alternative B: Commercial Harvest Units – 1, 3, 39, 42, 52, 53, 57, 58, 68, 75, 85, 109, 115, 126, 127, 128, 134, 140, 142, 143, 144, 146, 149, 151, 156, 157, 163, 166, 176, 205, 206, 208, 210, 211, 212, 227, 231, 233, 234, 238, 245, 252, 253, 254, 255, 258, 261, 351, 352, 353, 354, 356, 378, 381, 387, 388, 416, 424, 436, 461, 465, 466, 472, 479, 482, 484, 488, 491, 494, 495, 496, 499, 500, 502, 503, 506, 507, 513, 516, 518, 520, 522, 524, 526, 528, 600, and 601.

Alternative C: Commercial Harvest Units – 1, 3, 38, 39, 42, 52, 53, 57, 59a, 68, 75, 85, 115, 126, 127, 128, 134, 140, 142, 144, 146, 149, 151a, 151b, 156, 157, 166, 176, 205, 206, 208, 210, 211, 212, 227, 233, 238, 252, 253, 254, 255, 258, 261, 351, 352, 353, 354, 356, 378, 381, 387, 388, 416, 436, 461, 465, 466, 472, 482, 484, 488, 494, 495, 496, 499, 500, 502, 503, 506, 507, 509, 513, 516, 518, 520, 524, 526, 528, 534, and 600.

Alternative D: Commercial Harvest Units – 3, 39, 42, 52, 53, 57, 59a, 68, 75, 85, 115, 127, 128, 134, 140, 142, 143, 144, 146, 149, 151, 156, 157, 163, 166, 176, 206, 208, 210, 211, 227, 233, 234, 238, 245, 252, 253, 254, 255, 258, 261, 351, 352, 353, 354, 356, 378, 381, 387, 388, 416, 436, 466, 472, 482, 488, 494, 495, 496, 499, 500, 506, 507, 513, 516, 518, 520, 524, 526, and 528.

- If scarification were not feasible, operations that cause additional detrimental soil disturbance would be limited to already impacted areas.

Alternative B: Commercial Harvest Units – 4, 40, 50, 51, 60, 69, 107, 121, 129, 130, 159, 175, 183, 196, 216, 217, 226, 230, 232, 237, 246, 257, 313, 314, 315, 316, 317, 317a, 318, 326, 327, 357, 360, 400, 453, 454, 454a, 455a, 463, 485, 501, 508, 509, 529, and 534.

Alternative C: Commercial Harvest Units – 4, 40, 50, 51, 60, 69, 107, 129, 130, 159, 175, 183, 196, 216, 217, 226, 230, 237a, 237b, 246, 257, 314, 315, 316, 317, 317a, 317c, 318, 318a, 326, 327, 357, 360, 400, 453, 454, 454a, 455a, 455b, 485, 501, 508, and 529.

Alternative D: Commercial Harvest Units – 4, 40, 50, 51, 60, 69, 107,129, 130, 159, 175, 183, 196, 216, 217, 226, 230, 232, 237, 246, 257, 314, 315, 316, 317, 317a, 326, 327, 360, 453, 454, 455a, 485, 508, 509, and 534.

- For tractor yarding units, the leading end of logs must be suspended above the ground during skidding or swing operations to limit soil displacement. Designated skid trails would not be placed on the portions of units where slopes exceed 35 percent. Skidding operations would be restricted and feller buncher and/or line pulling would be required. Skid trails would be designated and approved before logging and would be located on already disturbed areas where possible. There would be no skidding off designated skid trails. Skid trail crossings, temporary roads, and landings would be kept to a minimum along the forest/scab interface (50 to 66 foot zone) to provide an infiltration buffer to mitigate sensitive hydrologic conditions.

  All Alternatives: Reference Appendix F for tractor units identified by alternative.

- Prescribed fire, and other management activities, would be conducted so that a minimum of 60 percent effective ground cover remains after harvest and site preparation is completed. Effective ground cover is defined as the basal area of perennial vegetation, plus litter and coarse fragments (greater than 2 mm) including tree crowns and shrubs that are in direct contact with the ground (Forest Plan, Chapter 4, Section 3, p. 4-196).

  All Alternatives: All treatments.

Fuels

- Fuel treatments within the Summit Trail Management Area and visual corridors are required to leave native vegetative cover as described above.

  Alternative B: Fuel Treatment Units – 7, 9, 32 38, 14, and 18.

  Alternative C: Fuel Treatment Units – 7 and 17.

  Alternative D: Fuel Treatment Units – 17.

- Soil scorching would be minimized. Prescribed burning prescriptions would limit the burn intensity and residence time. All prescribed fire operations would be in accordance with Oregon Smoke Management Guidelines. No fire line (machine or hand) would be constructed within RHCAs. Exceptions would occur to stop burning activities if RHCA objectives are not being met. Natural fuels underburning or wildlife burning are designed to avoid burning in scablands. No lighting would occur in these areas. Juniper larger than 12" in diameter at breast height would not be cut in Natural Fuels and Wildlife Enhancement/Juniper Reduction burn areas.

- Prescribed burning, including activity fuels treatments, within upland shrub areas would incorporate silviculture prescriptions that benefit upland shrubs.

  All Alternatives: Natural Fuels Units.

Improvements

- Livestock fences, cattle guards, and other developments would be protected and/or returned to their original condition after commercial harvest operations.

- Timber harvest, burning and road closure activities would be coordinated with range permittees as needed.

Noxious Weeds

- Avoid weed-infested areas for camps, landings, and parking areas.

  All Alternatives: Roads – Six Corners Junction, Jct. Of 4250/4254, Jct. 30/30-700, Jct.

42/42-650, 42 (along Buck Hollow Creek). Consult with Botanist for activities along roads 4256, 4250-100, 4256-010. Helicopter Landing – H12

- Roads proposed for closure/decommissioning would be surveyed prior to closure activity to avoid the spread of existing weeds and to determine if treatment is needed prior to closure.

  Reference Alternative Transportation System Maps for road numbers (20.9 miles for Alternatives B and D. 31.4 miles for Alternative C).

- Where straw bales are used for capturing sediment during roadwork or other activity, they would be from a field certified as weed-free.

- The Timber Sale Contract would include the C (T) 6.343 (Opt. 2) provision as a mitigation measure to preclude the potential for transport or spread of noxious weeds by road construction or logging equipment. This provision requires: (1) certification that equipment be clean of all plant or soil material that may result in the establishment or spread of noxious weeds; and (2) notification of location where equipment was most recently used. All other contracts would also require cleaning of equipment prior to transport to the forest.

- If the timber sale purchaser were required to seed portions of RHCAs, the purchaser would be required to provide a copy of the Seed Analysis Report that identifies the noxious weed seed content (C (T) 6.6#).

- Mineral sites that have been surveyed for weeds would be used as a rock source to support roadwork. When weeds are present, no disturbance would take place around the weed site. These sites include Aspen, Derr, Shown Trough, Timothy, and Younger Spring.

Sensitive Plant Populations and Habitat

- The District Botanist would coordinate layout of timber harvest units with the Presale Forester to provide recommendations for protecting populations or habitat for sensitive species.

  Alternative B: Commercial Treatment Units – 3, 69, 78, 81, 90, 130, 134, 140, 143, 149, 151, 166, 189, 194, 215, 238, 243, 244, 260, 310, 314, 316, 317, 326, 327, 329, 338, 352, 374, 387, 397, 401, 416, 420, 424, 440, 446, 454, 455, 463, 465, 466, 467, 473, 496, 501, 502, 503, 504, 509, 520. Aspen Units - 2, 11, 37, 49, 53, 65, 73, 75.

  Alternative C: Commercial Treatment Units - 78, 81, 130, 140, 143, 149, 166, 194, 151, 243, 244, 260, 310, 326, 327, 338, 374, 387, 397, 401, 416, 420, 424, 440, 454, 455, 463, 465, 466, 467, 473, 501, 502, 503, 504, 509. Aspen Units - 2, 11, 37, 49, 53, 65, 73, 75.

  Alternative D: Commercial Treatment Units – 3, 69, 78, 81, 90, 130, 134, 140, 143, 149, 151, 166, 189, 194, 215, 238, 310, 314, 316, 317, 326, 327, 352, 387, 397, 401, 416, 446, 455, 466, 473, 496, 509, 520. Aspen Units - 2, 11, 37, 49, 53, 65, 73, 75.

- Buffers of 50 feet that exclude ground-disturbing equipment would be established around sensitive plant populations and habitat. Exceptions may include the re-use of existing roads and areas reviewed by the District Botanist in coordination with other specialists.

  Alternative B: Commercial Treatment Units – 3, 69, 78, 81, 90, 130, 134, 140, 143, 149, 151, 166, 189, 194, 215, 238, 243, 244, 260, 310, 314, 316, 317, 326, 327, 329, 338, 352, 374, 387, 397, 401, 416, 420, 424, 440, 446, 454, 455, 463, 465, 466, 467, 473, 496, 501, 502, 503, 504, 509, 520. Aspen Units - 2, 11, 37, 49, 53, 65, 73, 75.

  Alternative C: Commercial Treatment Units - 78, 81, 130, 140, 143, 149, 166, 194, 151, 243, 244, 260, 310, 326, 327, 338, 374, 387, 397, 401, 416, 420, 424, 440, 454, 455, 463, 465, 466, 467, 473, 501, 502, 503, 504, 509. Aspen Units - 2, 11, 37, 49, 53, 65, 73, 75.

Alternative D: Commercial Treatment Units - 3, 69, 78, 81, 90, 130, 134, 140, 143, 149, 151, 166, 189, 194, 215, 238, 310, 314, 316, 317, 326, 327, 352, 387, 397, 401, 416, 446, 455, 466, 473, 496, 509, 520. Aspen Units - 2, 11, 37, 49, 53, 65, 73, 75.

- Planned activities within sensitive plant populations, such as large woody material placement, would be coordinated with the District Botanist, and would take place after the plants are dormant.

All Alternatives: Dispersed Recreation Site – 1. Culverts – 2, 3, 5, 6. Riparian Planting – 1, 2, 3, 5, 6, 8, 9, 12, 13, 14, 15, 16, 17, 19, 22, 25, 28, 31, 38, 40. Large Woody Material – A, B, E, F, H, I, K, N, P, S, T, U. Natural Fuels Units – 6, 9, 21, 27.

- Ground-disturbing activities on scablands would be avoided to protect sensitive plant habitat and archaeological resources. The appropriate specialists would review unanticipated disturbances on site.

Alternative B: Commercial Treatment Units – 310, 318, 375, 466. Aspen Units – 11, 12, 37, 53, 55, 65, 73, 75. Roads - 3000000T01, 4270210U02, 4272400T01. Helicopter Landings – 5, 6, 14, 15, 16, 23.

Alternative C: Commercial Treatment Units – 310, 318, 374, 466. Aspen Units – 11, 12, 37, 53, 55, 65, 73, 75. Roads - 3000000T01, 4270210U02, 4272400T01. Helicopter Landings – 5, 6, 14, 15, 16, 23.

Alternative D: Commercial Treatment Units – 310, 466. Aspen Units – 11, 12, 37, 53, 55, 65, 73, 75. Roads - 3000000T01, 4270210U02, 4272400T01. Helicopter Landings – 5, 6, 14, 15, 16, 23.

- Motorized vehicles used in project activities, including road reconstruction and maintenance would be restricted to the road prism.

All Alternatives: All activities. All roads within the prism.

- Treatment areas identified as Moist Grand Fir plant associations would protect habitat for yellow lady's slipper (*Cypripedium calceolus* var. *parviflorum*). Treatments would restrict machine piling and burning activities. The District Botanist would review any activities within these areas prior to implementation.

All Alternatives: Commercial Treatment Units – 238, 520.

- Areas of known plant sites would be avoided in meadow enhancement projects and plant sites would be protected with a 50-foot buffer. The District Botanist would delineate plant sites on the ground.

All Alternatives: Meadows – 2630 #1, 2630 #2, 2630 #3, 2630-800, 4270, Haypress, Double Corral, Derr, Jackson Creek, Toggle, Dicer South, Round, Big Springs.

The following design elements apply to Selected and Non-Selected Populations (Draft Species Management Guide, Kagen 1996) of Peck's mariposa lily (*Calochortus longebarbatus* var. *peckii*).

- No prescribed fire ignition would take place within a 100-foot protection zone. Prescribed fire activity would take place in late summer or fall.

Alternative B: Activity Fuels within Commercial Harvest Units – 3, 78, 81, 90, 189, 194, 201, 215, 238, 243, 244, 310, 314, 326, 327, 352, 387, 397, 401, 416, 420, 447, 455, 463, 465, 501, 502, 509, and 520. Non-Selected Populations within Natural Fuels Units – 6, 7, 8, 10, 14, 15, 16, 17, 20, 23, 26. Selected Populations within Natural Fuels Units – 3, 4, 9, 11, 12, 13, 19, 21, 27, 28.

Alternative C: Activity Fuels Units within Commercial Harvest Units – 3, 81, 140, 143, 149, 189, 194, 215, 238, 310, 314, 326, 327, 387, 397, 401, 416, 420, 447, 501, 502, 509, and 520. Non-Selected Populations within Natural Fuels Units – 7, 14, 17, 20, 22, 26. Selected Populations within Natural Fuels Units – 3, 9, 11, 12, 19, 21, 27, 28.

Alternative D: Activity Fuels Units within Commercial Harvest Units – 78, 81, 90, 140, 143, 149, 194, 326, 327, 387, 397, 401, 416, 446, 447, 455, and 509. Non-Selected Populations within Natural Fuels Units – 14, 15, 16, 17, 20, 21, 22, 23, 26. Selected Populations within Natural Fuels Units – 3, 9, 11, 12, 19, 27.

- Slash would not be piled on top of known sensitive plant locations.

  Alternative B: Commercial Treatment Units – 3, 78, 81, 90, 189, 194, 201, 215, 238, 243, 244, 310, 314, 326, 327, 352, 387, 397, 401, 416, 420, 447, 455, 463, 465, 501, 502, 509, and 520. Precommercial Thinning Units – 5, 7, 8, 10, 18, 31, 34, 50, 55, 70, 71, 76, 78, 79, 81, 82, 84, 90, 92, 93, 94, 97, 109, 110, 114. Meadow Enhancement Units – 2630 #1,2 and 3, 2630-800, Haypress, Double Corral, Derr, Jackson, Toggle, Dicer south, 4270, Big Springs. Aspen Units: 2, 11, 37, 49, 53, 65, 73, 75, 20, 39, 64, 66. Natural fuels (juniper thinning) – 3, 11.

  Alternative C: Commercial Treatment Units – 3, 81, 140, 143, 149, 189, 194, 215, 238, 310, 314, 326, 327, 387, 397, 401, 416, 420, 447, 501, 502, 509, and 520. Natural Fuels (juniper thinning) – 3, 11. Precommercial Thinning Units – 5, 7, 8, 10, 18, 31, 34, 50, 55, 70, 71, 76, 78, 79, 81, 82, 84, 90, 92, 93, 94, 97, 109, 110, 11. Meadow Enhancement Units – 2630 #1,2 and 3, 2630-800, Haypress, Double Corral, Derr, Jackson, Toggle, Dicer south, 4270, Big Springs. Aspen Units - 2, 11, 37, 49, 53, 65, 73, 75, 20, 39, 64, 66.

  Alternative D: Commercial Treatment Units – 78, 81, 90, 140, 143, 149, 194, 326, 327, 387, 397, 401, 416, 446, 447, 455, and 509. Natural Fuels (juniper thinning) – 3, 11. Precommercial Thinning Units – 7, 34, 50, 55, 70, 76, 78, 84, 90, 92, 93, 94, 109, 110. Meadow Enhancement Units – 2630 #1,2 and 3, 2630-800, Haypress, Double Corral, Derr, Jackson, Toggle, Dicer South, 4270, Big Springs. Aspen Units - 2, 11, 37, 49, 53, 65, 73, 75, 20, 39, 64, 66.

- The District Botanist would coordinate with project specialists in the field prior to commencing with stream rehabilitation, culvert replacement, riparian plantings, and natural fuels treatments to ensure locations are known. Where projects are planned in the vicinity of sensitive plant populations, areas of disturbance would be spot checked at the proper time of year for the presence of sensitive plants or habitat. If plants were found, mitigation measures would be incorporated that would protect the site.

  All Alternatives: Dispersed Recreation Site – 1. Culverts – 6. Riparian Planting – 6, 12, 13, 14, 15, 16, 17, 19, 22, 25, 28, 31. Large Woody Material – A, B, E, F, I, K, N, P. Meadow – 2630-800.

- Adjustments of these design elements would be identified for specific areas or treatments such as aspen stands, winter logging over snow, RHCA treatments, or other riparian enhancement activities after consulting with the District Botanist.

  Alternatives B and C: Commercial Treatment Units – 3, 69, 189, 201, 314. Aspen Units – 2, 11, 37, 49, 53, 65, 73, 75.

  Alternative D: Commercial Treatment Units – 3, 69, 189, 314. Aspen Units – 2, 11, 37, 49, 53, 65, 73, 75.

The following design elements apply only to the Selected Populations (Draft Species Management Guide, Kagen 1996) of Peck's mariposa lily (*Calochortus longebarbatus* var. *peckii)*.

- For selected *Calochortus* populations (Crazy, Derr, Little Summit and Buck Hollow Creeks), protection zones of 100 feet would be placed around sensitive plant populations and habitat. No mechanical equipment use would take place within this zone. The first 50 feet of this zone would not be treated.

Alternative B: Commercial Treatment Units – 90, 140, 143, 149, 194, 151, 310, 326, 327, 352, 387, 401, 416, 420, 424, 446, 455, 463, 465, 466, 467, 501, 502, 503, 504, 509.

Alternative C: Commercial Treatment Units – 90, 140, 143, 149, 194, 151, 310, 326, 327, 352, 387, 401, 416, 463, 465, 467, 509.

Alternative D: Commercial Treatment Units – 90, 140, 143, 149, 151, 310, 326, 327, 352, 387, 401, 416, 446, 455, 466, 509.

- Precommercial thinning and meadow restoration within or directly adjacent to *Calochortus* Selected Populations will take place after the growing season. No slash piling would occur on top of sensitive plants. The District Botanist will assist in designing silvicultural treatments to enhance these populations.

Alternatives B and C: Precommercial Thinning Units - 7, 8, 18, 70, 76, 84, 90, 93, 94, 97, 109, 110, 114. Meadows 2630 #1, 2630 #2, 2630 #3, Haypress, Double Corral, Derr, Jackson, 4270.

Alternative D: Precommercial Thinning Units - 7, 70, 76, 84, 90, 93, 109, 110. Meadows 2630 #1, 2630 #2, 2630 #3, Haypress, Double Corral, Derr, Jackson, 4270.

Monitoring

A comprehensive monitoring plan has been prepared as a working document in conjunction with this FSEIS (Appendix B). It incorporates implementation and effectiveness monitoring as part of this vegetation management project. It will be updated with unit specific monitoring locations once a Record of Decision is signed and the Selected Alternative is identified.

The plan incorporates monitoring of a sample of activity areas by an IDT to evaluate the implementation of proposed activities and design elements and their effectiveness at meeting project resource objectives and plan standards and guidelines.

Descriptions of Treatments for the Action Alternatives

This section contains a brief summary of prescription information for the proposed actions.

Silvicultural treatments would promote stand health in order to maintain, develop, and enhance the existing vegetation and move the area closer to conditions described in the Viable Ecosystem Management Guide (VEMG). This entails adjusting the landscape-level abundance, distribution, and mosaic of seral/structural stages within the watershed.

Silvicultural treatments would incorporate the “Design Elements Common to All Alternatives” listed on the preceding pages. Treatments would also incorporate Forest Plan Standards and Guidelines and Regional Forester’s Forest Plan Amendment #2 standards for wildlife. These guidelines include retention of all trees 21 inches in diameter and greater. At least 10% of the treatment areas will be retained as no-treatment. Prescriptions would incorporate measures to enhance special habitats, such as upland hardwoods, to provide for within-stand diversity.

Treatments have been tailored to accelerate the development of LOS, maintain and enhance shade along streams where RHCA treatments have been prescribed, adjust species composition, and adjust stocking levels to meet overall landscape objectives for the vegetation. Historic disturbance factors created a mix of stand types, structures, and mosaics of conditions on the landscape. Silvicultural treatments that can assist in meeting these landscape objectives include:

Improvement Cutting (HIM) – This treatment is an improvement cutting (thinning) and is classed as an intermediate treatment (Smith 1962). This treatment is applied to stands that are irregular in age and species distribution. It is a preliminary treatment to improve the composition of both species and quality of tree. The treatment is used in stands having a relatively high percentage of mid and late seral species. Early seral species such as ponderosa pine and western larch would be retained where possible. Stand densities would be reduced to levels that allow for improved tree vigor, accelerated LOS development and reduced risk of insect infestations.

Commercial Thinning (HTH) – Commercial thinning is an intermediate stand treatment used to regulate the distribution of growing space for the advantage of the remaining trees (Smith, 1962). Thinning prescriptions would be applied in stands exhibiting a relatively high proportion of early or mid seral species that are more uniform in age and size distribution. Typically these stands have been previously thinned. The objectives would be to reduce stand density to maintain or improve stand vigor and increase tree growth to promote larger tree structures (accelerate LOS development). Important elements of stand diversity would be retained through retention of snags, large down wood, variable spacing of residual trees, retention of “no-thin” patches, and creation of small patch openings.

Group Selection Harvest (HSG) – This treatment is an uneven-aged silviculture system that would remove trees by group selection. This entry would initiate pockets of regeneration and create a mosaic pattern within the stand (20-30% of the area). Within the regeneration groups, additional residual tree structure would be retained for wildlife and vegetation diversity purposes. This prescription can be used to improve both species composition and structure for the long-term landscape goals. The groups would be regenerated to early seral species by planting. The resulting stand will be a mosaic of seral and structural stages. The small openings will maintain and enhance within stand diversity and emulate some of the historic patterns created by fire and forest pathogens.

Clearcut with Reserve Trees (HCR) – This treatment is a regeneration cut using an even-aged silviculture system of clearcut with seed trees. Additional residual trees would be retained for wildlife and vegetation diversity purposes. Maintaining at least 10% of the area in an untreated condition would add to the vegetation diversity. This treatment is used in stands that do not provide desirable stand conditions as defined by management objectives for the management area. This treatment would improve both species composition and structure for the long-term landscape goals.

Shelterwood Harvest with Reserve Trees (HSH) – This treatment is a regeneration cut using an even-aged silviculture system of clearcut with shelterwood trees. Additional trees other than those trees left for seed and shelter would be retained for wildlife and vegetation diversity. Again, vegetation diversity would be provided for by approximately 10% of the area to remain untreated. This treatment is used in stands that do not currently provide desirable stand conditions and cannot be managed to provide for long-term objectives. The treatment would improve both species composition and structure for the long-term landscape goals.

Sanitation Harvest (HSN) – This treatment is a sanitation treatment for the purpose of reducing the spread of damaging insects and protecting the residual stand. Trees that are susceptible to infestation or currently showing signs of infestation would be removed to protect the residual trees. This is an intermediate stand treatment.

Precommercial Thinning (PCT) – Precommercial thinning would occur in stands overstocked with small diameter trees. This could include older plantations or in stands mostly, but not fully, stocked with larger diameter trees (>7 inches diameter) that also have an excess of smaller diameter understory trees. The objectives of PCT are to regulate the distribution of growing space (density management), improve tree quality and control species composition. Redistribution of growing space to residual trees would increase growth rates and decrease the time necessary to reach larger stand structures. Generally, only trees that are less than 7” dbh are cut. Precommercial thinning would occur after harvest in stands that are predominantly fully stocked with larger trees but are still overstocked with small diameter trees. In areas of stands where full stocking exists with the overstory, precommercial thinning would result in an understory removal. In areas where full stocking from larger overstory trees does not occur, the understory would be precommercially thinned.

Whipfall/Cleaning/Understory Removal – Whipfall is used to remove small diameter trees in a stand cleaning and weeding operation, usually as part of a site preparation treatment before planting. For this project, whipfall would be used to describe not only site preparation cleaning and weeding but would include understory removal of small diameter trees in stands fully stocked with desirable, larger diameter trees. The understory treatment differs from precommercial thinning described above in the objective to reduce the number of canopy layers of the stand and move the stand toward a single-story condition. Generally, trees fewer than 7 inches in diameter are cut but some cleaning treatments would remove trees up to 9 inches in diameter.

Fuels Reduction (Underburning) – This burning prescription is designed to apply prescribed fire to reduce natural fuels to levels that reduce the risk of high severity wildfire. Burning objectives are to reduce fuels while maintaining current stand structure and creating a mosaic burn pattern that mimics natural fire (10-15% of an area unburned).

Forage Enhancement and Juniper Encroachment (Underburning and Juniper Thinning) – Objectives for this burning treatment are to reduce juniper encroachment and generate additional forage for wildlife. Like the fuels reduction burning, it would reduce natural fuels accumulations and leave the area in a burned/unburned mosaic. A portion of larger diameter juniper (up to 10 inches in diameter) would be cut before burning.

Fuel Continuity Reduction (Jackpot Burning) – This prescription is designed to reduce the continuity of fuels by reducing patches of the large fuel component (15”+) by 25%. It is designed to reduce some of the concentrations of fuels, while maintaining down wood levels for wildlife. The objective is to reduce the overall continuity of horizontal fuels, reducing the intensity and spread of wildfires within the area.

Meadow Enhancement – This treatment is similar to PCT in terms of reducing stand densities of smaller diameter stems. No treatment buffers would be established adjacent to the channel as described under the design elements listed above. Trees up to 9 inches in diameter would be cut within the meadow. Fuel treatments would be combinations of lop and scatter, piling, and/or burning.

Riparian Planting – This is prescribed to increase the riparian hardwood component along selected stream reaches to promote bank stability and improve shade along stream courses. Native hardwood species such as willow, alder, cottonwood, aspen, and other riparian species would be planted and protected from browsing by a combination of tubing, cages, fencing, and/or high density planting.

Large Woody Material (LWM) – This includes the placement of large woody material in stream channels to assist in reducing the hydraulic gradient, catch sediment and organic matter, reduce erosion potential during high flows, and help develop deeper, narrower channels.

Aspen Treatments – These treatments are designed to be a combination of commercial and PCT treatments. Treatments would remove competing conifers to allow the light necessary for a vigorous stand to reach the forest floor, and to protect the suckers from browsing. Treatment stands were chosen by the recovery potential estimated for the stand. The number and vigor of sprouts, condition of overstory trees in relation to insects and disease, and proximity of the water table, were used to estimate the recovery potential**.** Protection of sprouts will occur through fencing, cages, and/or slash barriers. This treatment would increase bank stability and shade.

Road Decommissioning and Closure – Road decommissioning would involve removing culverts, removal of fill material from the floodplain, scarification or tilling, waterbar installation, revegetation, and ditch removal depending on the road. Decommissioned roads would be put in a condition where they are capable of handling storm events and would be removed from the road system. Roads that are proposed for closure would be used on an intermittent basis but would be put in a closed capacity. These roads would be capable of handling storm events similar to decommissioned roads but are expected to be re-used sometime in the future. Closure entails a variety of actions such as the removal of sidecast material, some culverts, cross drain installation, revegetation, slope stabilization, and outsloping. A closure device would be placed at the entrance. These activities would reduce sediment delivery to streams and enhance infiltration around the road prism area. By eliminating culverts at road crossings, floodplain interaction and bedload transport would be restored.

Culvert Replacements – Culvert replacement would entail installing new culverts that are designed to increase the hydraulic capacity and to correct existing fish passage problems. These culvert replacements are done in conjunction with the vegetation treatments under the alternatives and would enhance the stream's ability to pass bedload and peak flows as well as provide vegetative recovery within the influence of the culverts.

Dispersed Recreation Site Rehabilitation – This treatment is designed to reduce compaction around areas adjacent to stream channels, decrease sediment delivery, and provide vegetative recovery within the influence of these sites. Vehicle access would be eliminated from two sites through actions similar to the above road closures. Other sites would have some barriers placed to limit vehicle use, reduce additional compaction and sediment delivery, and protect the vegetation within the riparian zones. Revegetation would be incorporated.

Soil Mitigation and Rehabilitation – Tillage is defined as the mechanical manipulation of soil aimed at modifying conditions for plant or tree growth. Decompaction operations are conducted to counteract the cumulative effect of ground based timber harvest operations on bulk soil density. The tillage decreases bulk density so that water and air can interact more effectively with roots and soil microflora/fauna. Infiltration rates are increased so that overland flow, peak flows, and rates of subsequent surface, rill and channel erosion are reduced. Methods used to decompact areas are: scarification with brushblades (shallow tillage); forest cultivator (effective approx. 14 – 18"); subsoiling with winged subsoiler (most effective for timber units); ripping with rock rippers on crawler type tractors (usually used for roads and landings); discing or harrowing (surface decompaction).

Identification of the Preferred Alternative

Alternative C is the Agency preferred alternative.

Summary of Effects by Alternatives as Related to Key Issues and the Purpose and Need

The following table compares the environmental consequences for each alternative. The purpose of this comparison is to summarize the major conclusions of the effects analysis relative to the issues and project objectives. The effects of the alternatives are discussed in more detail in Chapter 4, Environmental Consequences and in specific resource reports.

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Table 2- 2 Summary of Effects by Alternatives

Key Issue	Alternative A No Action	Alternative B Proposed Action	Alternative C	Alternative D
WATER QUALITY & FISH HABITAT				
Stream Temperature	Increase in LWM due to mortality in streamside stands. Higher potential for catastrophic wildfire potentially resulting in loss of stream shading. Current temperature regimes expected to be maintained. Long-term (decades) movement toward water quality standards or site potential would be minimal or on small localized scales.	Thinning prescriptions in RHCAs would promote future shade and LWM recruitment to streams. No-treatment buffers within RHCAs will prevent loss of existing shade. 24 acres commercial thinning in RHCAs; 354 acres PCT in RHCAs. Natural fuels treatments on 1,684 acres of RHCAs. Increased stream shading, fish habitat, and bank stability through riparian planting (28 miles) and LWM placement (5.5 miles). Enhanced stream shading in the long term would result from aspen stand treatments on 77 acres Most risk of reducing stream shade on localized stream reaches from aspen, precommercial thinning, and prescribed fire. Design elements will reduce this risk. This alternative does the most for reducing the risk of catastrophic fire effects to riparian habitats. Monitoring would ensure meeting objective of maintaining existing shade. ***Stream temperatures are not expected to increase over the long term (1-5 years).***	Thinning prescriptions in RHCAs would promote future shade and LWM recruitment to streams. No-treatment buffers within RHCAs will prevent loss of existing shade. 24 acres commercial thinning in RHCAs; 354 acres PCT in RHCAs. Natural fuels treatments on 612 acres of RHCAs. Increased stream shading, fish habitat, and bank stability through riparian planting (28 miles) and LWM placement (7.4 miles). Enhanced stream shading in the long term would result from aspen stand treatments on 81 acres. Less risk of reducing stream shade from aspen, precommercial thinning and prescribed fire than Alt. B. Fewer acres treated to reduce the risk of catastrophic fire effects to riparian habitats. Monitoring would ensure meeting objective of maintaining existing shade. ***Stream temperatures are not expected to increase over the long term (1-5 years).***	No commercial thinning in RHCAs except for aspen treatments; 354 acres PCT in RHCAs. Precommercial thinning prescriptions would promote future shade and LWM recruitment to streams. No-treatment buffers within RHCAs will prevent loss of existing shade. Natural fuels treatments on 587 acres of RHCAs. Increased stream shading, fish habitat, and bank stability through riparian planting (28 miles) and LWM placement (5.5 miles). Enhanced stream shading in the long term would result from aspen stand treatments on 77 acres. Similar to Alt. C for risk of reducing stream shade on localized stream reaches from aspen, precommercial thinning, and prescribed fire. Alt. C does the least to reduce the risk of catastrophic fire effects to riparian habitat. Monitoring would ensure meeting objective of maintaining existing shade. ***Stream temperatures are not expected to increase over the long term (1-5 years).***
Sedimentation	No direct increase in sediment input from any vegetation, fuels, or roading actions. Higher potential for catastrophic wildfire, which could result in an increase in sediment. Continued sediment delivery from existing roads and stream crossings, past harvest	Prescribed burning on 2,163 acres of RHCA would lower the risk of sedimentation effects from moderate to high intensity fires. Riparian planting (28 miles) would increase root strength and improve bank stability. LWM placement on 5.5 miles would improve bank stability. Aspen treatments (77 acres) would improve channel stability and enhance water table interactions.	Prescribed burning on 612 acres of RHCA would lower the risk of sedimentation effects from moderate to high intensity fires. Riparian planting (28 miles) would increase root strength and improve bank stability. LWM placement on 7.4 miles would improve bank stability. Aspen treatments (81 acres) would improve channel stability and enhance water table interactions.	Prescribed burning on 776 acres of RHCA would lower the risk of sedimentation effects from moderate to high intensity fires. Riparian planting (28 miles) would increase root strength and improve bank stability. LWM placement on 5.5 miles would improve bank stability. Aspen treatments (77 acres) would improve channel stability and enhance water table interactions.

Key Issue	Alternative A No Action	Alternative B Proposed Action	Alternative C	Alternative D
	practices, and livestock in riparian zones.	Meadow enhancement on 825 acres would increase water table interaction, stimulate grasses, sedges, and rushes to improve bank stability. Dispersed recreation site restoration at six sites would reduce compaction, sediment, and runoff. Road obliteration and inactivation on 20.9 miles. Road restoration would reduce sediment production and delivery to streams. Road construction (1.8 miles), reconstruction (24.4 miles) and temporary roads (9.3) miles may increase sedimentation in the short-term. Design elements and BMPs will minimize sediment. 7 culvert replacements will have short-term moderate increase in local sedimentation. ***Overall potential for higher levels of sediment to be produced from timber harvest, roads, and fire. Least likely to meet State Water Quality Standards and INFISH direction.***	Meadow enhancement on 825 acres would increase water table interaction, stimulate grasses, sedges, and rushes to improve bank stability. Dispersed recreation site restoration at six sites would reduce compaction, sediment, and runoff. Road obliteration and inactivation on 31.4 miles. Road restoration would reduce sediment production and delivery to streams more than Alts. B and D. Road construction (1.1 miles), reconstruction (23.9 miles) and temporary roads (5.9) miles may increase sedimentation in the short-term. Design elements and BMPs will minimize sediment. 8 culvert replacements will have short-term moderate increase in local sedimentation. ***Less overall potential for sediment production than Alt. B. would meet State Water Quality Standards and INFISH direction.***	Meadow enhancement on 825 acres would increase water table interaction, stimulate grasses, sedges, and rushes to improve bank stability. Dispersed recreation site restoration at six sites would reduce compaction, sediment, and runoff. Road obliteration and inactivation on 20.9 miles. Road restoration would reduce sediment production and delivery to streams the same amount as Alt. B. No new road construction. Road reconstruction (22.7 miles), and temporary roads (7.8) miles may increase sedimentation in the short-term. Design elements and BMPs will minimize sediment. 7 culvert replacements will have short-term moderate increase in local sedimentation. ***The least overall potential for sediment production. Would meet State Water Quality Standards and INFISH direction.***
Peak Flows	Continued decline in EHA values. Current range utilization, roads, and potential wildfire effects would offset hydrologic recovery.	Equivalent Harvest Acres (EHA) values remain below Forest Plan threshold levels for Deep Cr. Watershed. Potential for further negative adjustments in channel form (increased turbidity, loss of pools, increased width to depth ratios). Reduced effectiveness of watershed improvement projects. ***Highest risk to fish and aquatic habitats for a 5-year period between 2004 and 2009.***	Equivalent Harvest Acres (EHA) values remain below Forest Plan threshold levels. No measurable increases in peak flows are expected. Timing of sales will better address risk of increased flows. No expected acceleration channel degradation, low potential for undesired adjustments in width to depth ratios. Improved effectiveness of watershed improvement projects. ***Lowest risk to the fish and aquatic habitats.***	Equivalent Harvest Acres (EHA) values remain below Forest Plan threshold levels. Low potential for further negative adjustments in channel form (increased turbidity, loss of pools, increased width to depth ratios). Watershed improvement projects will be more effective than in Alt. B and are expected to offset this potential. ***Higher risk to fish and aquatic habitats than Alt. C, but lower than Alt. B.***
VEGETATIVE DIVERSITY				
Post-Treatment Seral/Structural	Continuation of current vegetation trends moving outside the HRV. Seral	482 acres regeneration harvest would change stand structure to open conditions and species to early seral	131 acres regeneration harvest would change stand structure to open conditions and species to early seral	257 acres regeneration harvest would change stand structure to open conditions and species to early seral

Key Issue	Alternative A No Action	Alternative B Proposed Action	Alternative C	Alternative D
Stage Distributions Relative to HRV	conditions would continue to move toward late seral stages; structural stages would continue to develop additional multi-canopy stands from single-story stands as understories continue to develop. ***43% of watershed within HRV. Proportion of the landscape outside HRV would continue to increase.***	and species to early seral. 6,630 acres intermediate harvest would move stands toward historic seral and structural conditions, favoring a greater abundance of early seral species and sing-story conditions. Precommercial thinning on 3,550 acres to reduce stand density and manage species composition. ***54% of the watershed within HRV. Increase the proportion of the watershed within HRV by 11%.***	conditions and species to early seral. 6,620 acres intermediate harvest that would move stands toward historic seral and structural conditions, favoring a greater abundance of early seral species and sing-story conditions. Precommercial thinning on 3,757 acres to reduce stand density and manage species composition. ***52% of the watershed within HRV. Increases the proportion of the watershed within HRV by 9%.***	conditions and species to early seral. 4,910 acres intermediate harvest to move stands toward historic seral and structural conditions, favoring a greater abundance of early seral species and single-story conditions. Precommercial thinning on 2,007 acres will reduce stand density and manage species composition. ***50% of the watershed within HRV. Increases the proportion of the watershed within HRV by*** 7%.
LOS Development	No treatments to promote accelerated LOS development or move current imbalance in LOS structure toward single-stratum conditions. Continued loss of single-stratum LOS. ***11,595 acres LOS projected in the watershed after 50 years.***	4,293 acres of LOS treated to reduce canopy layers, decrease ladder fuels, and reduce inter-tree competition. Susceptibility to wildfire, insects, and disease reduced and conditions moved towards HRV for single-stratum stands. 2,957 acres of high priority LOS treated. Reduction of fire hazard on 3,718 acres LOS. ***13,817 acres LOS projected in the watershed after 50 years.*** ***3,424 acres of multi-stratum LOS moved to single-stratum LOS, and towards HRV levels.***	3,315 acres of LOS treated to reduce canopy layers, decrease ladder fuels, and reduce inter-tree competition. Susceptibility to wildfire, insects, and disease reduced and conditions moved towards HRV for single-stratum stands. 1,792 acres of high priority LOS treated. Reduction of fire hazard on 2,909 acres LOS. ***14,050 acres LOS projected in the watershed after 50 years.*** ***2,365 acres of multi-stratum LOS moved to single-stratum LOS, and towards HRV levels.***	2,819 acres of LOS treated to reduce canopy layers, decrease ladder fuels, and reduce inter-tree competition. Susceptibility to wildfire, insects, and disease reduced and conditions moved towards HRV for single-stratum stands. 1,814 acres of high priority LOS stands treated. Reduction of fire hazard on 2,582 acres LOS. ***13,355 acres LOS projected in the watershed after 50 years.*** ***2,191 acres of multi-stratum LOS moved to single-stratum LOS, and towards HRV levels.***
Treatment of High Risk Stands	No treatment of stands at high risk to mortality from competition-induced stress. Continuation of trends would lead to increased stand densities, eventually resulting in higher levels of mortality. Increased mortality in high risk LOS stands. Long-term decline in large diameter ponderosa pine. Higher risk of stand-replacement fire events. ***No reduction in the amount of high risk stands.***	4,519 acres of high risk stands treated to reduce densities levels at a low to moderately low risk. 2,957 acres of high risk LOS stands treated to reduce susceptibility to insects, disease, and fire impacts. ***Largest reduction of acres of high-risk stands (32%).***	3,134 acres of high risk stands treated to reduce densities levels at a low to moderately low risk. 1,792 acres of high risk LOS stands treated to reduce susceptibility to insects, disease, and fire impacts. ***Second greatest reduction of high-risk stands (22%)***	2,842 acres of high risk stands treated to reduce densities levels at a low to moderately low risk. 1,814 acres of high risk LOS stands treated to reduce susceptibility to insects, disease, and fire impacts. ***Smallest reduction of high-risk stands (20%).***

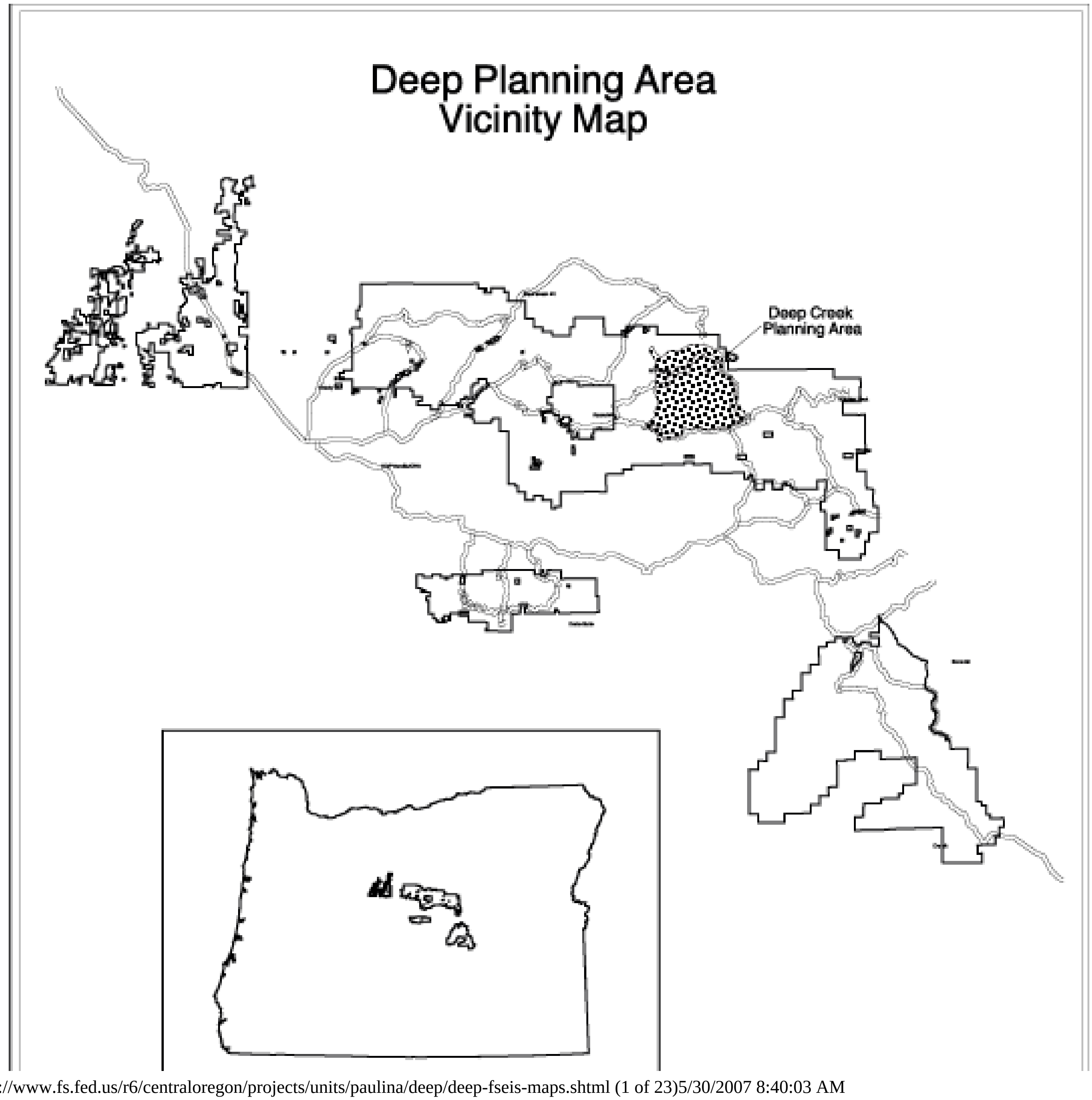
Key Issue	Alternative A No Action	Alternative B Proposed Action	Alternative C	Alternative D
Protection and Enhancement of Riparian and Upland Shrub Communities	No conifer treatments would be undertaken with RHCAs. Decline and degradation of riparian communities would continue. Conifer encroachment would increase and browsing would continue to hinder juvenile plant establishment. Continued degradation of upland shrub and hardwood habitat. Risk of catastrophic fire within RHCA would increase.	8 acres of commercial treatments within RHCAs will decrease adverse impacts from potential wildfire. 4 acres of commercial treatment to increase shade and LWM recruitment. 12 acres of commercial treatment to increase understory development and promote channel stability. Precommercial thinning on 354 acres to promote RMOs. No treatment of upland shrub communities. 1,760 acres treatment within potential upland shrub habitat. 77 acres of aspen treatments and 28 miles riparian hardwood planting. Meadow enhancement on 825 acres would increase understory riparian/wetland species.	8 acres of commercial treatments within RHCAs will decrease adverse impacts from potential wildfire. 4 acres of commercial treatment to increase shade and LWM recruitment. 12 acres of commercial treatment to increase understory development and promote channel stability. Precommercial thinning on 354 acres to promote RMOs. 16 acres of treatment of western juniper to maintain a healthy condition. 1,470 acres of treatment within potential upland shrub habitat. 81 acres of aspen treatments and 28 miles of riparian hardwood planting. Meadow enhancement on 825 acres would increase understory riparian/wetland species	No commercial treatments within RHCAs to decrease adverse impacts from potential wildfire, increase shade, or promote channel stability. Precommercial thinning on 202 acres to promote RMOs. No treatment of upland shrub communities. 1,470 acres of treatment within potential shrub habitat. 77 acres of aspen treatment and 28 miles of riparian hardwood planting. Meadow enhancement on 825 acres would increase understory riparian/wetland species
FIRE HAZARD AND FUELS				
Re-introduction of Fire	No prescribed burning would result from this Alternative. Continued accumulation of natural fuel levels. Increase in overall fuel abundance and continuity. ***No prescribed fire to reduce natural fuel concentrations, enhance forage or reduce juniper encroachment.***	Increased stand vigor, reduced fuel loading, and reduced risk of higher severity fire effects through prescribed burning on 20,692 acres. Prescribed burning for fuel reduction on 11,661 acres. Fuel continuity burning (jackpot) on 692 acres in north end of planning area to reduce intensity and spread of potential wildfire. ***Alt. B reduces natural fuel concentrations on more than twice the acres of Alts. C or D.***	Increased stand vigor, reduced fuel loading, and reduced risk of higher severity fire effects through prescribed burning on 8,741 acres. Prescribed burning for fuel reduction on 4,192 acres. No fuel continuity burning. 4,549 acres of forage enhancement/juniper encroachment burning. ***Slightly more prescribed burning than Alt. D, less than half the burning prescribed in Alt. B.***	Increased stand vigor, reduced fuel loading, and reduced risk of higher severity fire effects through prescribed burning on 8,476 acres. Prescribed burning for fuel reduction on 3,293 acres. No fuel continuity burning. 5,183 acres forage enhancement/juniper encroachment burning. ***Least amount of treatments to address current fuel conditions and risk of wildfire.***
Reduction of Fire Hazard	No reduction in overall fire hazard or crown fire initiation. No reduction in ladder fuels.	Commercial harvest (5,525 acres), precommercial thinning (3,550 acres), aspen (77 acres) and meadow (825 acres) treatments, and natural fuels burning (20,692 acres) would all reduce the overall fire hazard within the watershed. Thinning from below will reduce vertical	Commercial harvest (5,696 acres), precommercial thinning (3,757 acres), aspen (81 acres) and meadow (825 acres) treatments, and natural fuels burning (8,741 acres) would all reduce the overall fire hazard within the watershed, but at a smaller scale than Alt. B.	Commercial harvest (5,525 acres), precommercial thinning (3,550 acres), aspen (77 acres) and meadow (825 acres) treatments, and natural fuels burning (8,476 acres) would all reduce the overall fire hazard within the watershed. Thinning from below will reduce vertical

Key Issue	Alternative A No Action	Alternative B Proposed Action	Alternative C	Alternative D
		continuity of the fuels. Short-term increase in horizontal fuels. Jackpot burning would reduce larger concentrations of fuel. ***Greatest potential to reduce overall fire hazard in the long term.***	Thinning from below will reduce vertical continuity of the fuels. Short-term increase in horizontal fuels. No jackpot burning to reduce larger concentrations of fuel. ***Second highest potential to reduce fire hazard across the landscape.***	continuity of the fuels. Short-term increase in horizontal fuels. No jackpot burning to reduce larger concentrations of fuel. ***Slightly lower potential to reduce fire hazard across the landscape than Alt. C.***
Expected Fire Effects	No reduction in stand-replacement conditions that are outside HRV. Anticipated fire effects would be higher severity over more area than in B, C, or D.	Moves the planning area closer to the historic range of variability for potential fire effects. 4,475 acres are moved to the non-lethal category. ***Reduces stand-replacement conditions by 1,777 acres.***	2,718 acres are moved to the non-lethal category. ***Reduces stand-replacement conditions by 571 acres.***	2,558 acres are moved to the non-lethal category. ***Reduces stand-replacement conditions by 538 acres.***

Maps for Deep FSEIS.

The following maps are included in the HTML version of the FSEIS but are not in the PDF version.

Figure 1-1 (page 1-3)
also Figure S-1 in Summary



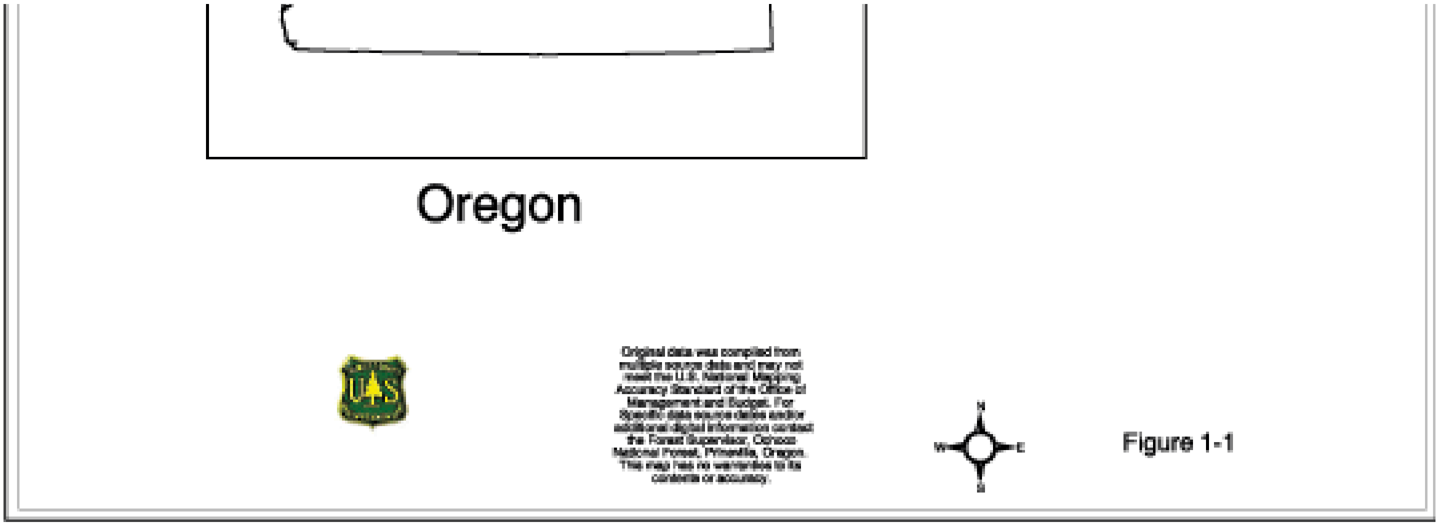
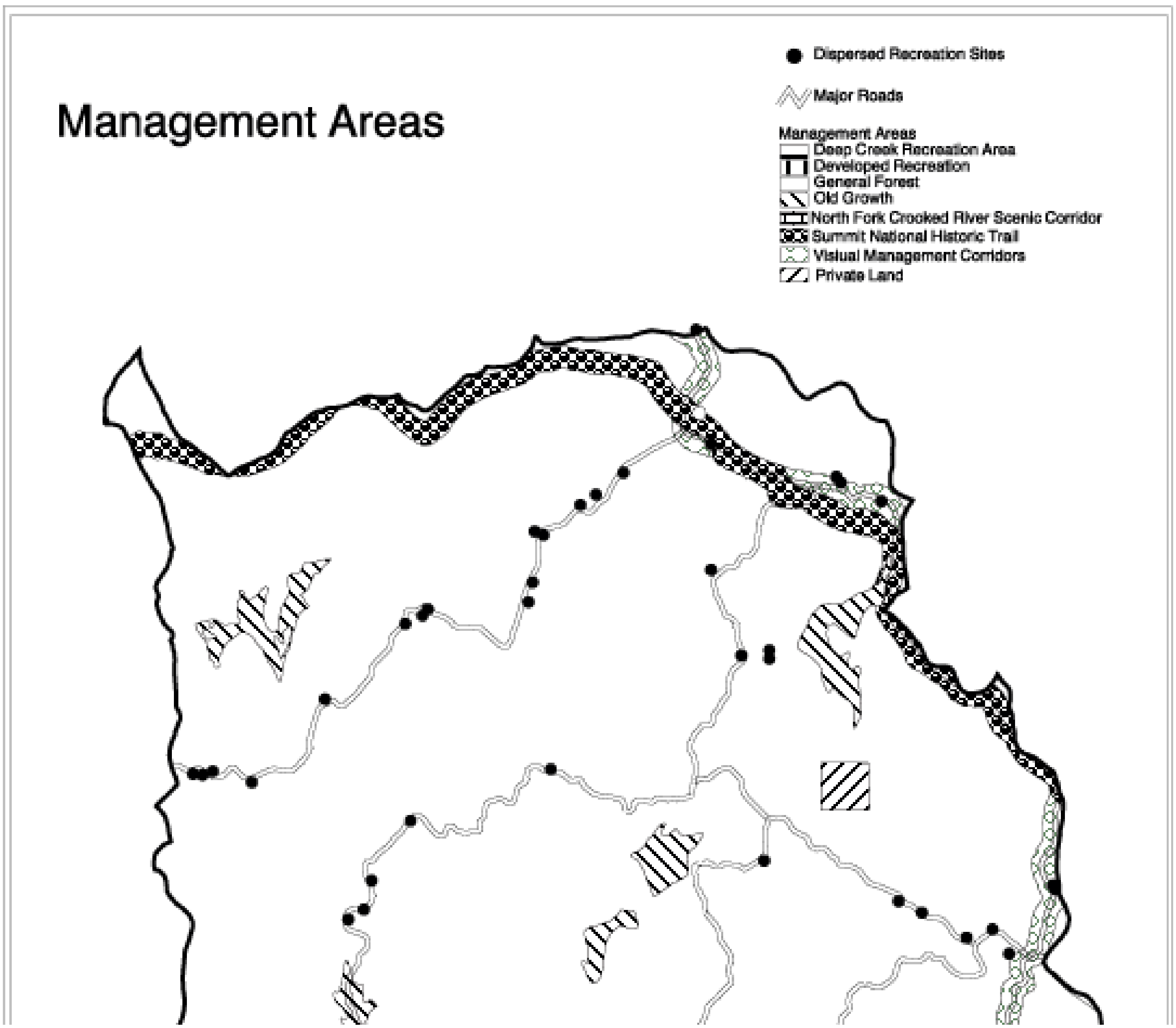


Figure 1-3 (page 1-15)



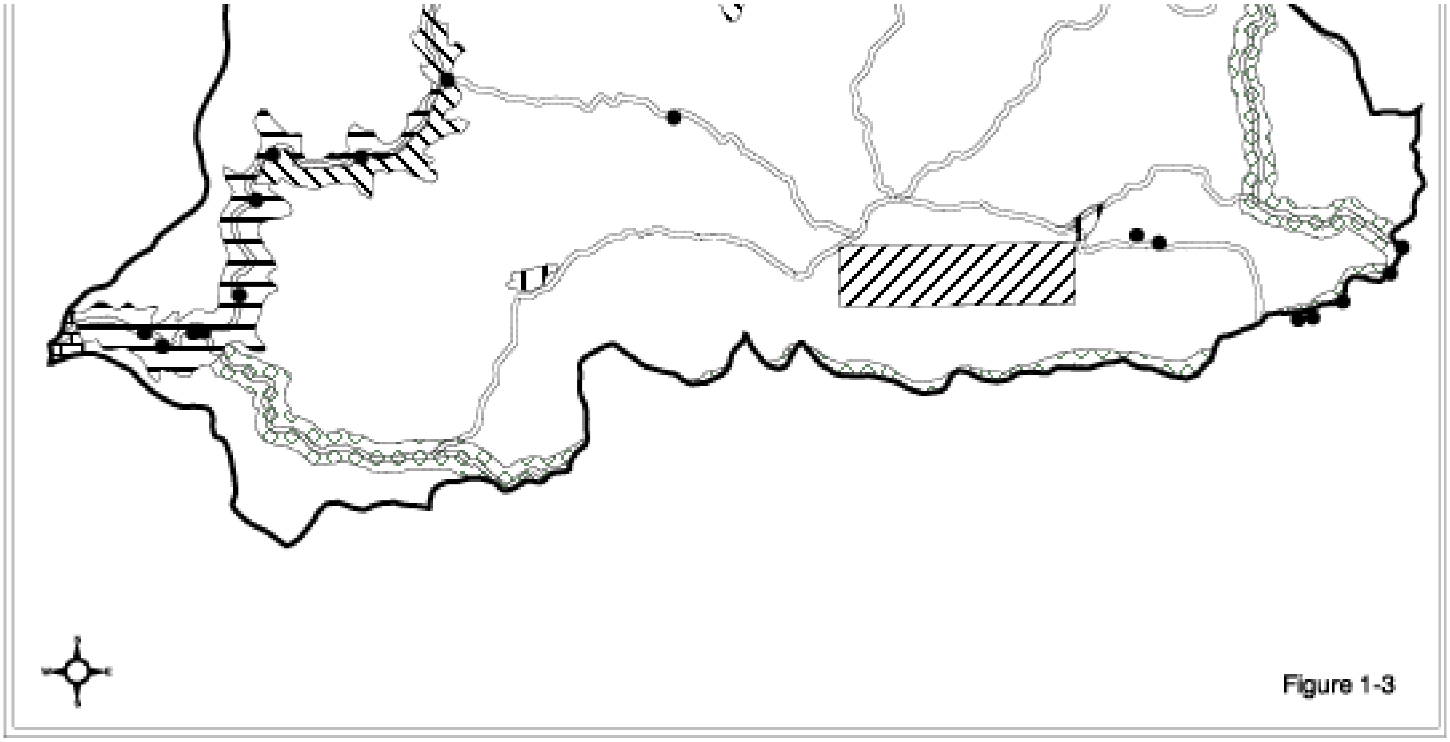


Figure 2-1 (page 2-5)

Alternative B Commerical and Precommercial Thinning

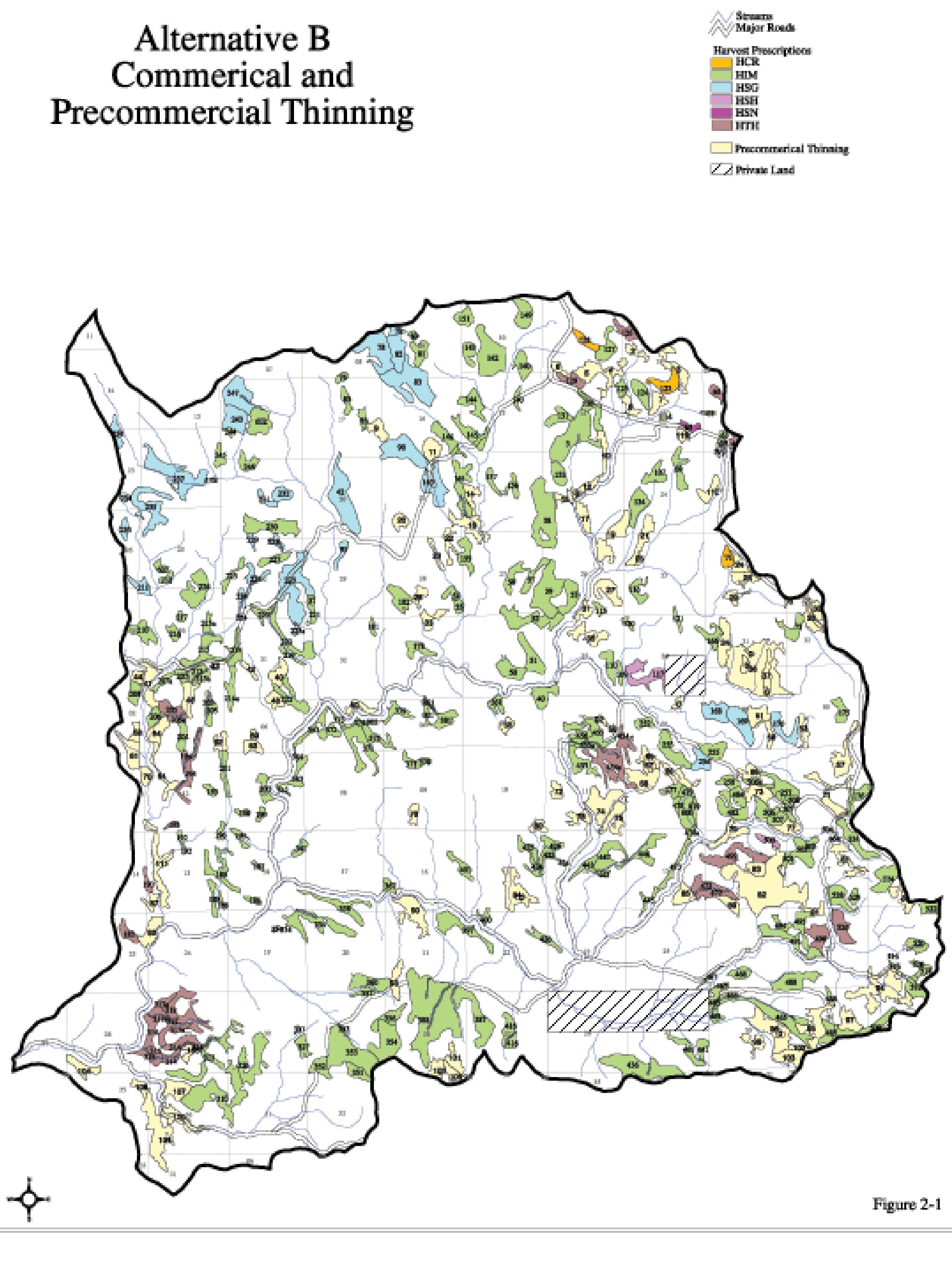
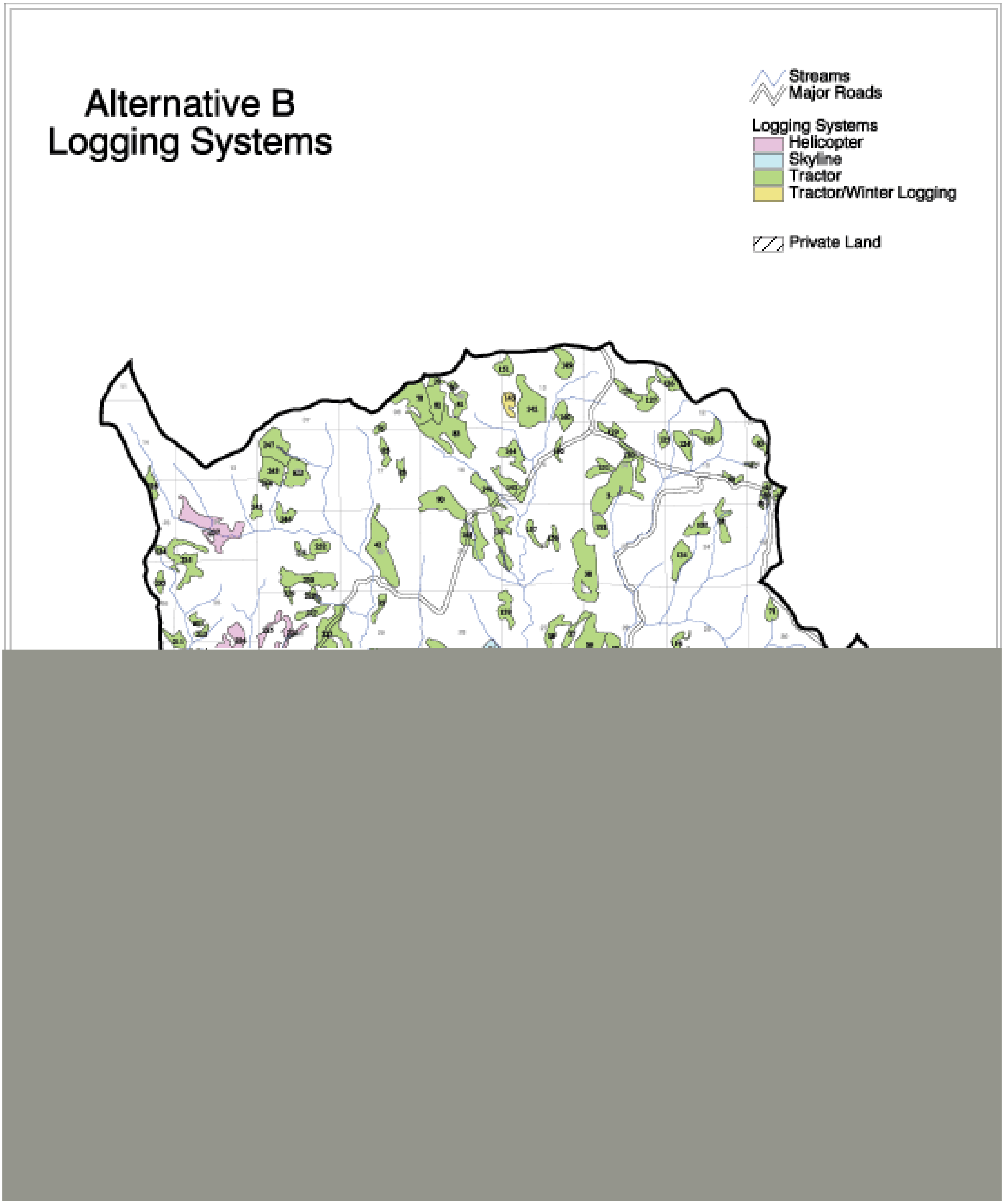


Figure 2-1

Figure 2-2 (page 2-7)



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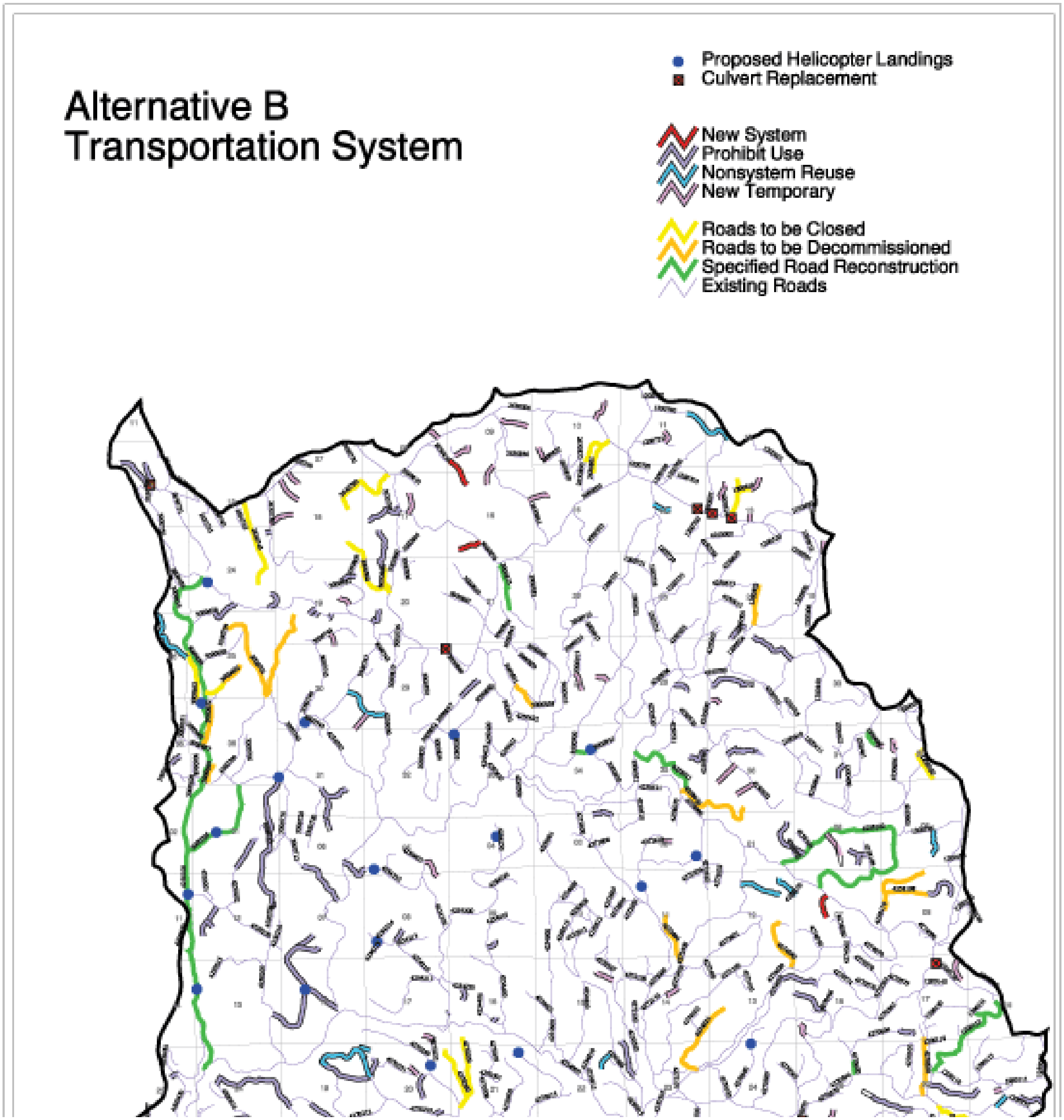


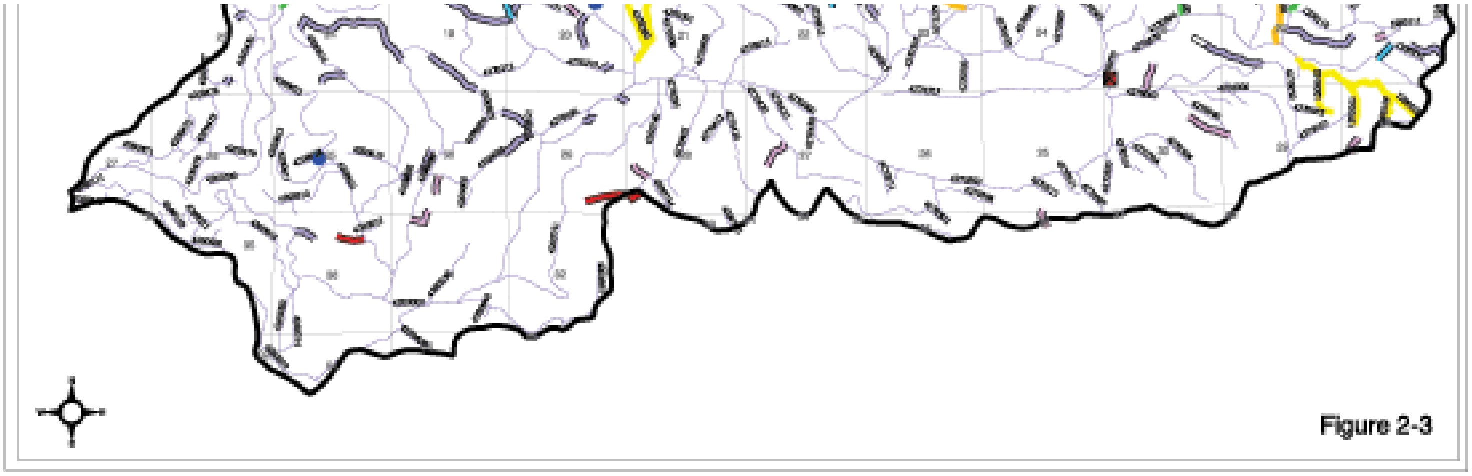
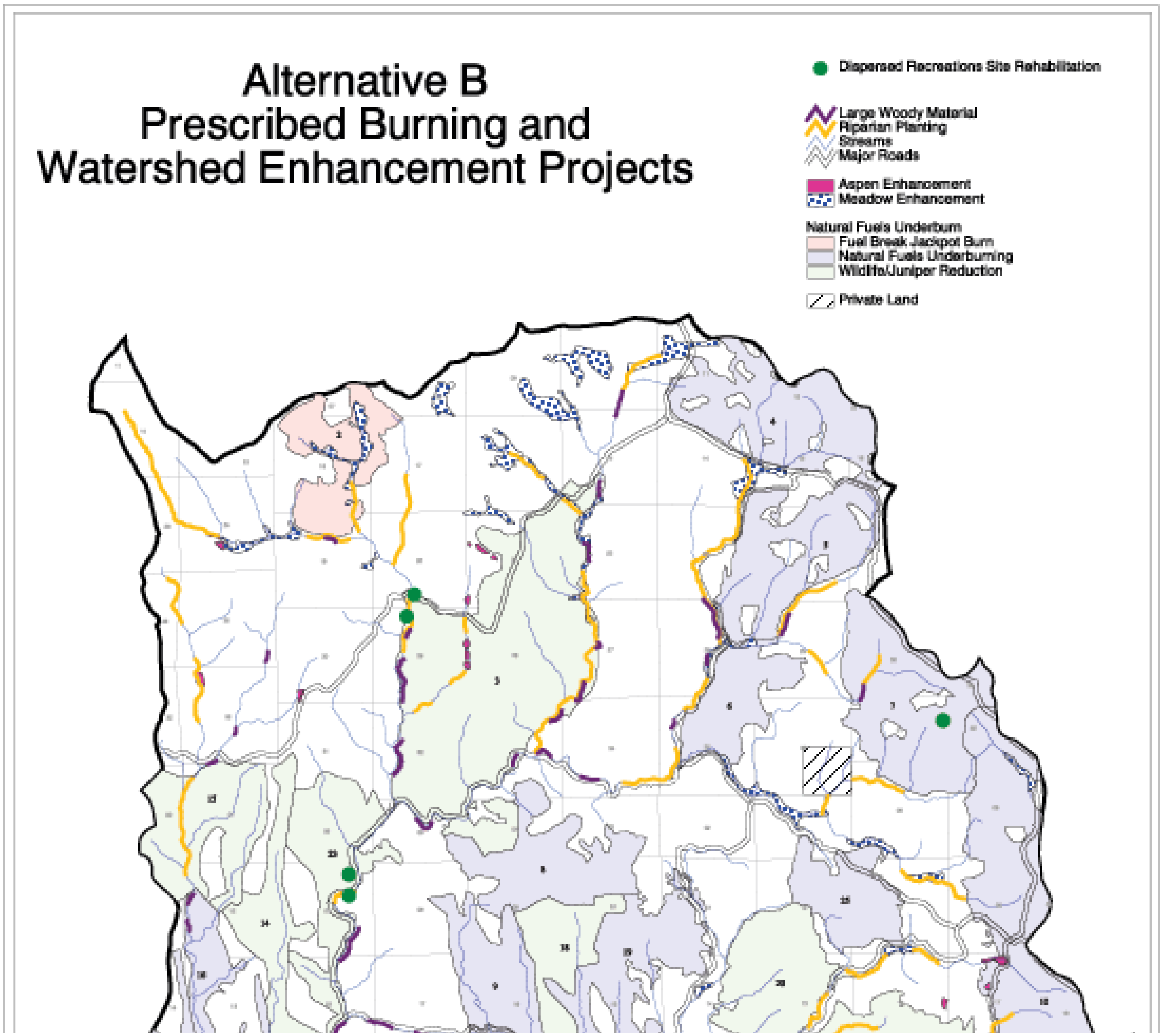
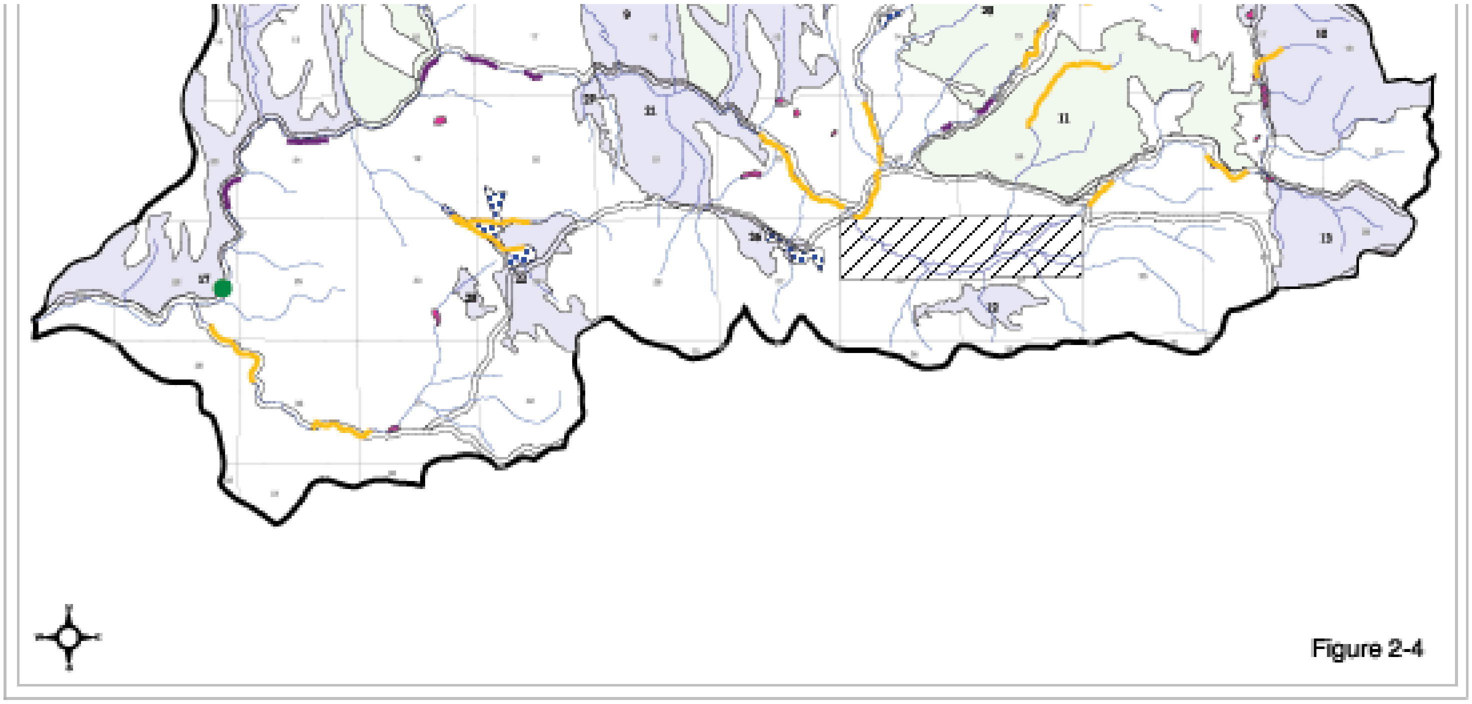


Figure 2-4 (page 2-11)





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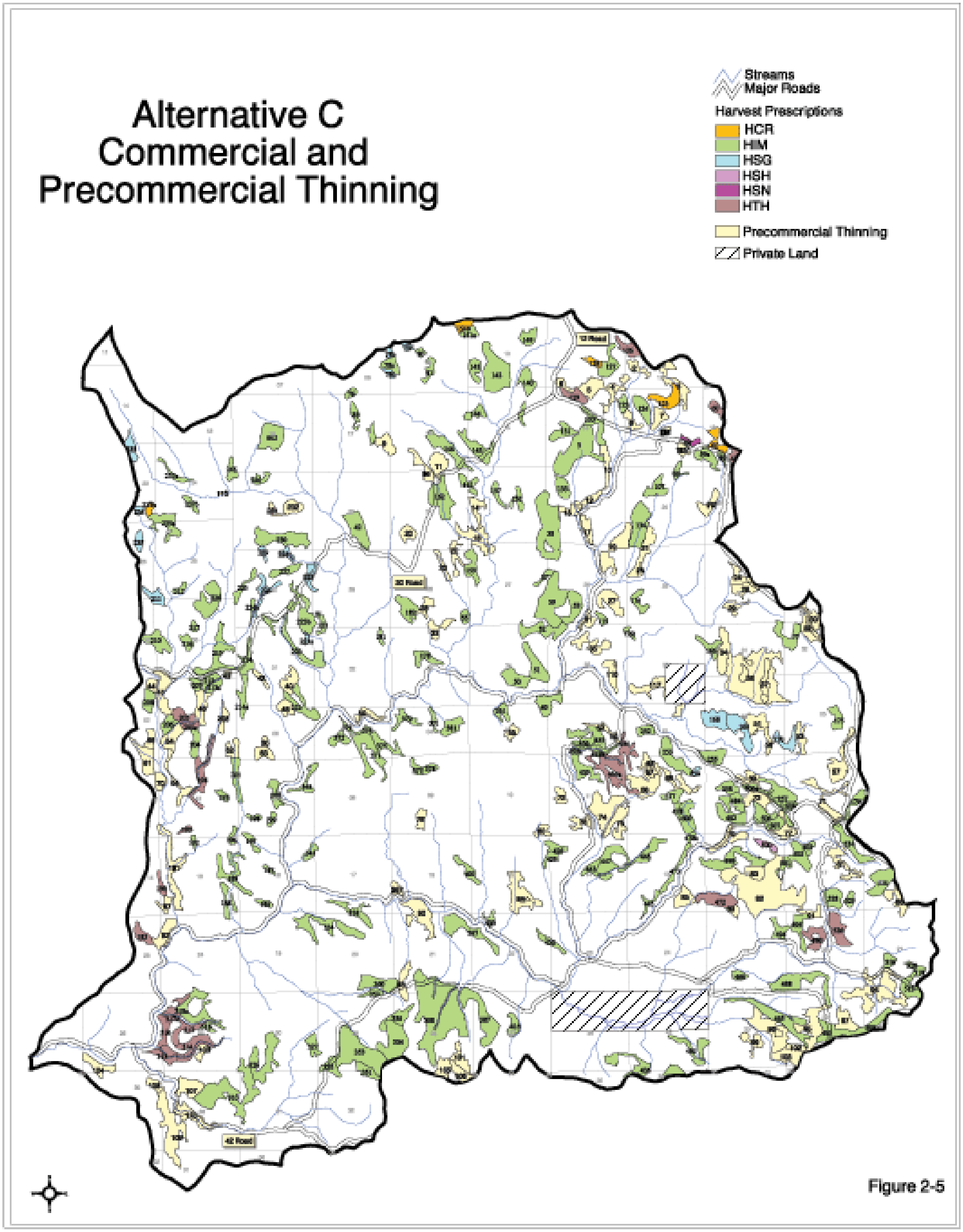

Alternative C
Commercial and
Precommercial Thinning
Streams
Major Roads
Harvest Prescriptions
HCR
HIM
HSG
HSH
HSN
HTH
Precommercial Thinning
Private Land
Figure 2-5

Figure 2-6 (page 2-19)

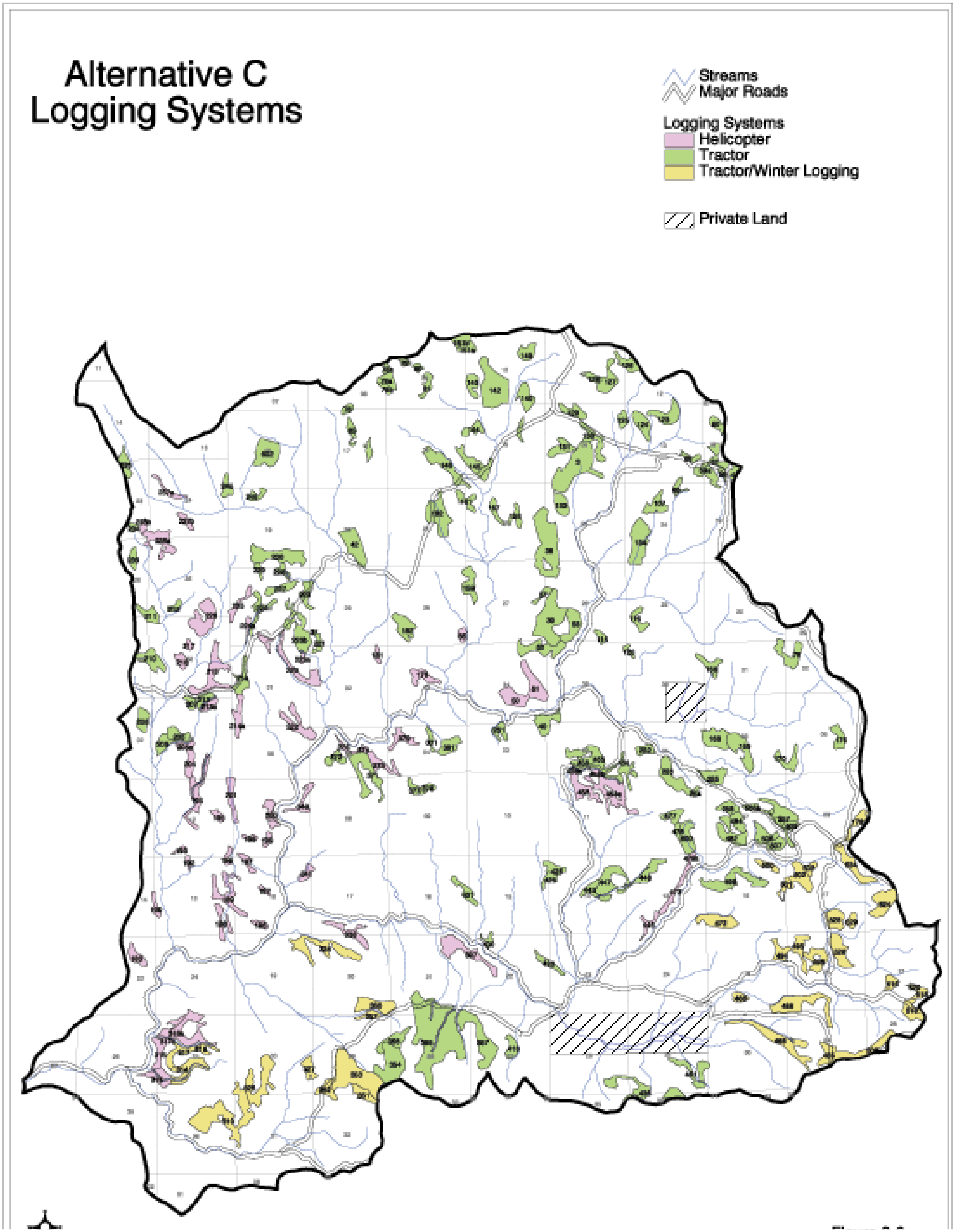
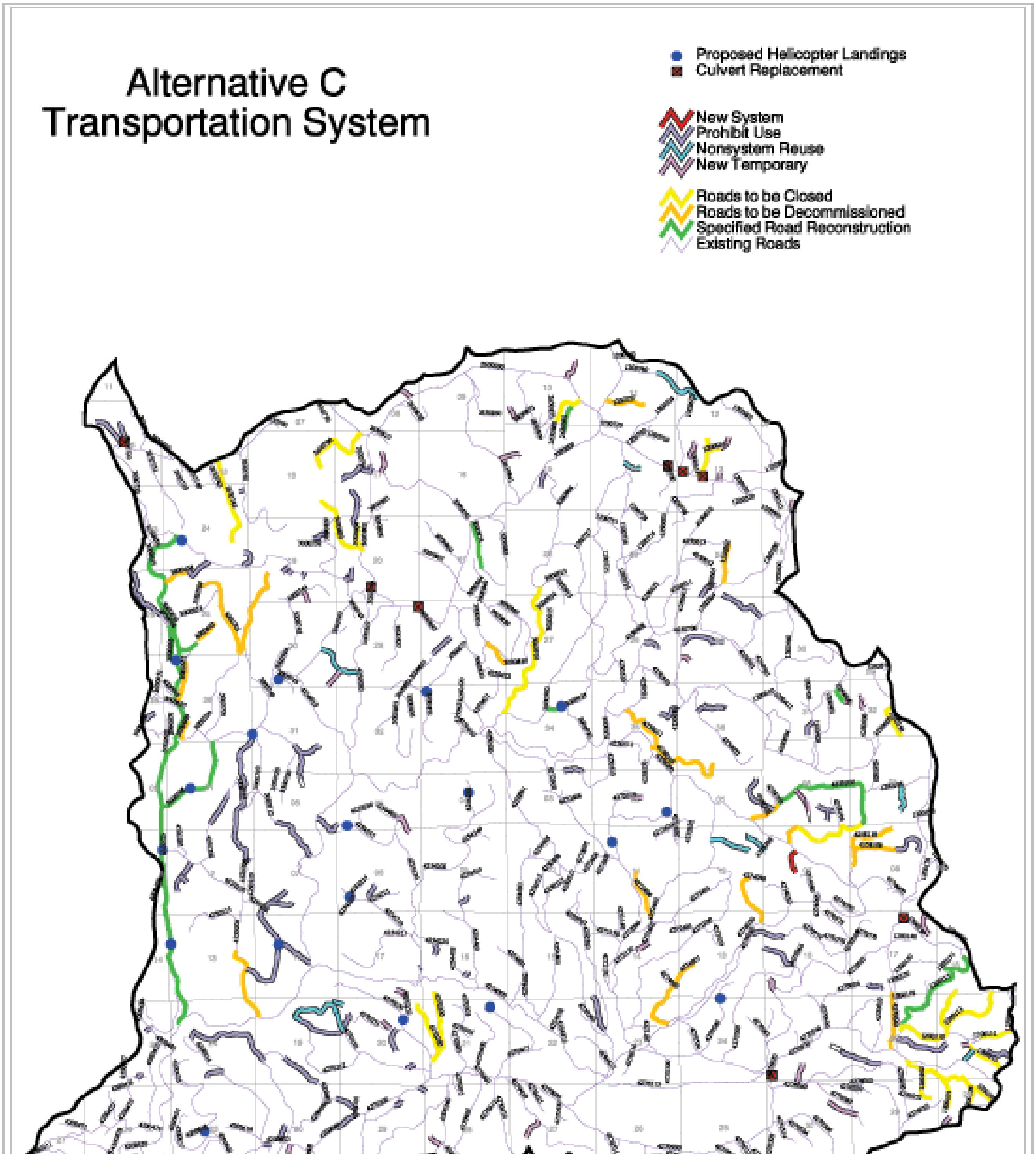
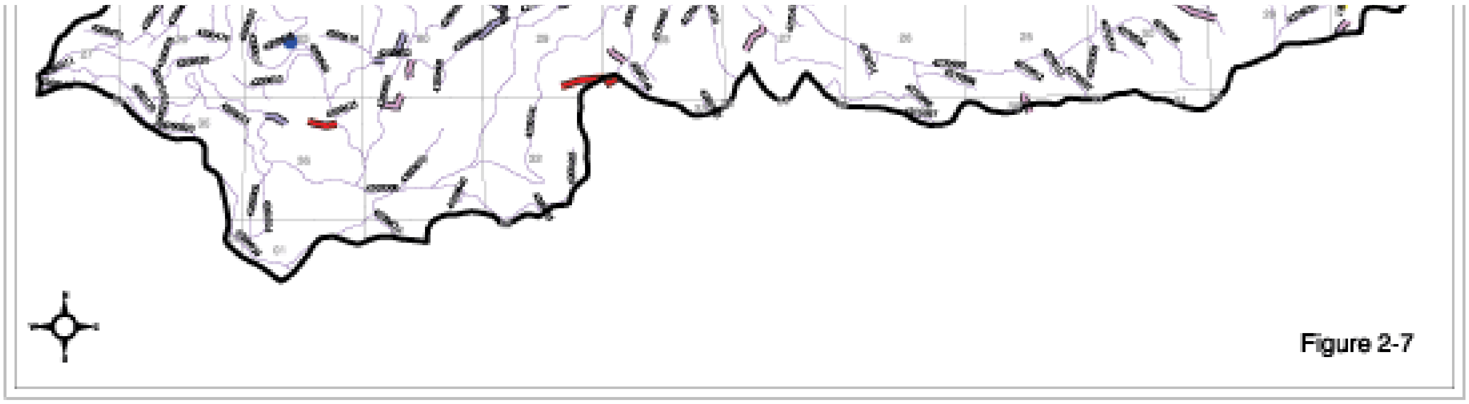


Figure 2-7 (page 2-21)





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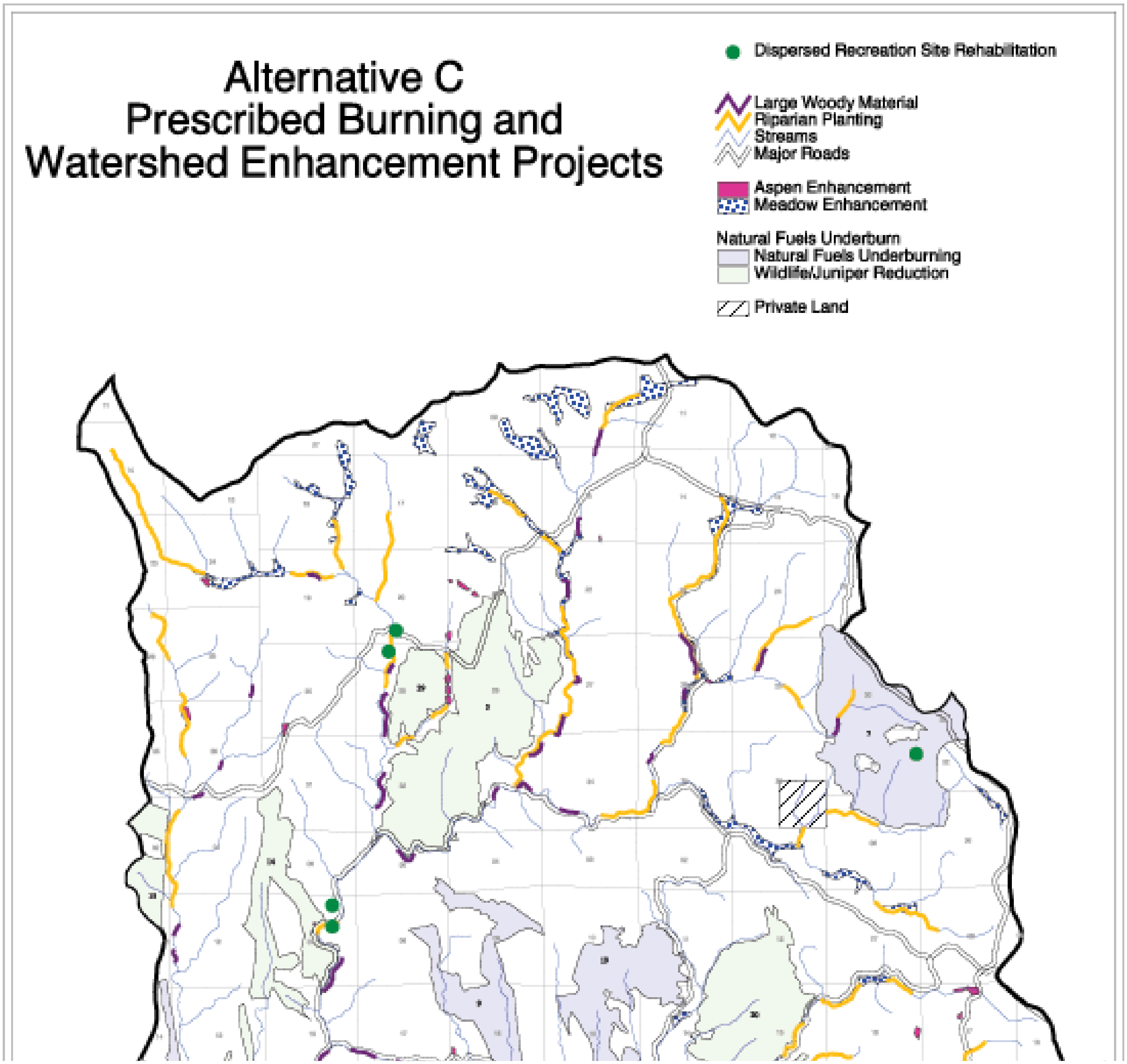

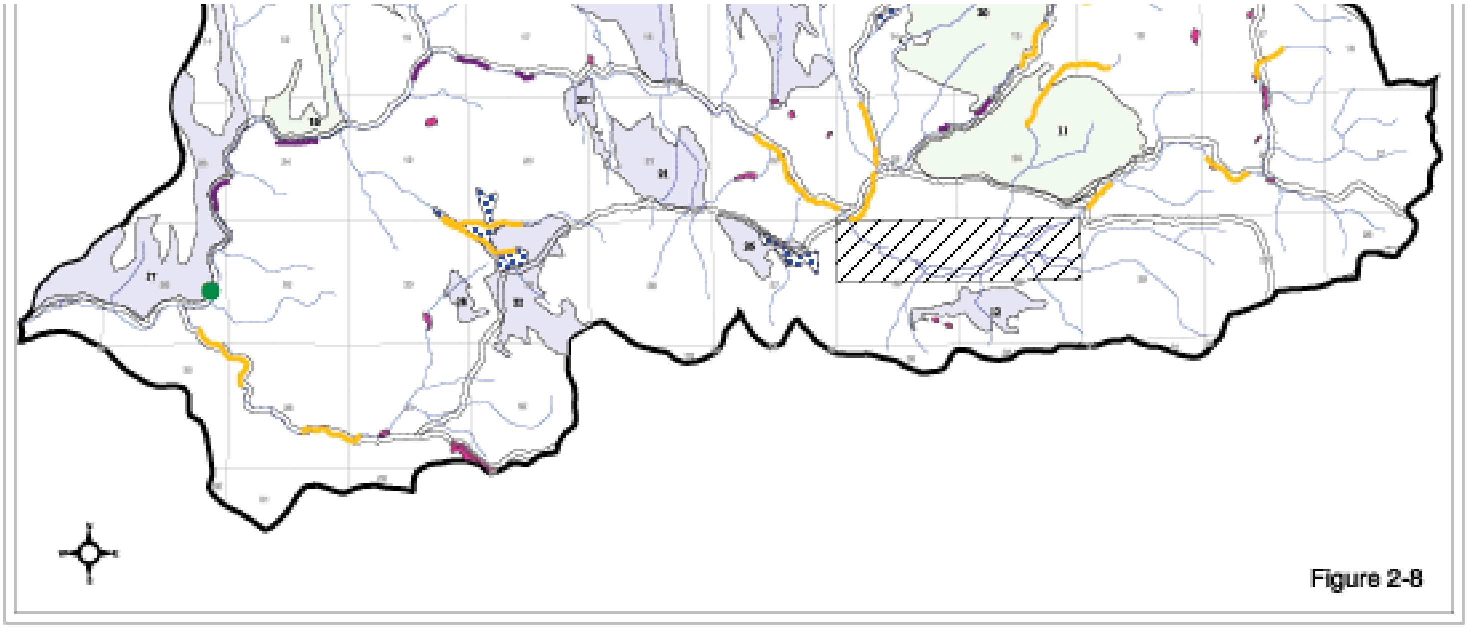

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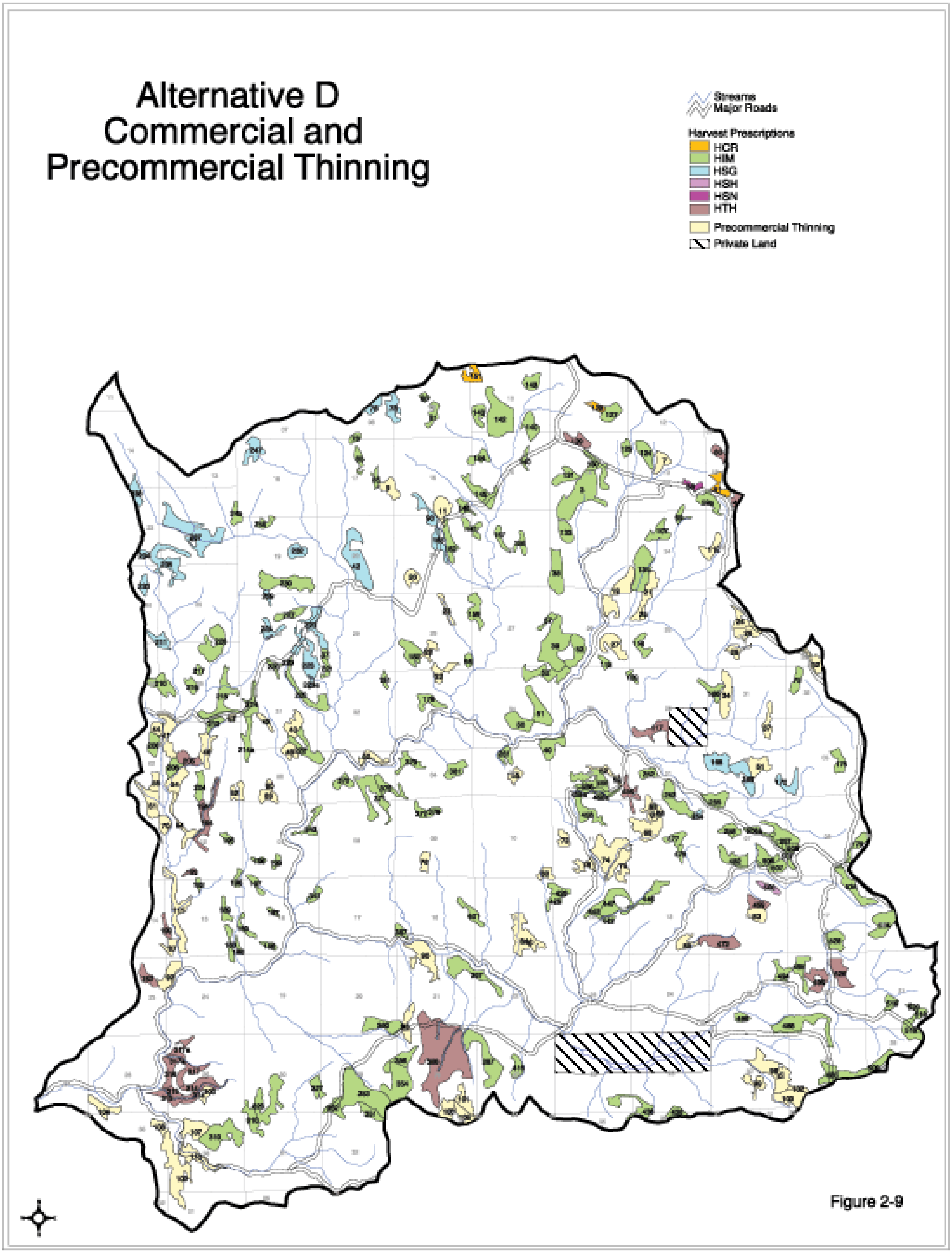

Alternative D
Commercial and
Precommercial Thinning
Streams
Major Roads
Harvest Prescriptions
HCR
HIM
HSG
HSH
HSN
HTH
Precommercial Thinning
Private Land
Figure 2-9

Figure 2-10 (page 2-29)

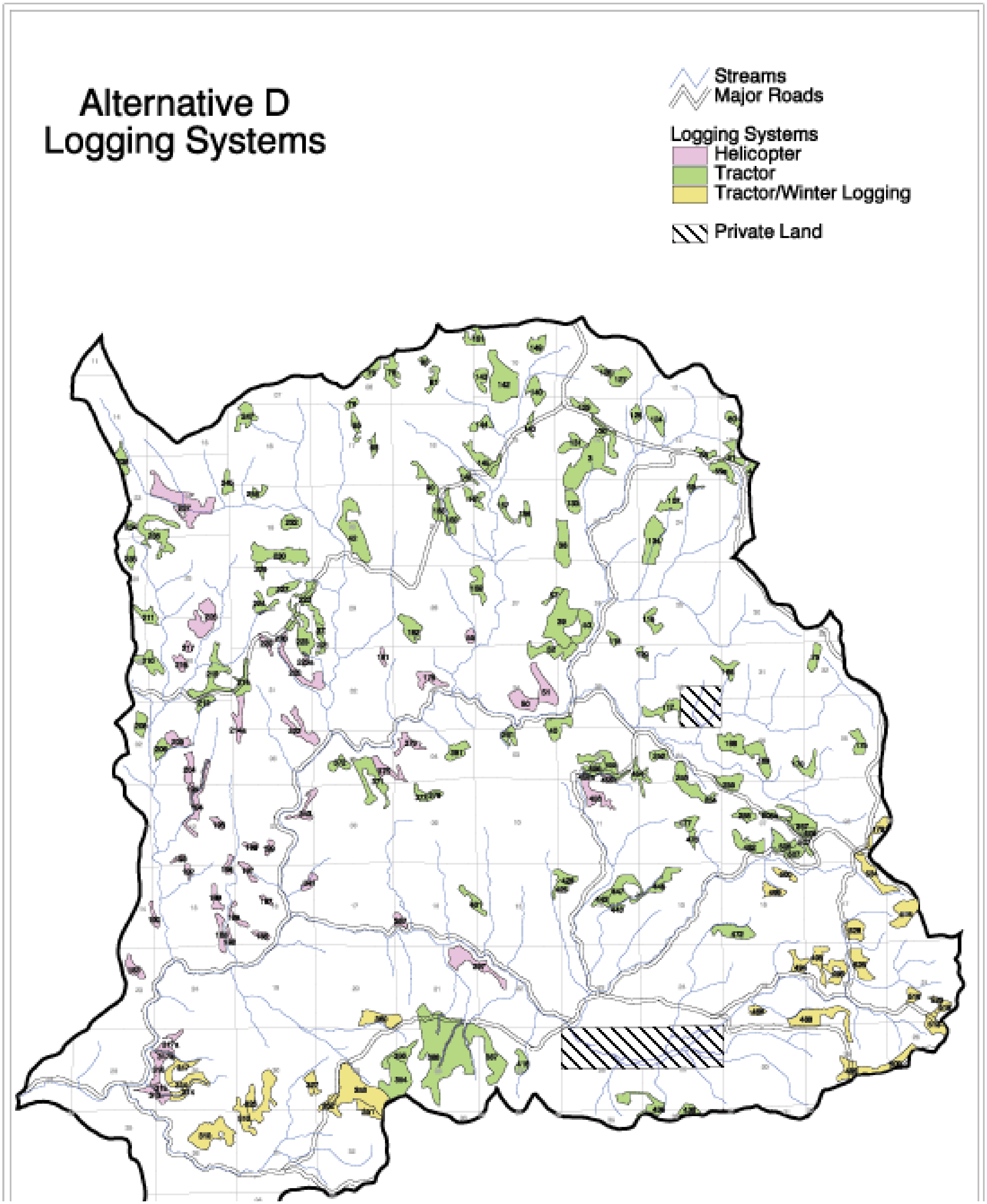
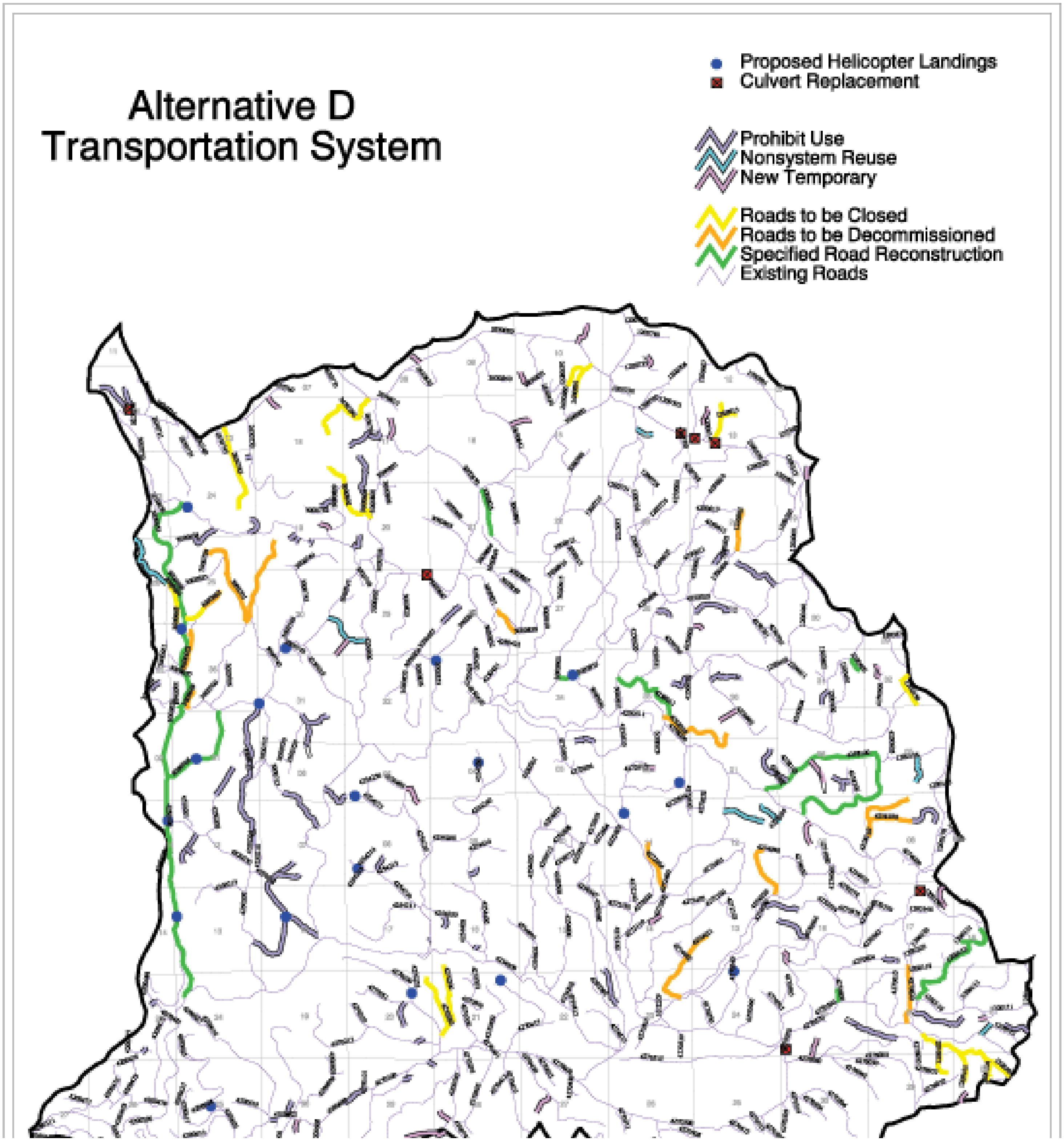
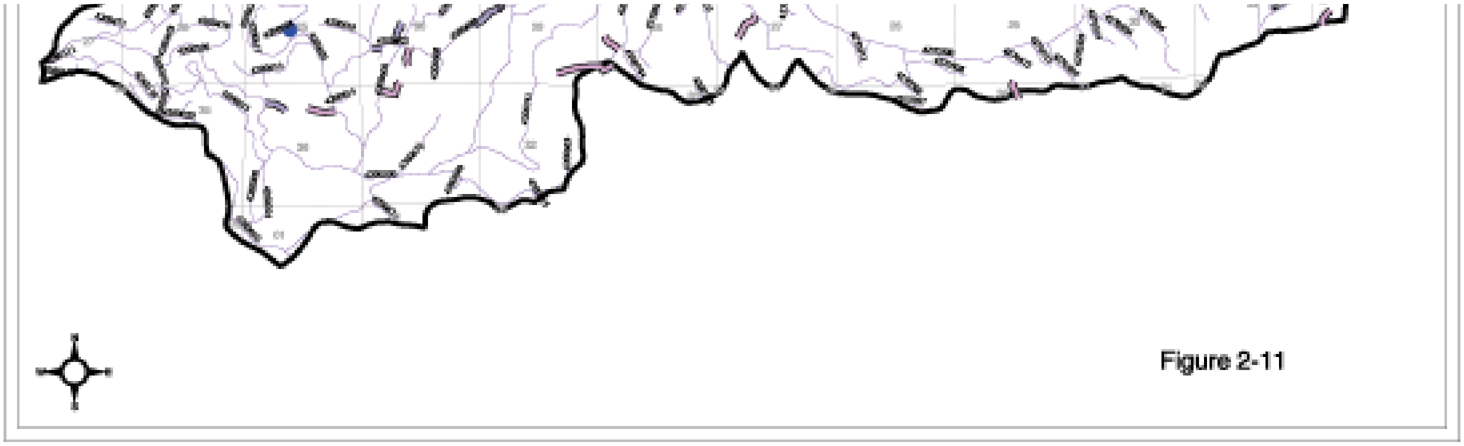


Figure 2-11 (page 2-31)





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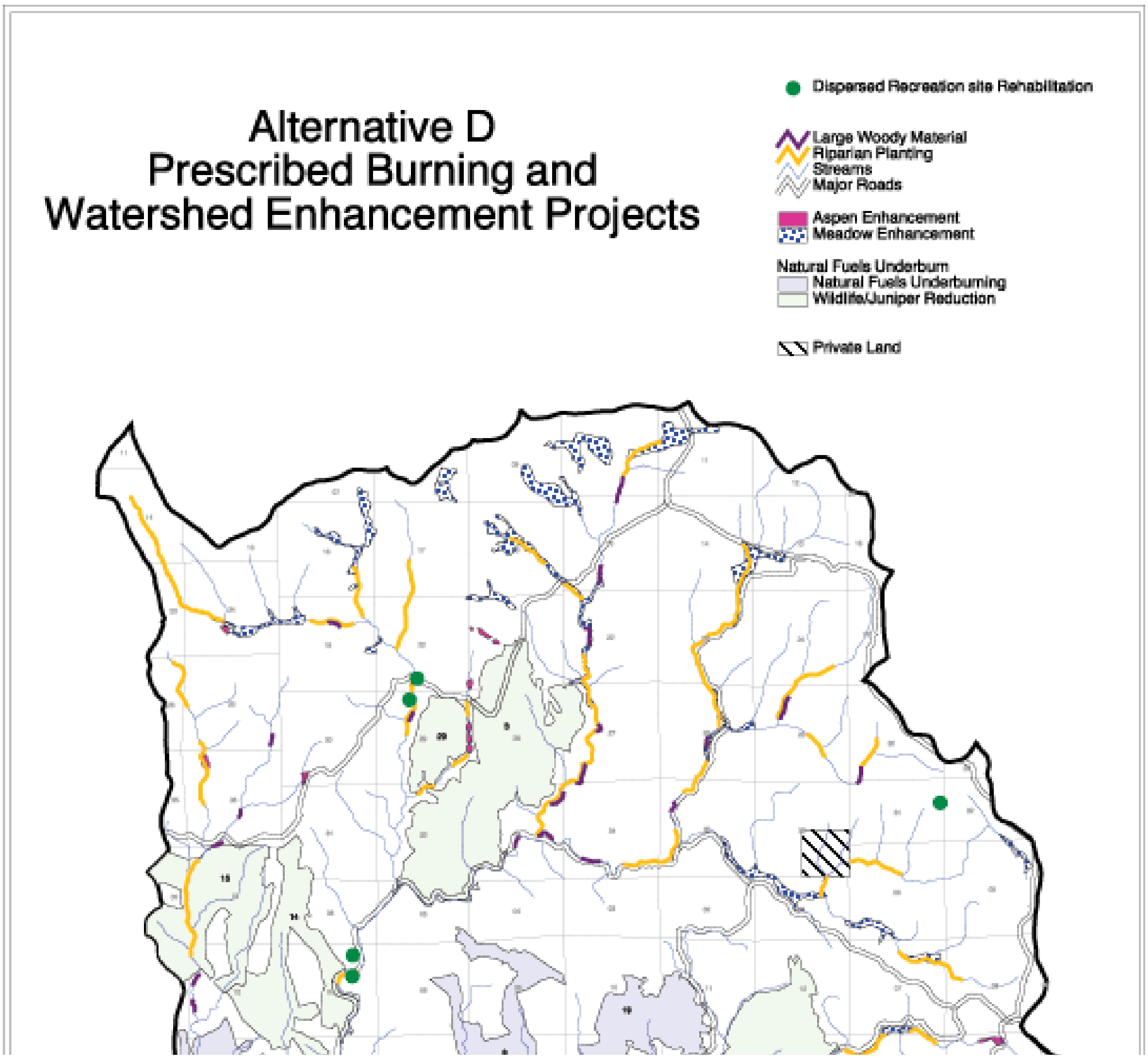

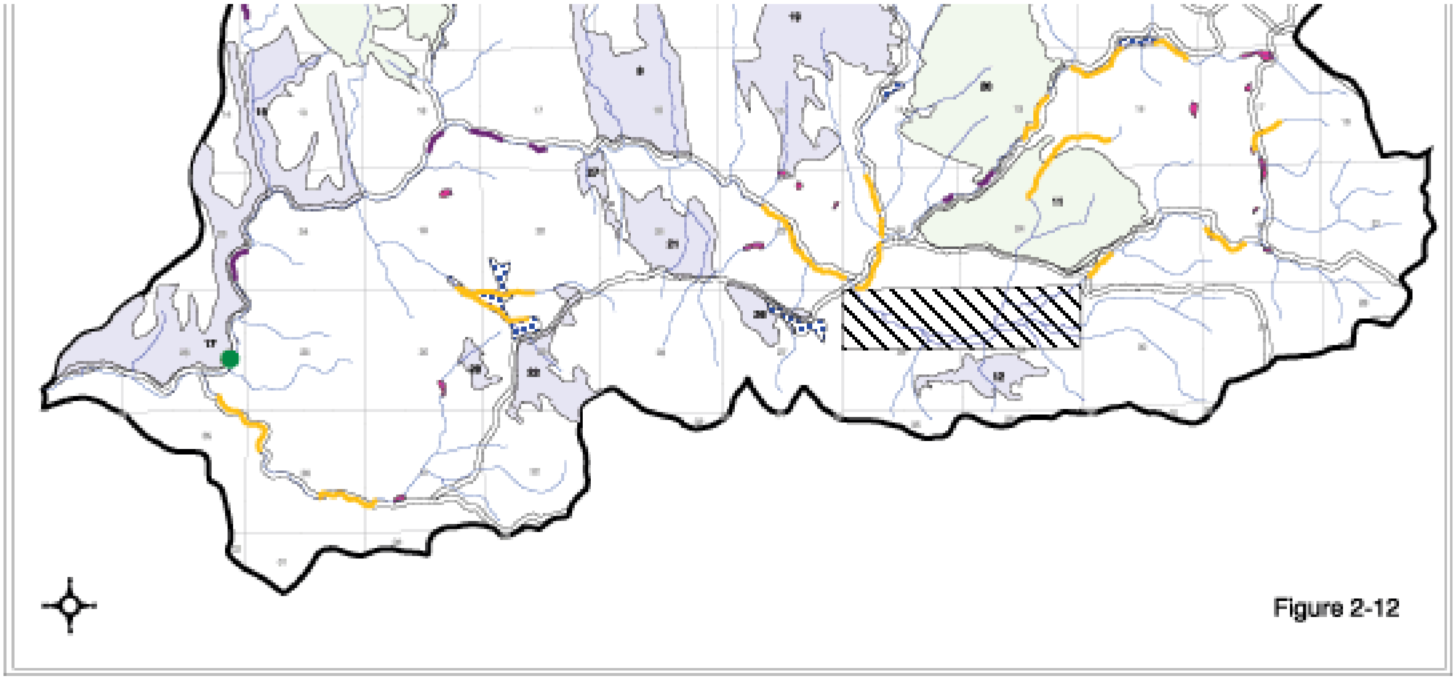

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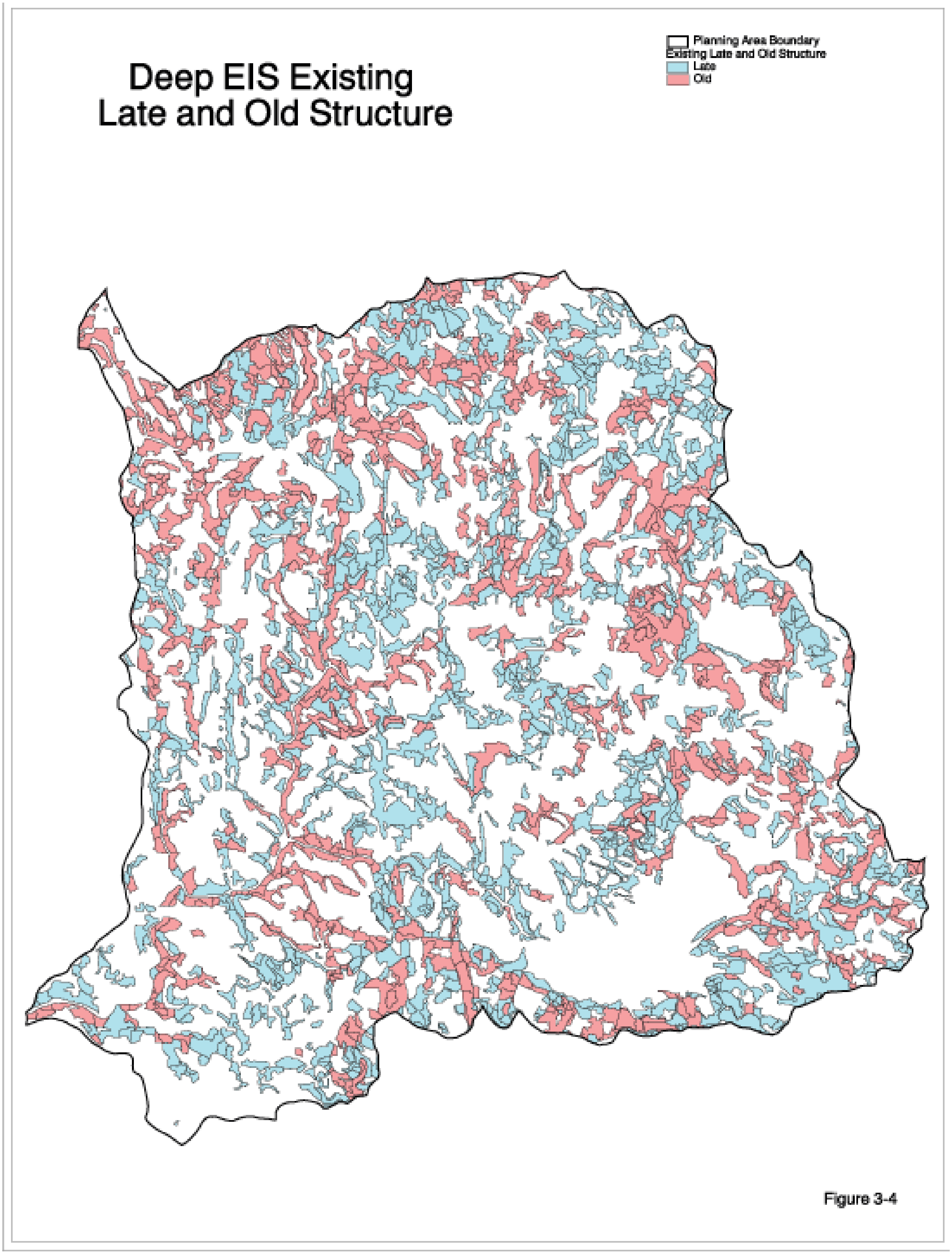
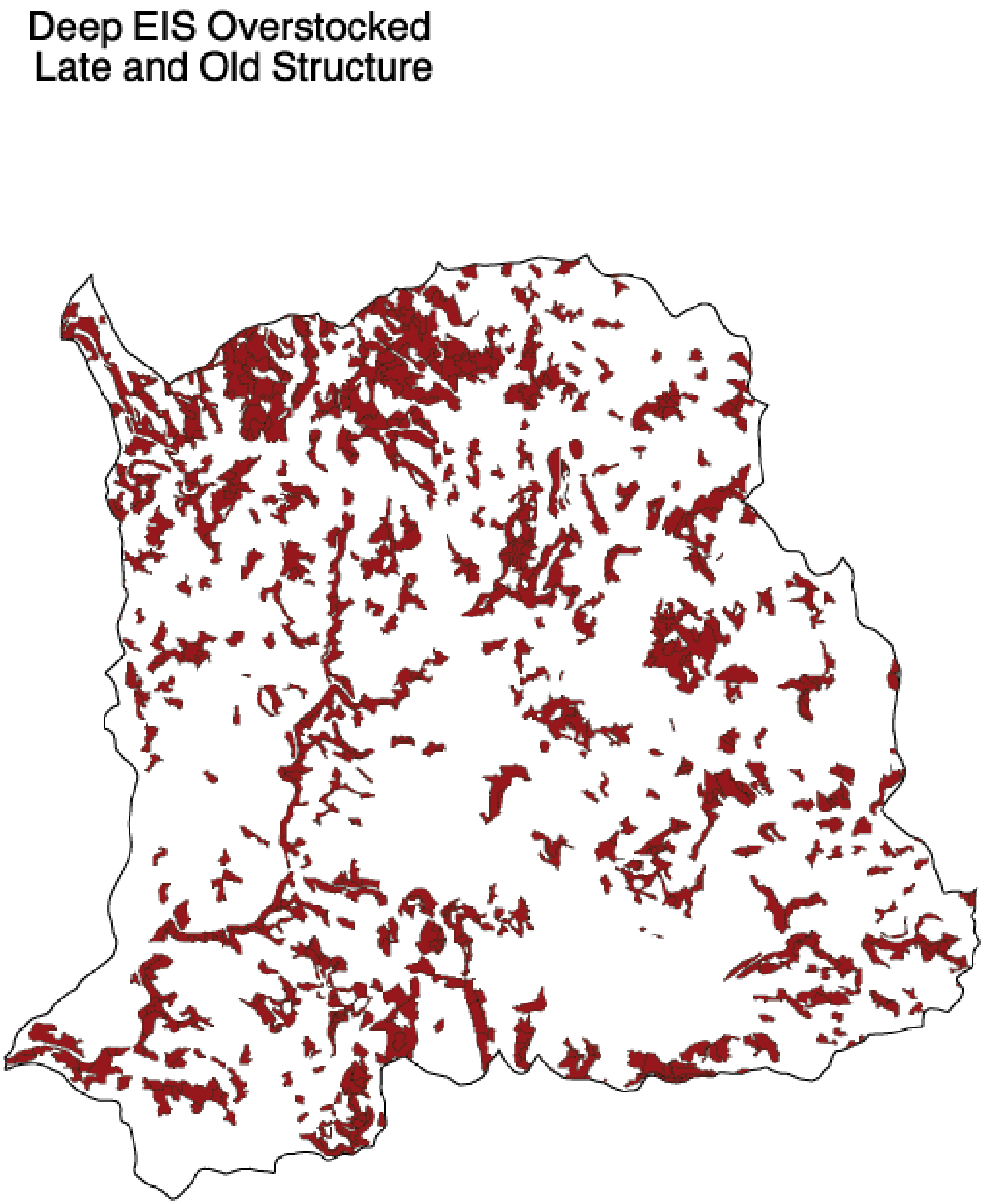

Deep EIS Existing
Late and Old Structure
Planning Area Boundary
Existing Late and Old Structure
Late
Old
Figure 3-4

Figure 3-5 (page 3-23)



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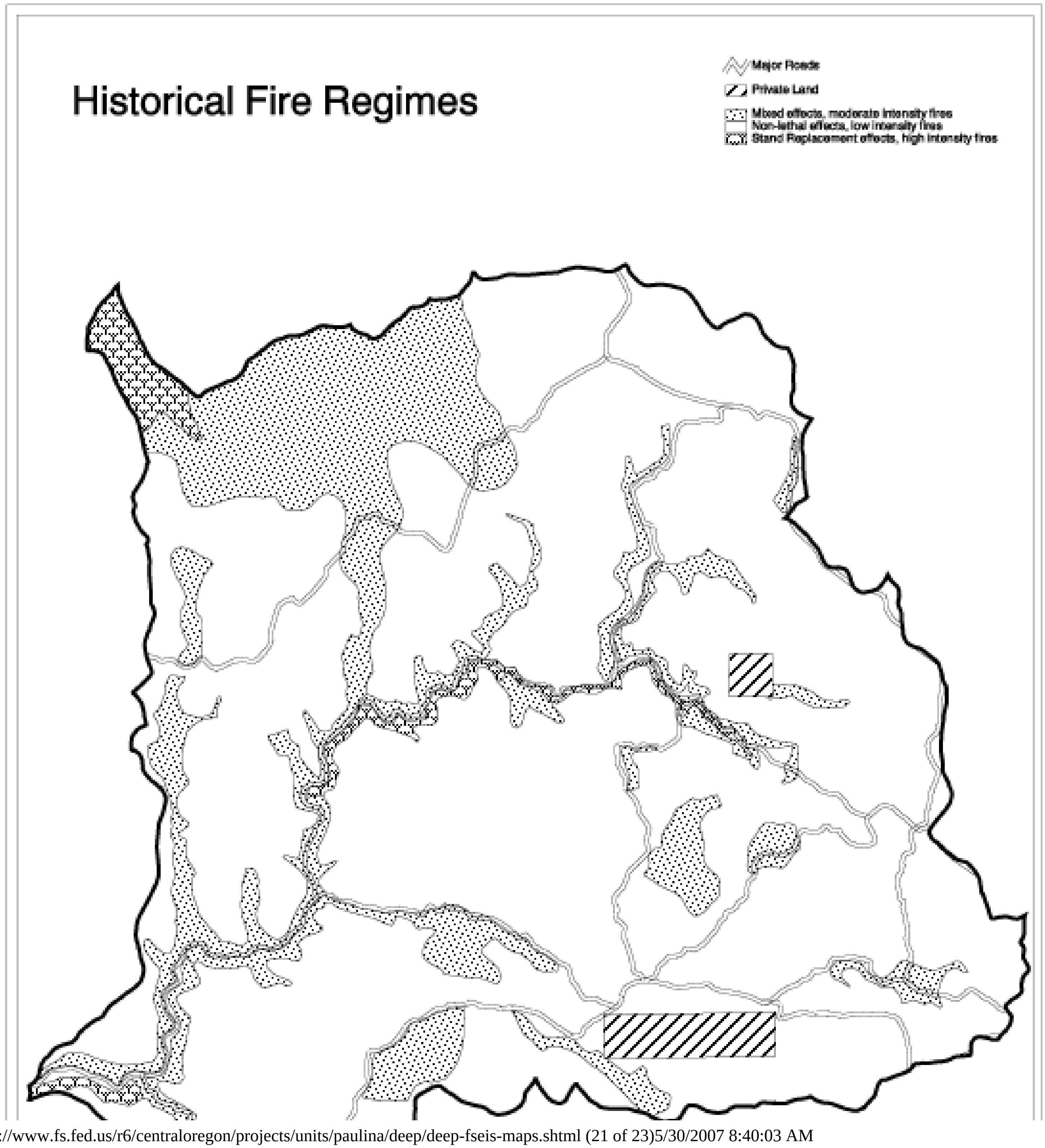

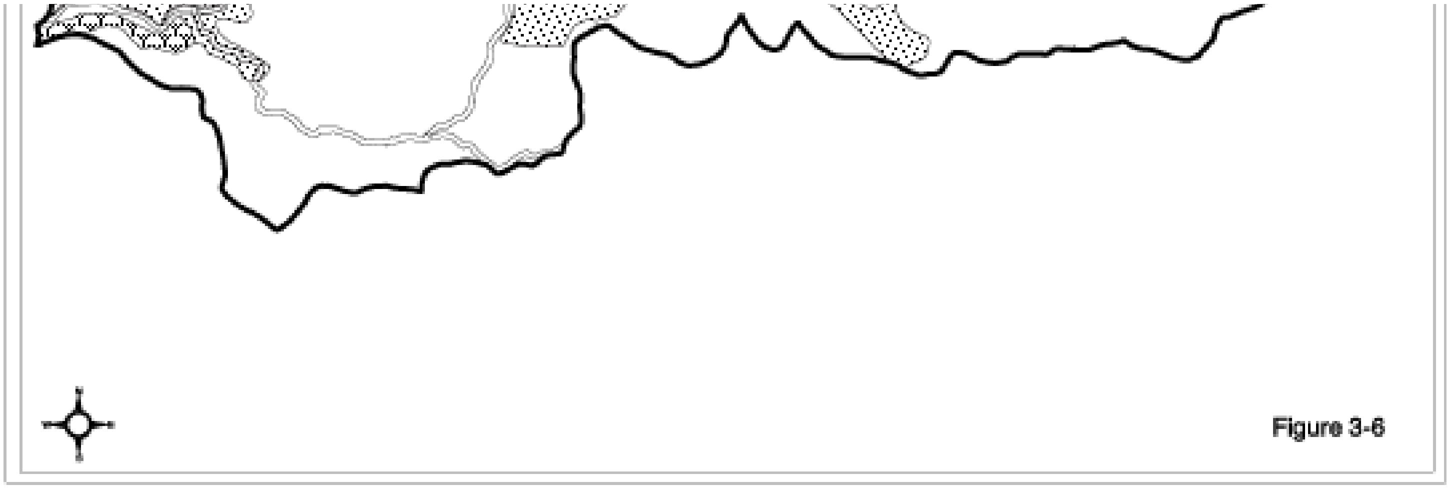

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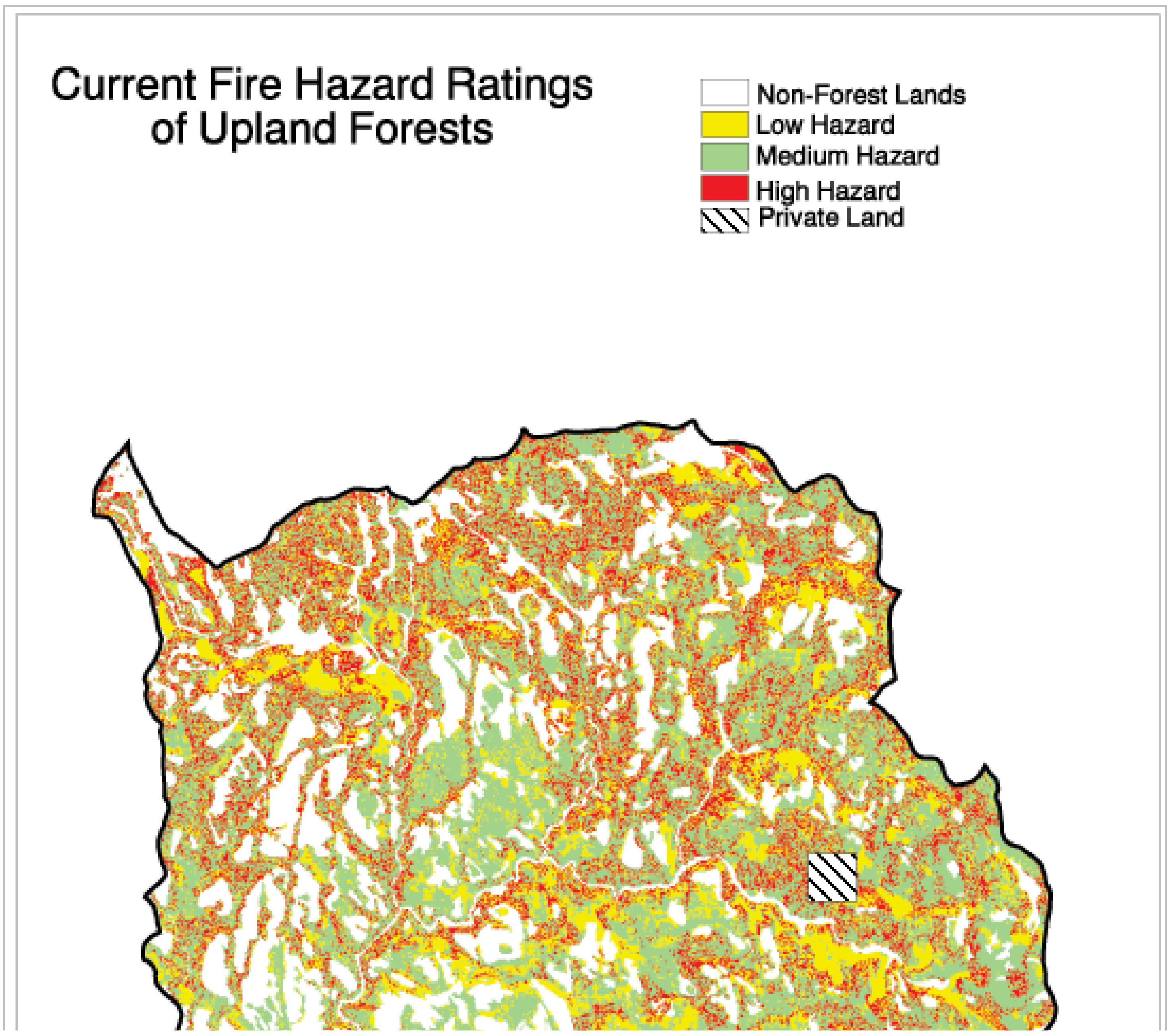


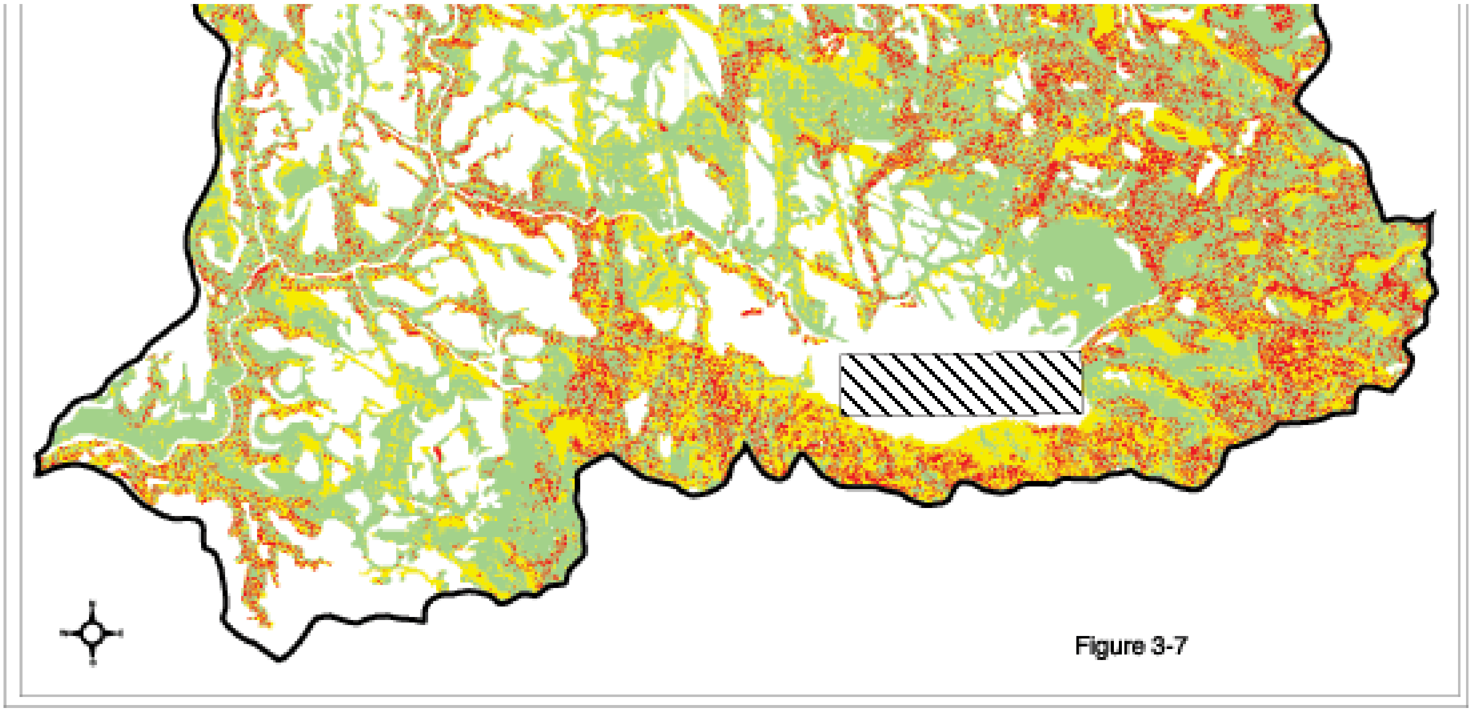


Figure 3-7

CHAPTER 3

AFFECTED ENVIRONMENT

Chapter 3 describes aspects of the environment that could be affected by the alternatives. This provides the baseline for the effects analysis in Chapter 4. The environment is described in terms of the “key” and “other” issues identified in Chapter 1, page 1-15, of this document.

Physical Characterization of the Deep Planning Area

The Deep Watershed is 55,368 acres and includes Happy Camp (5,787 acres), Jackson (18,415 acres), Little Summit Prairie (16,607 acres), and Lower Deep (14,559 acres) subwatersheds. Elevation ranges from 4,500 feet (Deep Creek confluence at the southwest corner of the planning area) to 6,314 (Broadway Lava at the northwest corner).

Landforms in the watershed are a reflection of the past climate and geologic history of the area. The tectonic movement, uplift of the Blue Mountain anticline, and the mass wasting process have combined to create two distinct landforms consisting of broad, gently sloping ridges with steep-sided draws and a small area of hummocky bench terrain. The climate has evolved from a warm moist tropical regime (60 million years ago) to the temperate four distinct seasons of today. Currently, annual precipitation varies from around 12-15 inches in the lower end of the watershed to about 25 inches at the upper end. This precipitation falls predominantly as spring and autumn rains and winter snows. There can also be severe summer thunderstorms and cloud burst events.

The analysis area is underlain primarily by Picture Gorge basalt with small amounts of landslide debris and alluvium. Volcanic ash from Mt. Mazama blanketed the area approximately 7,000 years ago, followed by Newberry Crater ash approximately 1,300 years ago.

The fault-derived fractures in the basalt are areas of concentration for groundwater infiltration, supporting recharge for the regional and local aquifers. The faults provide avenues for collection of soil and ash that make a more fertile growing environment and coincide with some of the 'stringers', areas with trees and shrub components.

The basalt surfaces are incised with deep, steep-sided drain ways in the lower portion of the planning area. Soils on these steep drainages are moderately deep to deep on the northerly aspects, and shallow to moderately deep on southerly aspects. Soils within the drain ways are derived from ash and are either overlying or mixed with colluvium. The drainages have served to collect ash from scab flats that eroded from both water and wind. Currently, approximately 30 percent of the Planning Area is covered in deeper ash soils.

Roughly 28 percent of the watershed is characterized as non-forestland. This includes scablands, meadows, and shrub lands. The scablands have very shallow to shallow lithic soils derived from the basalt. Infiltration in the deep ash soils is rapid but very slow on the scablands. The transition zone between scablands and forested stringers helps slow down and dissipate the runoff from scabs. The remainder of the soils in the watershed are either derived from basalt residuum or are shallow, ash-capped soils.

Water Quality and Fish Habitat

Overview of Watershed

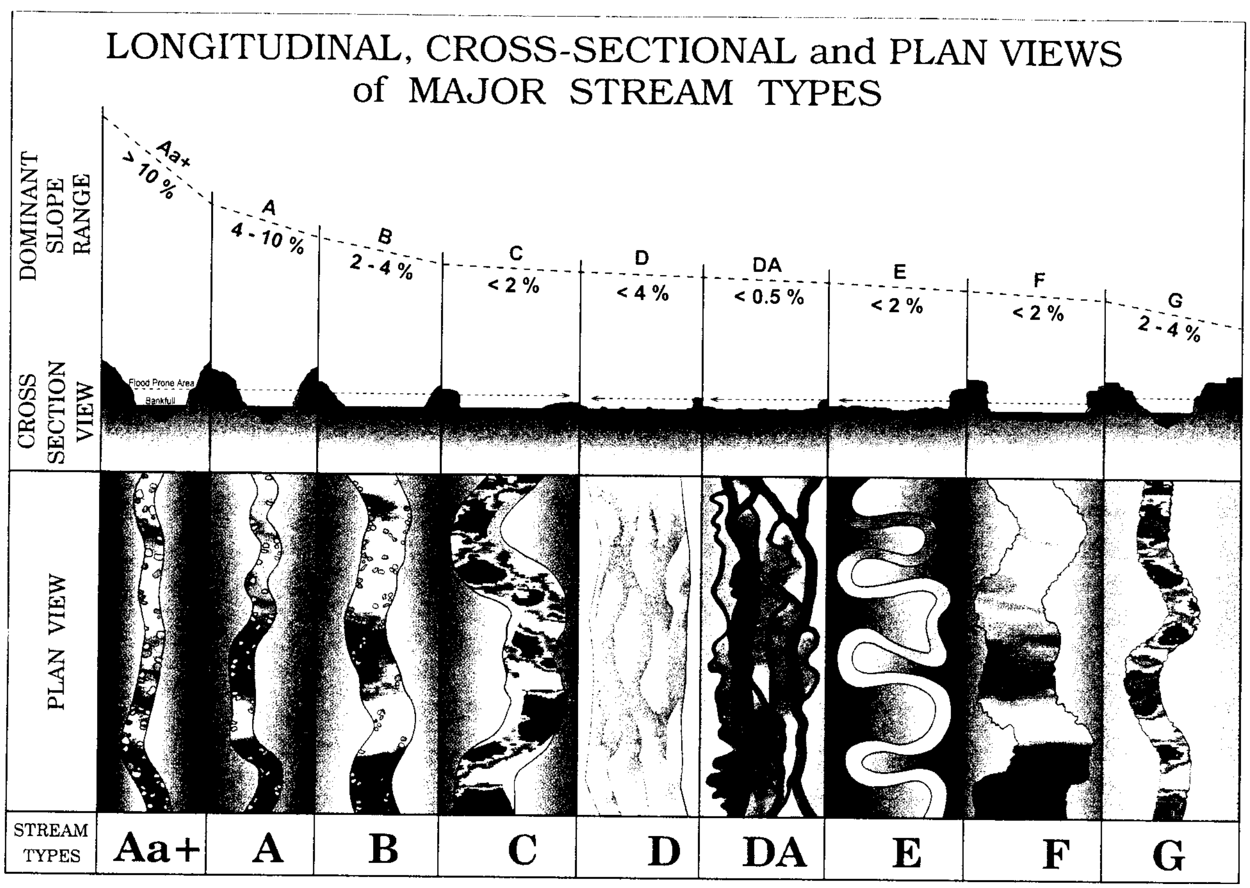
The following discussions are summarized from the Fisheries and Hydrology Specialist’s Report. The Analysis file contains the complete specialist's reports. Information for this section also comes from the Deep Creek Water Quality Restoration Plan and the Deep Creek Watershed Assessment. The Deep Creek Watershed is located within the Upper Crooked River sub-basin, which is part of the larger Deschutes River Basin. Deep Creek empties into the North Fork Crooked River. In 1988 Congress designated the North Fork Crooked River as Wild and Scenic (USFS 1993).

Streams that occur in the Deep Creek watershed include: Deep Creek, Little Summit Creek, Crazy Creek, Happy Camp Creek, Jackson Creek, Double Corral Creek, Derr Creek, Thornton Creek, and their tributaries.

Channel morphology within the planning area can be generally characterized as Rosgen channel types A, B, C, E and G (Rosgen 1994) with low to moderate relief (1-4 percent). Figure 3-1 displays Rosgen channel types (Rosgen 1996). Wetlands and meadow systems are scattered throughout the watershed where higher channel sinuosity occurs along with cold water seeps and springs. In the lower third of the watershed, drainages occur at the bottom of steeper canyons where straight flowing channels are generally typical.

Riparian Habitat Conservation Areas (RHCAs) were established by the Inland Native Fish Strategy (INFISH) primarily to reduce the risk of loss of inland resident native fish populations and the negative impacts to their habitat on National Forest System Lands. RHCAs generally parallel the stream network, with widths varying by stream type. RHCAs are associated with stream Classes I – IV and make up a total habitat area of 6,332 acres within the planning area. See page 1-13 for Riparian Management Objectives.

Figure 3-1 Rosgen Channel Types



Stream flows that originate from the Deep planning area are characteristic of a snow melt hydrograph. A larger portion of the base flows are comprised of ground water recharge influenced from water table interaction (i.e. springs and seeps). Annual peak discharges result from snowmelt and at times from direct rainfall. Although rain-on-snow events are relatively uncommon (20-50 year return interval), flow regimes within the planning area exhibit bankfull discharges an average of every 2-5 years. Rain on snow events predominantly account for 25 year or greater flood occurrences that have taken place within the Deep Planning Area.

Stream Condition and Fish Habitat

Oregon Department of Environmental Quality (ODEQ) has placed a number of streams within the Deep Planning Area on the state 303(d) list (under Section 303(d) of the Clean Water Act). These streams have been identified as being impaired for because of stream temperature or habitat modification or both (see Table 3-2). Habitat modification has affected fish populations within the Deep Creek Watershed, but it is not known to what degree. Large woody material, channel stability, and pools are habitat parameters and are discussed below.

Some fish habitat elements within the watershed are, or are close to being, below ideal levels as established by the INFISH Riparian Management Objectives (RMOs). These include elements such as channel width to depth (W/D) ratios, large woody material (LWM), shade, and bank stability. RMOs are described on page 1-13, and are also described more specifically by stream type in the Fisheries/Hydrology Report. Many factors have contributed to these conditions within the planning area. Both individually and cumulatively, these factors have degraded the fishery, water quality, and riparian resources within the planning area. However, there are segments of streams that currently exhibit desirable habitat parameters. It would be beneficial to expand these attributes to other areas. The current conditions of each of these elements are summarized in Table 3-1. A description of each element follows the table. Figure 1 in Appendix D (Deep Creek Water Quality restoration Plan) contains a map of Deep Creek Watershed, its subwatersheds, and streams.

Table 3- 1 Existing Stream Conditions in the Deep Planning Area

(Data represents an average for the reaches of each stream survey.)

Stream	Class @ mouth	Miles Surveyed	LWM/ 100 ft	% Cutbank/ 100 ft	% Shade/ 100 ft	W/D Ratio	Pools/ 100ft
Deep	I	6.6	3.1	2.7	38	20.7	0.4
Little Summit	I	7.9	1.9	7.1	51.5	14.4	1.9
Jackson	I	8.9	1.9	11.7	31.3	17.3	1.1
Chamberlain	II	2.2	1.6	15.5	53	15.3	0.4
Crazy	II	3.9	0.8	2.2	47	11.3	1.3
E. Fk. Crazy	II	2.3	1.3	1.4	48.5	5.8	1.0
W. Fk. Crazy	II	2.8	1.7	14.9	41	6.8	0.9
Thornton	II	6.3	2.7	14.3	37	11.1	1.2
Happy Camp	II	7.9	0.8	9	37.4	10.7	1.4
Double Corral	II	5.3	1.8	18	25.2	9.5	2.6
Toggle	II	5.9	0.6	18.8	22.7	13.9	1.3

Large Woody Material

Recruitment of LWM is an important element of fish habitat. Typically, higher densities of LWM within the bankfull channel have shown increases in pools, fish habitat refugia, and cutbank protection. LWM will slow hydraulic gradients, reduce potential erosion during high flow events, help develop narrower and deeper channels, catch and retain sediment and organic matter, and may allow fish colonization of previously unused habitat.

Living, dead, and dying trees within and potentially outside the riparian corridor influence present and future levels of large woody material (LWM). Consult the Fisheries and Hydrology Report for additional information. Trees with a height to distance from stream ratio of greater than one will directly influence the stream if they fall. Stream segments within the planning area which are currently meeting INFISH standards (> 20 pieces per mile) include: portions of Deep Creek, Crazy Creek, W.F. Crazy Creek, Happy Camp Creek, Jackson Creek, Chaimberlain Creek, Little Summit Creek, and Thornton Creek. Variations of deficiencies occur throughout all streams within the planning area (surveyed and non-surveyed). Those reaches that are currently deficient in LWM (pieces ≥ 12 inch dbh and ≥ 35 feet length) do show slight increases by recruiting from adjacent stands as a result of insect and disease mortality.

Streambank Stability and Width/Depth Ratios

The Deep Creek Watershed has a significant amount of C and E stream types, which serve as high quality fisheries habitat occurring throughout 60 percent of the planning area, in the upper channel reaches. These stream types are heavily dependant on riparian vegetation for bank stability because of higher sinuosity and associated critical shear stress. As riparian vegetation (e.g. sedges, rushes, willow, alder, etc.) along stream banks and adjacent floodplains is reduced by existing land management activities such as livestock grazing, streams evolve to exhibit D, G, and F conditions. Currently 41 percent of the historic C and E stream types (high quality fish habitat) have been converted to degraded D, G, and F types that are typical of high bank erosion and lateral instability. This situation occurs in areas throughout Happy Camp Creek, Jackson Creek, Thornton Creek, Little Summit Creek, Toggle Creek, and Haypress Creek.

Rosgen A and B stream types occur predominantly in the lower third of the watershed. Rosgen A stream types exist in small contributing tributaries along Deep Creek, while B stream types occur in Deep Creek, Happy Camp Creek, Jackson Creek, and Little Summit Creek. Although Rosgen A stream types rarely exhibit bank instability (due to geologic factors), B stream types within the planning area are displaying lateral movement associated with bank sloughing. This situation occurs in areas throughout Happy Camp Creek, Double Corral Creek, Crazy Creek, Little Summit Creek, and Deep Creek. Inadequate streamside riparian vegetation (willow, alder, aspen, cottonwood and coniferous rooting) and lack of LWM are the main factors leading to stream bank instability. Bank and lateral instability result in increases in width/depth ratios that lead to increased suspended sediment, undesired adjustments in channel bedload, increased stream temperatures, and loss of pool habitat for fisheries.

Bedload data obtained from Deep Creek shows fine sediment (particle sizes < 2 mm) making up 40 percent of the desired spawning material (gravels). This can result in a "binding" effect between gravels and fine particles and cause a decrease in spawning success for fisheries. It is estimated that between 60 - 70 percent of all Class II, III and IV drainages within the planning area are severely incised or laterally unstable as a result of channel evolution (i.e. E→G, C→F, etc.). The main factors that have negatively affected these drainages are undersized culverts at road crossings, bank shearing/sloughing from cow hoof action, accelerated headcut advancement resulting from lack of vegetative stability resulting from livestock grazing, and past timber harvest practices that have accelerated peak flow regimes and sedimentation on channels that can no longer withstand this magnitude of shear stresses. Big game utilization has impacted riparian vegetation as well, but not at the scale at which livestock have.

Overall, bank stability within the planning area is generally poor, with approximately 65 percent of the watershed (based on surveyed reaches) meeting the 80 percent bank stability standard. Past harvest practices, road crossings, range utilization, and natural channel adjustments are the primary contributors toward bank instability within the Deep Creek watershed.

Much of the stream reaches throughout the planning area are deficient in riparian hardwoods or are exhibiting a trend in that direction. Lowered water tables, conifer competition, browse, and fire suppression have contributed to a decline of these species. See Page 3-25 for more discussion of hardwood plant communities within RHCAs. Consult the Fisheries and Hydrology Report for additional information.

Pools

Pools are an important fisheries habitat component and provide excellent refugia and exceptional spawning areas. Pool densities within the Deep Creek watershed are variable, but typically low as stream courses transition through different channel types. In Deep Creek and similar stream types pool densities are low ($\leq$ 1.3 per 100 feet) due to increases in bankfull width. Deep Creek has exhibited a 30 percent loss of pool density as width/depth ratios increase. This general trend is evident in other stream segments across the planning area.

Stream types such as A, C, and E within the watershed typically have higher pool frequencies due to their morphological dimension, pattern, and profile. B stream types in the planning area support lateral scour pools associated with substrate, root wads, and LWM. Past timber management activities have removed a certain percentage of the historic LWM that existed in many channels, thus degrading and reducing pool habitat. Consult the Fisheries and Hydrology Report for additional information.

Temperature and Shade

In 1996, the Oregon Department of Environmental Quality (ODEQ) listed certain streams within the planning area as water quality limited for temperature. The State and Forest stream temperature standard is the same, hence these streams do not meet the Forest Plan Standard for stream temperature. The listing status evolves from data showing stream temperatures regularly exceeding the ODEQ standard of 64˚F between the months of June and September. Table 3-2 displays the stream temperature summary, as well as the listed water bodies. Section 303(d) of the Federal Clean Water Act mandates outcomes or Total Maximum Daily Loads (TMDLs) for these listed water bodies (Boyd and Sturdevant 1997). The present conditions of degraded water quality have resulted from impacts on the forest during more than a century of use. A Water Quality Restoration Plan (USFS 2001) has been completed for the planning area (see Appendix D).

In open meadow systems, influxes of cold water from discrete spring sources have historically had a dampening effect on stream temperature. Decreases in water table interaction, that is, loss of floodplains, has reduced the ability of streams to maintain lower, more consistent temperatures during dry summer months. Channel incision has lead to some loss of water storage efficiency. As channel incision has progressed, conifer encroachment has further degraded water table levels and reduced the understory riparian/wetland species such as rushes, sedges, and grasses.

Vegetation providing stream shading is predominantly produced from mixed conifer and hardwood stands. The Forest standard of > 80 percent surface shade is not being met in 94 percent of the planning area. Contributors to this condition are road development adjacent to stream channels, past harvest activity along portions of stream channels, and livestock and big game utilization in riparian areas. Effects to channel form as a result of these management activities include: increases in bankfull width, stream straightening, and incision. Diurnal temperature fluctuations increase with these adjustments to physical parameters, resulting in loss of stratified water columns. Currently, an average of two to ten percent of the existing riparian shade is contributed by deciduous shrubs. Many of the stream reaches throughout the planning area are currently deficient in or losing riparian hardwood density. Hardwoods such as mountain alder, willow, red-osier dogwood and aspen provide stream shade.

Riparian vegetation potential, and associated stream shade, is assumed to be much greater than what is currently being exhibited along many of these stream courses, while in other areas it is assumed to be currently at or near potential. Riparian vegetation potential is primarily a function of stream type coupled with soil type and disturbance regimes (e.g. flood events). Consult the Fisheries and Hydrology Report as well as the Deep Creek WQRP for additional information.

Table 3- 2 Temperature Data for 303(d) Listed Streams in the Deep Planning Area

303(d) Listed Stream	1994	1995	1996	1997	1998	1999	2000
Listed for Temperature and Habitat Modification							
Deep Creek	73.5	73.4	74.9	74	ND	73.9	77.8
Crazy Creek	64.5	ND	ND	ND	ND	69.5	ND
East Fork Crazy Creek	64.3	ND	ND	ND	61.3	ND	ND
West Fork Crazy Creek	72.7	ND	ND	ND	ND	71.9	ND
Little Summit Creek	64.5	71.3	69.3	67.7	70.7	85.8	70.5
Happy Camp Creek	78.3	ND	ND	ND	74.1	73.7	76.7
Jackson Creek	76.7	ND	ND	ND	ND	77.0	75.6
Double Corral Creek	71.3	ND	ND	ND	ND	75.8	ND
Listed for Temperature Only							
Toggle Creek	72	ND	ND	ND	66.4	73.2	ND
Derr Creek	78	ND	ND	ND	ND	72.0	ND

1994: This is the average high for the entire period of record. 1995-2000: This is the average 7-day floating for the period of record. ND: No data available.

Vegetative Diversity

Upland Forest Vegetation

Plant Association Groups (PAGs)

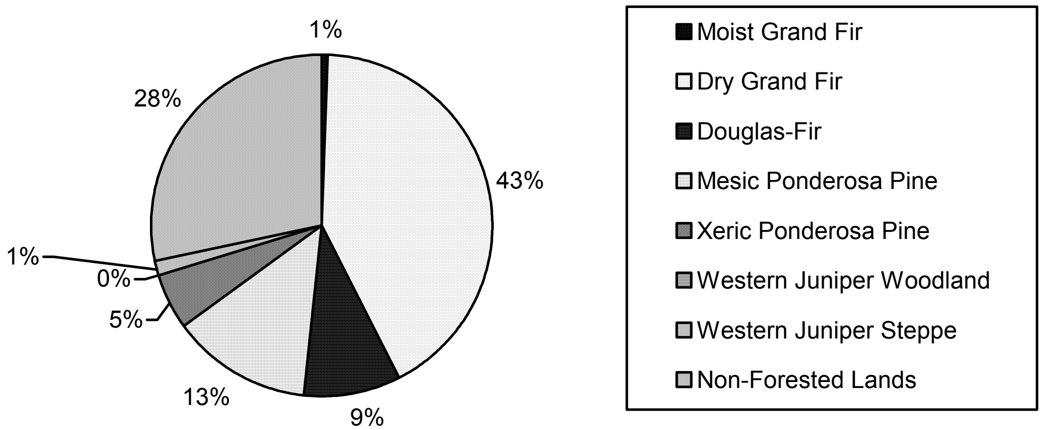
Seven upland forest and woodland plant association groups are present within the Deep Planning Area. Plant associations are a method of land classification based on the projected plant community that would occupy a site given enough time and no disturbance. The non-forested lands classification consists of meadows, scablands, rock and aspen stands.

Forest plant associations identified in the Deep Planning Area are grouped by Ochoco National Forest's VEMG Plant Association Groups (PAG) and are described below. The distribution of PAGs is shown in Table 3-3 and Figure 3-2. Publications used to describe these associations include: Plant Association and Management Guide for the Ochoco and Southern Blue Mountains, (Hall 1989); Plant Communities of the Blue Mountains of Eastern Oregon and Southwestern Washington, (Hall 1973); Plant Associations of the Blue Mountains, (Hall and Johnson 1990); and Plant Associations of the Blue and Ochoco Mountains, (Johnson and Clausnitzer 1992).

Table 3- 3 Plant Association Groups of the Deep Planning Area

Plant Association Group	Acres	Percent of the Watershed
1. Moist Grand Fir	324	<1%
2. Dry Grand Fir	23,262	42%
3. Douglas-Fir	5,064	9%
4. Mesic Ponderosa Pine	7,386	13%
5. Xeric Ponderosa Pine	2,857	5%
6. Western Juniper Woodland	35	<1%
7. Western Juniper Steppe	746	1%
Non-Forested Lands	15,694	28%

Figure 3- 2 Plant Association Groups of the Deep Planning Area



1. <u>Moist Grand Fir PAG [<1% - 324 Acres]</u>

This PAG makes up <1% of the watershed area or about 324 acres. Within this group, approximately 204 acres are currently identified as being mid seral with another 101 acres identified as late seral. White fir and Douglas-fir are the dominant species present.

Moist grand fir PAG sites are the most productive sites and tend to be associated with high elevation draws in the northwest corner of the watershed. These sites are generally found between 4,500 feet and 6,700 ft in elevation. The Moist Grand Fir PAG typically occurs on north to east aspects, but may occur on other slopes if enough moisture is present. Most sites are found on concave slopes but may also be found on toe-slopes, cold air drainages, and riparian areas.

Key insect and disease associates in these plant associations include the western spruce budworm (*Choristoneura occidentalis*), the Douglas-fir tussock moth (*Orgyia pseudotsugata*), laminated root rot (*Phellinus weirii*), armillaria root disease (*Armillaria ostoyae*), and Indian paint fungus (*Echinodontium tinctorium*). All of these organisms are favored by high densities of grand fir and Douglas-fir. Although the defoliating insects are generally more severe in the drier associations, they still exert a profound effect in the moist plant groups such as these, where the host species component is abundant.

For this plant association group within the Deep project area, Indian paint fungus is probably the most significant pathogen yet identified. Indian paint fungus is a pervasive stem decay that can cause structural failure in the boles of larger trees. This in turn influences the subsequent structure of the stand. Species composition would not likely be affected by the Indian paint fungus. Laminated root rot and armillaria root disease are present but not identified to the extent of Indian paint fungus. Areas with Indian paint fungus identified are associated with suppression due to stand density, structure, and tree wounding.

Historically, fire regimes in the Moist Grand Fir PAG were variable, ranging from frequent to infrequent return intervals with severity ranging from non-lethal to stand-replacing. Currently, fire regimes in the Moist Grand Fir PAG have moved toward longer fire return intervals with more severe effects to the stands, as canopies have closed, ladder fuels have increased, and downed woody fuels have accumulated. Live fuels in the form of understory trees have added greatly to the crown fire hazard for this plant association group. Current dead, downed fuel loadings and live ladder fuels have generally increased from historic levels.

With this group making up such a small portion of the landscape (<1%), frequent, non-lethal fires probably maintained a higher percentage of these areas in open, early seral stand conditions. These small assemblages of moist grand fir plant associations were probably strongly influenced by the dominant disturbance patterns of surrounding dry grand fir associations.

Plant Associations Present:

Grand fir/queen's cup beadlilly, CWF421, 39 acres. This site is among the highest productivity sites in the Blue Mountains with a very high productivity rating, a mean total basal area at 253 sq. ft./ac and a normal tree canopy coverage of 83% (Stand density expressed on a relative basis as approximated by the competition level represented by normal stand conditions, i.e. full stocking. (Forestry Handbook, Wenger, 1984.))

The grand fir/queen's cup beadlilly association is found on sites having a site index of 117 feet for western larch and 101 feet for grand fir at 100 years. The site index is the potential height for dominant or co-dominant trees at 100 years of age. Soils on these sites are generally ash influenced, deep, and typically have a loam texture in the surface and subsoil. Because of the high moisture holding capacity of these soils, this association occurs on all aspects. Western larch and Douglas-fir are early seral species with grand fir being late seral. Spruce may be associated with grand fir at a low percentage of coverage in the late seral stages.

Grand fir/Columbia brome, CWG211, 286 acres. This association is rated at a moderately high productivity, has a mean total basal area of 205 sq. ft./ac and a normal tree canopy coverage of 64%. The site index for western larch is 81 feet and grand fir is 80 feet at 100 years for dominant and co-dominant trees. Soils are ash influenced, generally deep, and typically have a loam texture in the surface and subsoil. This plant association occurs more commonly on north aspects. Western larch and Douglas-fir are early and mid-seral to grand fir. Englemann spruce may be present (mean of 7% coverage) about 50% of the time in late seral conditions. Late seral stand conditions promote insect and disease conditions such as spruce budworm, Douglas-fir tussock moth and Indian paint fungus.

2. Dry Grand Fir PAG [42% - 23,262 Acres]

Dry grand fir sites are the most common vegetation type found within the watershed with approximately 23,262 acres or 42% of the area identified within this PAG. These vegetation types are often found throughout the watershed in larger continuous blocks than other PAGs. The only exception is the southwest corner of the watershed, where a mosaic of scablands and stringer timber stands dominates the landscape. They commonly occur on south facing slopes between 4000'-6500' and topography and slope position are varied. Included in this plant association group are stands currently dominated by lodgepole pine. These stands occur along several streams (functioning as cold air drainages) in the watershed.

The most important insect associates in this stage would be western spruce budworm, Douglas-fir tussock moth, and fir engraver. The spruce budworm, and particularly the Douglas-fir tussock moth, could have a more profound effect on their hosts when these are growing on the drier sites. Thus here, these defoliators could produce greater levels of tree mortality within the grand fir and Douglas-fir components than they would in the Moist ABGR plant association group.

Depending on the abundance of the host species, insects having potential to cause disturbances that alter stand structure and species composition for this PAG include fir engraver, Douglas-fir beetle, and western pine beetle. As the stand densities increase due to encroachment of shade tolerant species, the role of western pine beetle would become more important in removing the largest and weakest pines - generally older trees within the overstory where competition from grand fir and Douglas-fir is the greatest. Fir engraver would tend to attack grand fir in dense stands whereas the Douglas-fir beetle would be most likely to thin stands from above, removing the largest Douglas-fir from the overstory. Historically, insect disturbances within this PAG played a relatively minor role in creation of landscape scale vegetation patterns and conditions when compared to fire’s historic role.

Important diseases include laminated root rot and armillaria root disease. Dwarf mistletoes of ponderosa pine, western larch, lodgepole pine, and Douglas-fir could be significant in stands where their host species are abundant.

On dry grand fir sites frequent surface fires maintained open stands dominated by fire-tolerant ponderosa pine along with some Douglas-fir. Johnson and Simon (1987) report fire return intervals of 15-30 years. Downed, dead woody fuel loads are often light. Hall (1976, 1980) estimates that natural underburns occurred every 10 years in ABGR/CARU plant associations in the Blue Mountains. Fire return intervals on a given site are influenced by slope position. Stands that occur on mid and upper slope positions had more frequent fires than stands on a toe slope or lower slope positions. Non-lethal to mixed severity fires favored open, seral stands of ponderosa pine, Douglas-fir, and larch and created the classic park-like stands that were typical in central and eastern Oregon when European settlers arrived in the mid 1800s. These fires regulated stand density and successful regeneration. However, occasional long fire-free intervals allowed grand fir to dominate and form a closed canopy.

Plant Associations Present:

Grand fir/grouse huckleberry, CWS811, 1275 acres. This plant association is rated moderately high in productivity, has a mean total basal area of 112 sq. ft./ac and a normal tree canopy coverage of 62%. The site index for western larch is 77 feet and grand fir is 75 feet at 100 years for dominant and co-dominant trees. Soils are ash influenced; moderately deep to deep with a shallower ash component than in the plant associations listed above. These soils also have a loam texture in both the surface and subsoil. This association occurs most often on north aspects associated with colder, frost prone sites that are drier than sites supporting twinflower and big huckleberry. A number of early seal species exists for this association and includes western larch, lodgepole pine, ponderosa pine and Douglas-fir. Late seral stand conditions promote insect and disease conditions such as spruce budworm, Douglas-fir tussock moth, and Indian paint fungus.

Grand fir/pinegrass, CWG113, 21,394 acres. This plant association is rated at moderately high in productivity with a mean total basal area of 151 sq.ft./ac and a normal tree canopy coverage of 65%. The site index for western larch is 93 feet and grand fir is 87 feet at 100 years for dominant and co-dominant trees. Soils are moderately deep and have a relatively shallower ash mantle than previously mentioned grand fir sites. The lower amounts of ash result in a lower moisture holding capacity. Surface and subsoils have loam influenced textures with increasing influence from smaller soil particles such as clay. The primary early seral tree species are ponderosa pine and Douglas-fir. Western larch and lodgepole pine may occur as minor seral species within this association (8% mean tree coverage an average of 46% of the time for western larch and 13% mean tree coverage an average of 20% of the time for lodgepole pine). This plant association is considered on the drier end of the range for grand fir.

Grand fir/elk sedge, CWG111, 594 acres. This plant association is rated moderately high in productivity with a mean total basal area of 154 sq. ft./ac and a normal tree canopy coverage of 66%. The site index for ponderosa pine is 80 feet and grand fir is 75 feet at 100 years for dominant and co-dominant trees. Soils are moderate in depth, derived from residual parent material and generally do not have an ash component. Soil moisture holding capacity is generally lower as a result. Ponderosa pine has historically been the climax species on these sites under historical fire influences. Dominance by grand fir indicates late seral conditions. Again, late seral conditions promote increased insect and disease situations. This plant association is also considered on the drier end of the range for grand fir.

3. Douglas-fir PAG [9% - 5,064 Acres]

In the Deep Creek Watershed these sites are generally related to draws, especially in the southwest corner of the watershed along Deep Creek where they contribute to the forested stringer-scabland mosaic. This group of plant associations makes up approximately 5,064 acres or 9 percent of the watershed.

Depending on the host species present, insects common in this PAG include Douglas-fir tussock moth, western spruce budworm, Douglas-fir beetle, western pine beetle, and mountain pine beetle. These insects would generally create small gaps within a stand but have the potential to alter stand density and species composition during epidemic outbreaks. Historically, insect disturbances within this PAG played a relatively minor role in creation of landscape scale vegetation patterns and conditions when compared to fire's historic role in this watershed.

Diseases typical for this PAG include western dwarf mistletoe, armillaria root disease, and in the drier fringes, annosus root disease.

This PAG was most heavily influenced by low severity fires ranging in size from several hundred to several thousand acres. Current fire regimes in the Douglas-fir PAG have been altered by fire suppression and now have longer fire return intervals and more severe stand effects as ladder fuels have developed and downed woody fuels have accumulated. Recent observations on the Snow Mountain Ranger District indicate that without underburning at 15-20 year intervals, reproduction becomes so advanced that underburning is either difficult or the overstory is at risk from wildfire (USFS 1997b)

Plant Associations Present:

Douglas-fir/pinegrass, CDG112, 2862 acres. This plant association is rated at moderately high in productivity with a total basal area of 117 sq. ft./ac and a normal tree canopy closure of 61%. The site index for ponderosa pine is 75 feet and Douglas-fir is 81 feet at 100 years for dominant and co-dominant trees. Soils are moderate in depth and often have a shallow ash cap. Ponderosa pine is the major seral species for this association.

Douglas-fir/elk sedge, CDG111, 2340 acres. This pant association is rated moderately high in productivity with a mean total basal area of 104 sq. ft./ac and a normal tree canopy coverage of 67%. The site index for ponderosa pine is 68 feet and Douglas-fir is 71 feet at 100 years for dominant and co-dominant trees. Soils are shallow to moderate in depth and often lack an ash influence. Ponderosa pine is the major early seral species preceding Douglas-fir on these sites.

Douglas-fir/common snowberry, CDS624, 38 acres. This plant association is rated at moderate in productivity with a mean total basal area of 105 sq. ft./ac and a normal tree canopy coverage of

53%. The site index for ponderosa pine is 83 feet and Douglas-fir is 89 feet at 100 years for dominant and co-dominant trees. Soils are generally moderate in depth and have an ash influence. Douglas-fir and ponderosa pine occur together as co-dominant species on these sites although ponderosa pine is an early seral species and may dominate the site. Western larch and western juniper may be present in low coverages (less than10% coverage less than 20% of the time).

4. Mesic Ponderosa Pine PAG [13% - 7,386 Acres]

This is the second most common plant association group (13 percent) in the watershed. These sites are primarily found in the southern half of the watershed. There are 7,386 acres of this PAG.

Under current conditions, pine bark beetles have the greatest potential to create disturbances that alter stand characteristics in this PAG. The western pine beetle would be a prominent factor in creating snags from low-vigor overstory ponderosa pine. The mountain pine beetle would occur as well, but would only be associated with thickets of even-aged trees of pole size. In this situation, mountain pine beetle would be a significant thinning agent, removing trees of all sizes. The pine engraver could also be found in this seral stage, but would be much less important in regulating PIPO stocking than it would be in the drier PIPO plant associations. Historically, insect disturbances within this PAG played a relatively minor role in creation of landscape scale vegetation patterns and conditions when compared to fire's historic role.

Western dwarf mistletoe and the P-strain of annosus root disease are the most important diseases for this PAG. Western dwarf mistletoe is promoted in dense, pure ponderosa pine stands having multiple canopies.

These plant associations were heavily influenced by low severity fires ranging in size from several hundred to several thousand acres. Current fire regimes in the mesic ponderosa pine PAG have been altered by fire suppression and now have longer fire return intervals and more severe stand effects as ladder fuels have developed and downed woody fuels have accumulated. Fire appears to have been important in establishing and maintaining open, widely spaced "park-like" old-growth stands (Crane and Fischer 1986). Unique to the ponderosa PAGs, the earlier seral stages were relatively rare because of periodic fire that favored the pine over juniper.

Plant Associations Present:

Ponderosa pine/mountain-mahogany/elk sedge, CPS232, 26 acres. This plant association is rated at moderate in productivity with a mean total basal area of 108 sq. ft./ac and a normal tree canopy coverage of 42%. The site index for ponderosa pine is 65 feet at 100 years for dominant and co-dominant ponderosa pine. Soils have developed from parent material, vary in depth from shallow to deep, and have limited water holding capacity. Ponderosa pine and western juniper generally occur together forming an open forest with mountain mahogany stands in the understory.

Ponderosa pine/pinegrass, CPG221, 4457 acres. This plant association is rated moderate in productivity with a mean total basal area of 163 sq. ft./ac and a normal tree canopy coverage of 47%. The site index for ponderosa pine is 71 feet at 100 years for dominant and co-dominant ponderosa pine. Soils are generally shallow but have an ash influence. Ponderosa pine dominates these sites but Douglas-fir and western juniper may occasionally be present in low coverages.

Ponderosa pine/elk sedge, CPG222, 3040 acres. This plant association is rated moderate in productivity with a mean total basal area of 90 sq. ft./ac and a normal tree canopy coverage of 42%. The site index for ponderosa pine is 70 feet at 100 years for dominant and co-dominant ponderosa pine. Soils vary in depth over various substrates and have little to no ash influence. Ponderosa pine is the climax species but western juniper and Douglas-fir may be present at low coverages.

5. Xeric Ponderosa Pine PAG [5% - 2,857 Acres]

Xeric ponderosa pine PAG sites typically border sagebrush scablands or juniper woodlands. Usually, ponderosa pine and western juniper are the only tree species on the site. Sites are frequently steep south and west-facing slopes where a scarcity of soil moisture limits both establishment and growth rates of trees. In the Deep Creek Watershed, these sites tend to be found on broad ridge tops, interspersed with sagebrush scabland and mesic pine. These stands help to form the forest stringer-scabland mosaic in the southwest corner of the watershed. This group of plant associations accounts for approximately 2,857 acres, or 5 percent of the watershed.

Important insects for this PAG are mountain pine beetle, western pine beetle, and pine engraver beetle. Historically, these insects would create small scale, within-stand disturbances, especially during dry years. Important disease organisms in this setting would include the P-strain of annosus root disease and western dwarf mistletoe. Historically, insect disturbances within this PAG played a relatively minor role in creation of landscape scale vegetation patterns and conditions when compared to fire's historic role.

Fire return intervals for this PAG are felt to be strongly influenced by the dominant understory in a given plant association. It has also been proposed that ponderosa pine communities with shrub undergrowth had longer fire intervals than those communities with grass undergrowth (Gruell et. al., 1982). Different ranges studied for specific plant associations varied between 5 and 25 years. Fire control within these associations has allowed understory tree development, creation of ladder fuels, and invasion of pine and juniper into formerly fire-maintained grasslands.

Plant Associations Present:

Ponderosa pine/mountain big sagebrush/Idaho fescue-bluebunch wheatgrass, CPS131, 33 acres. This plant association is rated at moderate productivity with a mean total basal area of 36 sq. ft./ac and a normal tree canopy coverage of 22%. Soils are generally shallow with poor moisture holding ability. Ponderosa pine is climax with western juniper strongly associated in low coverages. This association is considered as a transition zone between sagebrush steppe and forestland. Under historic fire regimes, ponderosa pine was mostly inhibited from colonizing these sites and so old growth stands are not common. Most stands seen today were established after the beginning of fire suppression activities.

Ponderosa pine/mountain big sagebrush/elk sedge; or ponderosa pine/squawapple; or ponderosa pine/low sagebrush, CPS1, 2518 acres. The nomenclature CPS1 denotes three different plant community types that at this point in time do not have plant association status. This classification attempts to provide a reference along the moisture-temperature gradient for similar environments where these plant species occur. These communities would generally form open forest or savannahs with low tree coverage. Soils are shallow and developed from parent rock material.

Ponderosa pine/Idaho fescue, CPG112, 265 acres. This plant association is rated low in productivity with a mean total basal area of 81 sq. ft./ac and a normal tree canopy coverage of 33%. The site index for ponderosa pine is 62 feet at 100 years for dominant and co-dominant ponderosa pine. Soils are moderately deep and have developed from parent rock material. Ponderosa pine is the climax species with western juniper being associated at low coverages.

Ponderosa pine/bluebunch wheatgrass, CPG111, 202 acres. This plant association is rated low in productivity with a mean total basal area of 43 sq. ft. /ac and a normal tree canopy coverage of 22%. The site index for ponderosa pine is 59 feet at 100 years for dominant and co-dominant ponderosa pine. Soils are shallow to deep and have developed from various parent rock materials. Ponderosa pine is the climax species with western juniper associated at low coverages.

6 & 7. Western Juniper Woodland and Steppe PAG [2% - 781 Acres]

Western juniper woodland and steppe plant associations are typically found on lower south slopes below the ponderosa pine zone or adjacent to sagebrush zones. These plant associations generally occupy ridge tops over cracked bedrock (Burkhardt and Tisdale 1969) and mountain slopes that face south. This vegetation type makes up only a small amount, approximately 781 acres, or 2 percent of the watershed.

Plant Associations Present:

Western juniper/Idaho fescue-bluebunch wheatgrass, CJG111, 24 acres. This plant association is not rated for timber productivity, as it is a non-commercial site dominated by western juniper. The plant association has a mean total basal area of 20 sq. ft./ac and a normal canopy coverage of 19%. Soils are shallow with poor moisture holding capacity. Fractured bedrock provides for deeper moisture reserves allowing western juniper to establish (Hall 1989). Ponderosa pine may occur at low coverages as an incidental species.

Western juniper/low sagebrush, CJS1, 511 acres. This is another plant association with no timber productivity rating. The sites are non-commercial with a low tree coverage of western juniper. Hall estimates 12-18% juniper canopy coverage on sites in the southern Blue Mountains (Hall, 1989).

Western juniper/mountain-mahogany/elk sedge or Western juniper/mountain-mahogany/Idaho fescue-bluebunch wheatgrass, CJS4, 12 acres. These two plant communities do not have full plant association status. In both communities, western juniper forms a savannah with mountain mahogany and various grass species. Ponderosa pine may be present in very low coverages. No mean total basal area or canopy coverages have been determined at this time for these communities.

Seral/Structural Distribution

The Ochoco National Forest's "Viable Ecosystem Management Guide" (VEMG) describes a seral/structural matrix for characterizing forest vegetation within each of the plant association groups (PAGs). VEMG separates seral species changes from structure development and tracks these as separate progressions (USFS 1997b)

Early, mid, and late seral species for each PAG vary to some degree by plant association. Refer to previous discussions describing plant associations for a more detailed discussion of the species found and their seral status in each plant association. Generally, early seral species can include western larch, lodgepole pine, ponderosa pine and western juniper depending on the given plant association. Mid seral species may include ponderosa pine, western juniper or Douglas-fir. Late seral species can include ponderosa pine, Douglas-fir or grand fir.

VEMG further discusses and quantitatively describes the abundance and mix of species by PAG. For example, early seral conditions for moist grand fir would have greater than 75 percent composition of early seral species; 25-75 percent of mid seral species for mid seral status; and less than 25 percent of early seral species for late seral status. The dry grand fir group would have greater than 75 percent of the stand in early seral species for an early seral status; 50-75 percent in mid seral species for mid seral status; and less than 50 percent in early seral species for a late seral status. See VEMG for additional seral descriptions for the Douglas-fir, moist ponderosa pine, xeric ponderosa pine and western juniper groups.

There are 5 stand structure conditions identified under VEMG. These structures are identified in Table 3-4. Generally, the structure is identified by the majority of trees in a stand being in a given size group.

To display and track all potential combinations of Viable size/structures for each of the 7 plant association groups, a total of 96 seral/structure combinations would need to be displayed for this analysis (some PAGs do not contain all 15 conditions). Each of the 96 conditions are tracked for this analysis and compared to the historic range of variability (HRV) through a spreadsheet that calculates acres and percentages of HRV. To simplify tables and displays within this document, summaries of seral conditions (early, mid and late) and structure conditions (grass/forb/shrub, seedling/sapling, pole, small and large) are used to display the existing condition and to track changes for the effects analysis. Full spreadsheet displays of existing conditions, and projections of change based on proposed treatment alternatives can be found in the analysis file for each recognized condition possible for each of the 7 PAGs.

Table 3- 4 Viable Ecosystem Seral/Structural Matrix

	Early	Mid	Late
grass/forb/shrub	E1	N/A	N/A
seedling/sapling (1-4.9" dbh)	E2	M2	L2
pole (5-8.9"dbh)	E3	M3	L3
small (9-20.9" dbh)	E4	M4	L4
large (21"+ dbh)	E5	M5	L5

The matrix is further broken down into a high and low density category (single or multi-stratum) under VEMG. To display and track all potential combinations of the size/structures for each of the seven plant association groups, a total of 96 seral/structural combinations would need to be displayed**.** Rather than present all 96 stages, this document will group species composition and structure into the basic categories for displaying the changes that have occurred in the watershed. The Western juniper plant association groups will not be included in the summary tables below but will be included in summary discussions. Structural diversity is displayed below in Table 3-5. The HRV ranges reflect conditions historically expected to have occurred within the Deep Planning Area. Ranges, midpoints and existing conditions are displayed as percentages of that structure within the PAG. Pole, small and large structures include both low and high density stands (single or multi stratum).

Table 3- 5 Structural Diversity by PAG

1. *Moist Grand Fir*

Structural Stage	Viable HRV Range and Midpoint in %	Existing Condition in %
grass/forb/shrub	2-10 (7)	6
seed/sapling (1-4.9" dbh)	3-16 (10)	0
pole (5-8.9"dbh)	4-20 (11)	7
small (9-20.9" dbh)	20-55 (22)	<1
large (21"+ dbh)	35-75 (50)	87

2. *Dry Grand Fir*

Structural Stage	HRV Range and Midpoint in %	Existing Condition in %
grass/forb/shrub	0-2 (1)	6
seed/sapling (1-4.9" dbh)	0-5 (2)	8
pole (5-8.9"dbh)	0-8 (3)	18
small (9-20.9" dbh)	20-55 (36)	30
large (21"+ dbh)	40-75 (58)	38

3. *Douglas-Fir*

Structural Stage	HRV Range and Midpoint in %	Existing Condition in %
grass/forb/shrub	0-2 (1)	2
seed/sapling (1-4.9" dbh)	0-3 (1)	4
pole (5-8.9"dbh)	0-3 (2)	33
small (9-20.9" dbh)	12-43 (29)	37
large (21"+ dbh)	52-83 (67)	24

4. *Mesic Ponderosa Pine*

Structural Stage	HRV Range and Midpoint in %	Existing Condition in %
grass/forb/shrub	0-2 (1)	2
seed/sapling (1-4.9" dbh)	0-4 (2)	<1
pole (5-8.9"dbh)	1-12 (5)	42
small (9-20.9" dbh)	10-36 (22)	46
large (21"+ dbh)	60-86 (70)	10

5. *Xeric Ponderosa Pine*

Structural Stage	HRV Range and Midpoint in %	Existing Condition in %
grass/forb/shrub	5-15 (10)	3
seed/sapling (1-4.9" dbh)	0-6 (3)	3
pole (5-8.9"dbh)	1-14 (7)	42
small (9-20.9" dbh)	25-55 (41)	51
large (21"+ dbh)	25-55 (39)	1

Of the 30 structure conditions shown above, 70% are outside their historic ranges. Large tree structures for moist grand fir, Douglas-fir, mesic ponderosa pine, and xeric ponderosa pine vary greatly outside historic ranges. Dry grand fir is two percent outside the low end of its range for large tree structure. This deviation from the low end of the range appears minimal, however, the distribution of LOS between multi-story and single-story shows a greater variation from historic levels (see Table 3-8)

Less than one percent of the Deep watershed area is represented by the moist grand fir group. The dominance of the drier plant associations reflects the relatively dry climate that influences the area. The average annual precipitation within this watershed ranges from 17 to 25 inches with most of this occurring as snow during the winter and spring months. Even at the higher end of the range of precipitation, 25 inches per year is considered relatively dry for high elevation forests. The low moisture gradient and frequent fire disturbances common to this watershed have strongly influenced past stand development and the VEMG recognizes that historically, single stratum stand structures were very common in these drier plant association groups.

The size classes of trees making up the middle and understories of stands typically range from young seedlings to small, saw-sized trees. Often, the pole to small saw-sized trees are as old as 90-130 years of age. The upper age range of 90-130 years generally correlates to changes in fire disturbance intervals related to settlement and early grazing practices. For most forest stands within the watershed, understory development has been ongoing for a hundred years or more. Seral species diversity is displayed below in Table 3-6.

The Viable Ecosystem Guide recognizes the historical conditions for this area with an 80:20 distribution between single-stratum and multi-stratum stand conditions for the dominant plant association group (the Dry Grant Fir plant association group accounts for 58% of the forested portion of the watershed).

Table 3- 6 Seral Species Diversity

1. *Moist Grand Fir*

Seral Stage	Viable HRV Range and Midpoint in %	Existing Condition in %
Early	16-60 (38)	6
Mid	37-80 (58)	63
Late	11-37 (24)	31

2. *Dry Grand Fir*

Seral Stage	Viable HRV Range and Midpoint in %	Existing Condition in %
Early	35-94 (64)	32
Mid	20-54 (20)	60
Late	10-27 (16)	8

3. *Douglas-Fir*

Seral Stage	Viable HRV Range and Midpoint in %	Existing Condition in %
Early	50-80 (65)	40
Mid	10-32 (30)	58
Late	4-10 (5)	2

4. *Mesic Ponderosa Pine*

Seral Stage	Viable HRV Range and Midpoint in %	Existing Condition in %
Early	0-6 (1)	3
Mid	0-12 (5)	39
Late	71-100 (96)	58

5. *Xeric Ponderosa Pine*

Seral Stage	Viable HRV Range and Midpoint in %	Existing Condition in %
Early	5-29 (16)	6
Mid	2-14 (8)	38
Late	51-93 (76)	56

Of the 18 seral conditions, 13 (72 %) are outside historic ranges. Again, the deviation from historic seral species conditions is the result of stand development continuing in the absence of fire, the primary historic disturbance within this watershed.

Fire's historic disturbance role was 1) to thin and maintain stands at lower tree densities which in turn maintained lower canopy closure values and fewer canopy layers and 2) to select against thin barked tree species (young, small diameter white fir, Douglas-fir, and western juniper) and limit their numbers. However, it is important to note that fire did not totally eliminate Douglas-fir and white fir from developing as co-dominates with ponderosa pine under historic disturbance regimes. The dry grand fir and Douglas-fir plant associations typically had 10-25% Douglas-fir and white fir that developed as cohorts with early seral ponderosa pine. Field reconnaissance and stand exam analysis of Douglas-fir and dry grand/white fir plant associations supports the presence of low numbers of Douglas-fir and white fir trees developing and eventually becoming co-dominants with ponderosa pine. Again, this variability in species mixture for early seral stands is recognized under VEMG which allows for up to 25% of fir species mixed with early seral species and still be recognized as an early seral stand.

Late and Old Structured (LOS) Conditions

Historically, a large portion of the Deep watershed was dominated by large ponderosa pines under an historic fire regime of frequent, low intensity fires. Douglas-fir and grand fir were at times present as co-dominants with ponderosa pine but generally in low numbers. Much of the landscape was historically much more open appearing than today. Large tracks of land were in an open, park-like structure. Relatively smaller areas of refugia within the landscape were represented by multi-stratum conditions where fire disturbance cycles were missed due to site-specific topographic features or other site factors. Historic ranges developed for the Viable Ecosystem Guide recognize this dynamic by assigning a larger proportion of the structure for the dry grand fir to single-stratum stand conditions. Multi-stratum conditions are recognized as occurring but as a much smaller proportion of the landscape for this area.

Stand Density of LOS: Multiple tree canopy layers developed in the understory of open ponderosa pine stands as historic fire cycles were missed. Stand density increased with the number of trees becoming established and growing in size. Site occupancy increased as stand density increased. Of the approximately 11,002 acres of LOS currently identified, approximately 8,052 acres, or 73 percent of LOS stands now have stand densities that are in the upper 1/3 of site potential. Of these high-risk stands, 88% are multi-storied and 12% are single-storied. See Figure 3-5 for overstocked LOS.

High-density stands typically exhibit tree characteristics of lowered vigor, reduced live crown, slow growth, and a higher susceptibility to insects and disease. Competition related mortality increases under these stand conditions and contributes to increased fire risks. Field observations in the Deep Watershed indicate many large, older ponderosa pine showing crown symptoms of senescence and stress.

Developing understory trees increasingly compete with the remnant overstory pine for site nutrients, growing space, and moisture. These dense stands promote competition-related stress that reduces the vigor of the older trees. This, in turn, promotes an elevated risk of undesirable impacts from inter-tree competition, insects, and disease. Large diameter, older ponderosa pines are especially sensitive to high stand densities. For example, western pine beetle often attacks large, older ponderosa pines that are under stress.

Seral Stages of LOS: A significant portion of the landscape is dominated by mid to late seral fir species that make up the understory and middle canopies of stands. This trend continues for LOS structure and is especially relevant for LOS stands in the dry grand fir and Douglas-fir plant association groups. In the absence of fire disturbance or management activities, large, old ponderosa pine will eventually be replaced by grand fir and Douglas-fir on sites where fire historically selected for ponderosa pine.

Table 3-7 below displays the breakdown of current seral stage distribution across the watershed for both multi and single stratum conditions.

Table 3- 7 Seral Composition of LOS Stands by Plant Association (Acres)

PAG: **Seral Stage**	**HRV Range Multi-Stratum**	**Existing Condition Multi-Stratum**	**HRV Range Single-Stratum**	**Existing Condition Single-Stratum**
Moist Grand Fir LOS				
Early	3-16	0	13-45	0
Mid	16-32	74	65-130	124
Late	16-49	83	N/A	N/A
Dry Grand Fir LOS				
Early	465-1163	868	7676-13491	290
Mid	465-1163	5,079	3024-6513	1754
Late	1163-3489	771	N/A	N/A
Douglas-fir LOS				
Early	101-253	222	2178-2937	0
Mid	51-152	712	203-709	211
Late	51-354	65	51-152	13
Mesic Ponderosa Pine LOS				
Early	0-73	27	0-73	0
Mid	0-73	356	0-363	0
Late	73-363	159	4289-5743	153
Xeric Ponderosa Pine LOS				
Early	0-29	0	0-145	0
Mid	0-29	31	29-145	0
Late	29-87	10	698-1280	0

Table 3-8 displays the historic ranges and existing condition for the Deep Watershed for both multi and single-stratum conditions.

Table 3- 8 Multi and Single Stratum LOS

Plant Association Group	HRV Range in Acres	Existing Condition in Acres
Moist Grand Fir:		
Multi	36-97	157
Single	78-175	124
Dry Grand Fir:		
Multi	2,093-5,815	6,718
Single	10,700-20,004	2,044
Douglas-fir:		
Multi	203-760	999
Single	2,431-3,798	224
Mesic Ponderosa Pine:		
Multi	73-509	542
Single	4,289-6,179	153
Xeric Ponderosa Pine:		
Multi	29-145	41
Single	727-1,570	0

In summary, the combined total of historical ranges for single-stratum LOS for this watershed is 18,225 acres at the low end to 31,726 acres at the high end. Currently, there are a total of 2,545 acres of single stratum LOS conditions. Each plant association group is deficit of large single-stratum structure. Historical ranges of multi-stratum LOS are 2,434 acres at the low end to 7,326 acres at the high end. Currently, there are a total of 8,457 acres of multi-stratum LOS conditions, however, the distribution of these acres contain a mixture of deficit and surplus conditions when comparing each specific PAG to HRV.

Figure 3-3 Current amount of single and multi-stratum LOS compared to HRV.

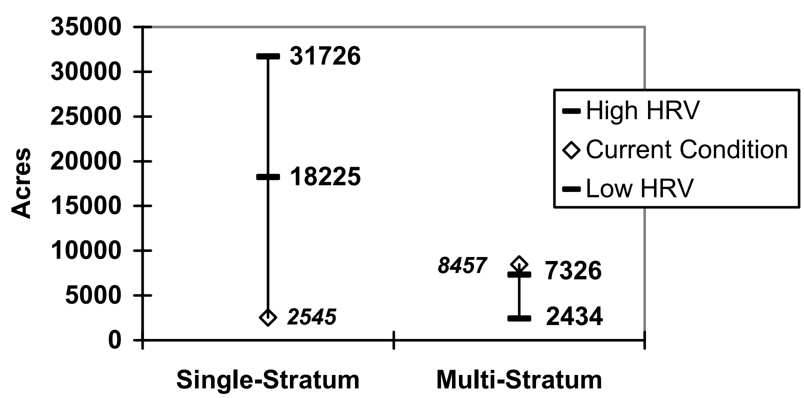


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Figure 3-4 – Insert LOS MAP

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Figure 3-5 - INSRET OVERSTOCKED LOS MAP

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Stand Density

Canopy closure values were used to determine relative stand densities within the Deep Watershed. Existing canopy closure values were compared to values identified in "Plant Associations for the Blue and Ochoco Mountains" (Johnson and Clausnitzer 1992) to determine the percentage of full site occupancy. This provided a relative determination of stand density. Stands were then rated for treatment needs and are displayed below:

Priority 1 (high risk for density, insect or disease related mortality), $\geq$ 66% of full site occupancy or upper third of site potential

Priority 2 (moderately high risk), 49-65% of full site occupancy

Priority 3 (moderately low risk), 39-49% of full site occupancy

Priority 4 (low risk) less than 39% of full site occupancy.

Table 3- 9 Summary of Risk of Insect and Disease Related Mortality based on Stand Density

PAG:	High Risk	Moderately High Risk	Moderately Low Risk	Low Risk
	Priority 1	**Priority 2**	**Priority 3**	**Priority 4**
Moist Grand Fir	292	7	0	24
Dry Grand Fir	8,942	6,754	1,265	6,301
Douglas-fir	1,384	1,660	503	1,517
Mesic Ponderosa Pine	3,336	743	708	2,481
Xeric Ponderosa Pine	415	26	61	2,406
Total	14,369	9,190	2,537	12,729

In summary, a total of 14,369 acres (37 percent) of the forestlands in the watershed are at stand densities representing the upper third of their site potential. These stands are at an elevated risk of competition related mortality, increased insect activity and disease impacts.

When stands with ratings of moderately high stand densities are included, a total of over 60 percent of the forested stands in the watershed can be considered to be at higher densities now than 150 years ago when fire disturbances regularly thinned stands and acted as a controller of stand density. Because of the relatively high percentage of stands in the watershed having high to relatively high stand densities and the high percentage of the area in fir dominated, mid and late seral conditions, these stands are at an elevated risk for competition related mortality and mortality due to insects or disease. Risk of stand replacement fire events is also higher for these areas due to the density of tree stems and crowns. Dense understories and interlocking crowns in the overstories increase the risk of fire moving into the crowns of trees and spreading through stands. Historically, these canopy conditions were limited in extent and did not occur over large, continuous areas within this watershed.

Upland Forest Vegetation within Riparian Habitat Conservation Areas (RHCAs)

RHCAs contain riparian, non-forested, and upland conifer vegetation. Of 6,332 acres within the RHCAs, approximately 4,735 acres are upland conifer associations. Acres at risk were determined by comparing existing canopy values with canopy values representing full stocking (indicator of site potential) for each plant association (Johnson and Clausnitzer 1992). Values in or greater than the upper 1/3 of the site potential are considered at high risk of mortality due to competition related stress. In these situations, insects are expected to be at high endemic levels and would contribute to tree mortality. Table 3-10 shows total acres at risk due to high stand densities by stream class.

Table 3- 10 RHCA Acreage and Acres at Risk

Stream Class	Total Acres	Acres At Risk	Percent of Total
I	1,058	530	50%
II	2,042	788	39%
III	761	315	41%
IV	874	312	36%

Mid and late seral species dominate the RHCAs indicating similar stand development processes occurring as in other upland conifer vegetation communities. Of the upland conifer associations, 79 percent of the acres within Stream Class I, 75 percent of Stream Class II, 82 percent of Stream Class III, and 75 percent of Stream Class IV RHCAs are dominated by mid and late seral species. High stand densities of mid and late seral species promote intense inter-tree competition, reduced tree vigor and elevated endemic levels of insects and infestation.

Table 3-11 displays acres by plant association group within each RHCA for each stream class. Also shown are acres of LOS and acres at risk for each PAG within different RHCAs for each stream class.

Table 3- 11 Acres within RHCA by PAG, LOS Component, and Acres at Risk

	Moist Grand Fir	Dry Grand Fir	Douglas-fir	Mesic P. Pine	Xeric P. Pine
Stream Class I					
(1058) Tot. Acres	0	471	406	171	10
LOS Acres	0	228	223	10	0
Acres at Risk	0	201	232	88	9
Stream Class II					
(2042) Tot. Acres	9	1,425	314	276	16
LOS Acres	8	475	114	17	2
Acres at Risk	9	518	121	138	2
Stream Class III					
(761) Tot. Acres	25	466	92	157	21
LOS Acres	22	177	37	12	0
Acres at Risk	25	153	45	89	4
Stream Class IV					
(874) Tot. Acres	16	580	82	183	13
LOS Acres	16	211	21	23	0
Acres at Risk	14	205	16	75	2

Dry grand fir and Douglas-fir plant association groups dominate the conifer portions of the RHCAs for Stream Classes I and II. The early seral stands within these types of drainages were typically dominated by ponderosa pine and western larch with only a small percentage of fir present (often 25 percent or less). These conditions have been altered predominantly by fire suppression. Stand understory development in the absence of fire has altered species composition, and increased stand density. Current levels of western larch are in decline due to heavy mistletoe infections. Large diameter western larch is being replaced by white fir, Douglas-fir, and small diameter lodgepole.

Dry grand fir and mesic ponderosa pine associations dominate stream Classes III and IV. Early seral stand conditions for dry grand fir associations in these areas would typically be dominated by ponderosa pine. These stands would tend to be lower in density, more open and have one canopy layer. Late seral ponderosa pine in the mesic ponderosa pine associations would be the dominant seral species. Again, historic stand conditions within the Class III and IV streams would be low density, open and single-story. Large trees would dominate for both plant association groups.

Hardwood Plant Communities within RHCAs

Deciduous riparian habitats dominated by quaking aspen (*Populus tremuloides*), black cottonwood (*Populus trichocarpa*), and willows (*Salix* spp.), provide a variety of important ecological functions. Riparian communities with these species are extremely diverse in plant life since they initiate forest succession, and thus provide great structural diversity. They provide an important niche for insects, reptiles, and wildlife, such as black bear, grouse, neotropical birds, raccoons, weasels and bats. Hydrologically, these deciduous plant communities provide excellent stability to stream banks and soil surfaces. Their deep and spreading root systems can resist flood pressures and therefore slow water velocity. They provide shade to help maintain stream temperatures, and abundant leaf shedding in the fall increases soil fertility. Aesthetically, riparian communities provide diversification on the landscape and enjoyment to humans.

Ecological development of aspen, cottonwood, and willow follow stream channel changes. They are considered pioneer species and are shade intolerant. When fine alluvial material is deposited, they become established readily. As more material is deposited and terraces develop, associated species composition within the riparian area changes to drier plants such as common snowberry. This is a natural decline of pioneer species; they need scour and disturbance along with fresh alluvial deposits for regeneration. Age is another natural cause of decline in aspen and cottonwood. These are short-lived species, 100-120 years, and as they reach maturity they become susceptible to root disease, stem rot, and canker diseases.

The extent of these riparian communities has been greatly reduced within the last 200 years. The physical conditions mentioned above that promote regeneration and vitality of hardwood species are lacking in today's riparian areas. This is due to a number of factors including fire suppression, conifer competition, over browsing of young plants by deer, elk and livestock, loss of habitat by lowered water tables through stream down-cutting, and road building.

The present riparian habitat of aspen and willow in the Deep Planning Area is limited and fragmented. There are currently 70 aspen stands covering 202 acres across the watershed. These range from isolated areas of one or two remaining trees, to a stand 15 acres in size. The pattern of aspen locations on the landscape, and evidence of prior stands, suggests that in the past, nearly all streams in the Deep Creek watershed were connected with aspen communities.

Many of the aspen stands, although mature, are fairly vigorous, have plenty of moisture and are reproducing. Happy Camp and West Thornton Creek sites are an example, however conifer competition and browse damage are preventing the stands from reaching a desired multi-story condition. Conifer competition in the understory alone ranges from 290 trees per acre to 680 trees per acre.

Willow is now confined primarily to moist, open meadows. There are scattered, remnant, hedged plants found along some creeks in the analysis area. Major species include *Salix exigua, S.*

monochroma, and *S. lemmonii.* Derr meadow on Jackson Creek, in the upper reaches of the watershed, has a population of *S. drummondiana.* This is one of only two known occurrences on the Ochoco National Forest. This plant is abundant from Canada, through Idaho into New Mexico, but is a rare plant community here, as this is on the western edge of its range. It is usually associated with soils high in coarse fragments (gravel and cobble) in drainages with gradients in excess of 2%. Once Drummond willow becomes established, it can survive a site that evolves into a floodplain where the coarse-textured gravels are covered with finer flood deposits (Crowe 2001). This situation occurs in Jackson Creek.

There are only two known locations of black cottonwood within the Deep Planning Area. One location is on an upper tributary of Happy Camp Creek between two scablands, at an elevation of 5500 feet. This is an atypical site for cottonwood, which normally inhabits broad floodplains with multiple stream channels. This may be an indication of how much stream morphology has changed, or perhaps it is an isolated, disjunct population. The site has several decadent, mature trees and a few older, hedged sprouts. The trees show typical signs of water stress, small leaves and partially dead crowns where branches have died from cavitation. The stream channel is incised and no longer connected to the floodplain. It has been heavily encroached by conifers; associated species include a relic aspen stand, squaw current, and riparian grasses. The other site is on Crazy Creek in a flat dry meadow. There are several large, mature trees, and no regeneration. It appears the creek has relocated away from the trees, leaving no alluvial deposition for new seedlings.

Upland Shrub Plant Communities

The primary upland shrub species in the Deep Planning Area are curlleaf mountain-mahogany (*Cercocarpus ledifolius*) and antelope bitterbrush (*Purshia tridentata*).

Curlleaf mountain-mahogany is an evergreen, nitrogen-fixing native shrub that grows east of the Cascade Mountains in Oregon. It generally occurs on south facing slopes, at low to moderate elevations. When prevalent enough to be a plant association indicator, the habitat it occupies is unique and important to landscape diversity. These habitats are ecotones, occupying edges between scablands and ponderosa pine/bunchgrass habitat on deeper soils. These stands provide high quality feeding, nesting, and breeding habitat for numerous mammals and birds. It is especially important winter foraging for native ungulates. The plant's response to browsing is to put all new growth into the top of the plant, resulting in a "hedge-line", where repeated grazing causes forage to become unavailable. As it is highly palatable, new seedlings are usually grazed to the point where the plant stays in a low shrub form, never replacing the mature stand.

The Deep Planning Area has a total of 29 acres of high quality habitat. Mountain-mahogany is also scattered throughout many other plant association types, but it occurs as individuals or in small clumps, not dominating the understory. The juniper/mahogany/Idaho fescue-bluebunch wheatgrass, and the ponderosa pine/mahogany/elk sedge plant associations are considered high quality habitat because mahogany dominates the shrub layer and is an "edge" community providing a variety of cover and food (Johnson & Clausnitzer 1991). There are approximately 3,720 acres in Deep where mountain-mahogany has the potential to be present.

Antelope bitterbrush is a widely distributed shrub occupying all elevation zones and slope aspects on the Ochoco National Forest. Bitterbrush is an extremely deep-rooted species that grows on a variety of soil types. Bitterbrush is used by game birds and small mammals, and provides important high quality winter browse for deer. It is highly palatable to big game and cattle, and therefore is often hedged into a mat-like form. Overgrazing by ungulates can reduce bitterbrush composition within a stand and prevent establishment of juvenile plants.

Bitterbrush in the Deep Planning Area is not prevalent or dominant enough to occupy habitat where it is an indicator in major plant associations, however it is widely adaptable to a variety of sites and is scattered throughout many plant associations in the area. There are 6,339 acres of potential habitat for bitterbrush.

Historically, upland shrubs in a variety of age classes were probably more abundant. Conifers are encroaching upon forest-steppe ecotones and scablands, where the density of the overstory is precluding the shade-intolerant shrubs. Fire suppression is a major factor in encroachment and overstory densities. Frequent fire intervals created two situations that promoted upland hardwood habitat: (1) it provided the disturbance necessary for hardwood expansion by reducing the amount of pine and juniper within the forest ecotone, (2) fire regenerated mature stands that reached advanced stages of succession (Gruell 1985). There is often an extensive lag-time, up to 20 years, between disturbance and revegetation of mountain-mahogany.

Meadow Complexes

Currently many of the meadows in the planning area have or are in the process of losing water storage efficiency. Channel incision has contributed to this condition, and conifer encroachment has further contributed to degraded water table levels. In combination, conifer encroachment and channel incision has resulted in a loss of understory riparian/wetland species such as rushes, grasses, and sedges. These habitats have become less suitable to the host of wildlife species that use these riparian areas. Refer to Appendix H for a description of the meadows.

Fire Hazard and Fuels

The Historical Role of Fire

The Deep Planning Area is part of the Blue Mountains Physiographic Province that is well known for its fire dependent ecosystems. Historically, fire has been the primary disturbance factor that has influenced species composition, structure, opening sizes, overall landscape-level pattern, and vegetative diversity.

Where fires of similar frequency, severity, and extent occur, such forests are said to have a similar fire regime (Agee 1993). Fire regimes are a function of climatic environment (temperature and moisture patterns), ignition pattern (lightening and human), and plant species characteristics (fuel accumulation, adaptation to fire). The effects of forest fires can be more precisely described if effects can be grouped by fire regimes. Fire regimes are characterized by three broad categories, and are described below: (from VEMG Appendix E (USFS 1997b)).

Non-Lethal Fire Regime (N/L)

- Very frequent fire return intervals (<25 years).
- Fire typically has no effect (non-lethal) to the dominant forest vegetation cover (N/L).
- The typical fire behavior expected within this regime is low severity, surface fires burning in fine fuels such as grass and forest litter. Flame lengths are generally <2 feet in length.
- Generally, this fire regime is associated with warmer, drier plant associations, and leads to a high percentage of the area dominated by fire tolerant, early seral species.
- Low severity fires commonly occurred from May through October. They probably burned for extended periods, often burning continuously as long as fuels and weather conditions were favorable. Although the fires may have been continuous across the landscape, the severity varied dramatically. Generally flame lengths were < 2 feet and caused little or no damage to the residual stands. Within the moister areas and during cooler burning periods, these fires would leave areas completely unburned or unaffected creating a mosaic of open stands and pockets of reproduction or small thickets across the landscape. During high and extreme fire conditions, small pockets burned at greater intensities creating small openings which then regenerated and provided diversity and the "clumpiness" that is associated with this type of

fire regime.

Mixed Fire Regime (M)

- Frequent fire return interval (25-75 years).
- Mixed fire effects to the dominant forest vegetation cover with the most pronounced effects to the understory.
- The typical fire behavior expected within this regime is moderate severity, surface fires with torching common. Fires burn in surface fuels and understory vegetation including seedlings, saplings, and some pole size trees. Flame lengths are expected in the 2 to 6 foot range.
- Generally, this fire regime is associated with warmer, drier plant associations. The patchiness of the forested stands contributes to this fire severity regime. Landscapes were composed of a mosaic of large and small trees of different species.
- Moderate severity fires typically occurred when drier conditions existed and stands had more diverse species composition. Most of these types of fires occurred during the summer, July through September. These fires would tend to cause more damage to residual stands and create larger and more abundant openings than the non-lethal regime.

Stand Replacement Fire Regime (S/R)

- Infrequent fire return interval (>75 years).
- Stand Replacement fire effects would be expected.
- The typical fire behavior expected within this regime is high severity. Fire burns in heavier surface fuels. Ladder fuels associated with multi-storied stands increase crown fire initiation and propagation due to vertical and horizontal fuel continuity. During periods of hot and dry weather, spotting is common which increases propagation potential. Fire burns in surface fuels and understory vegetation including seedlings, saplings, and some pole sized trees. Flame lengths are expected in excess of 8 feet.
- Most fires in this regime would begin as smoldering, creeping ground fires. During cool, wet weather or green-up conditions these fires might remain low intensity or even burn out. However, during long periods of drought or extreme weather conditions, these fires would become high severity stand replacement conflagrations. Nearly all of the vegetation is consumed due to the vertical continuity and the closed-canopy nature of these stands. The duff and litter layer is consumed exposing bare mineral soil.

Historical fire regimes were developed for the Deep Planning Area using several factors. Consideration was given to precipitation bands, slope, aspect, vegetation plant potential, and knowledge of the history of fire within the area to develop an approximation of these regimes (Figure 3-2). Table 3-12 summarizes the acreage within the watershed by historical fire regimes.

Table 3- 12 Historical Fire Regimes within Deep Planning Area

Historical Fire Regime	Acreage	Percent of Planning Area
Non-Lethal	43,725	79%
Mixed	10,520	19%
Stand Replacement	1,123	2%

Figure 3- 6 Historical Fire Regimes

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Potential Fire Effects within Deep Watershed

Fire regimes are simply the manifestation of the biological, physical, climatic, and human components of an ecosystem as reflected in the type, frequency, and size of fires (Pyne 1984). This relationship is circular, since while the biotic components are an expression of the fire regime, they will in turn influence the pattern and occurrence of fire across the landscape. Generally, human activities tend to either lengthen or shorten the natural fire return interval or fire intensities within an area. This is the case within the Deep Planning Area.

Past management practices have influenced the current vegetative conditions on the landscape and subsequently altered expected fire intensity and effects from wildfire. Past harvest has reduced the relative abundance of larger, fire tolerant trees in the forested stands. Exclusion of fire has given dense conifer understories an opportunity to develop. Understories include a higher percentage of shade tolerant, late seral tree species. Overstories are currently more susceptible to damage from catastrophic fire by providing ladder fuels to the crowns.

With the exclusion of fire, stand densities increase. This can lead to increased mortality and susceptibility to insects and disease. As trees die, an increase in natural fuels on the ground can be expected. The low annual rainfall (12-25'') and high summer temperatures prevent fuels from decaying rapidly and high levels of natural fuels can accumulate.

The overall result is that both live and dead vegetation has been affected, causing a drastic alteration in the arrangement and loading of fuels. Vertical separation between surface fuels and the conifer overstory has been reduced by the formation of a lower and mid-story conifer layer. Duff layers and woody debris have increased while the biomass of the herbaceous component has decreased.

This change in surface and ladder fuels has increased the probability of crown fire initiation and propagation in what were historically non-lethal fire regime areas. Fire effects within the non-lethal fire regime have been altered to react in a manner similar to a fire in an mixed or stand-replacing regime.

Table 3-13 displays the current forested vegetation conditions in the Deep Planning Area by projecting the fire effects (non-lethal, mixed, or stand-replacing) that could be expected given a wildfire. These figures are compared to the expected effects to forest vegetation under the historic range of variability for upland vegetation.

The relative abundance of acres that would be expected to have non-lethal fire effects has diminished to less than half the minimum of that which would be expected historically. The potential for fires with mixed effects is well above the historic range and stand replacement effects are nearing the high end of historic ranges.

Table 3- 13 Potential Effects on Upland Forestland from Wildfire Today as Compared with HRV

Potential Fire Effects	Historical Ranges Of Variability (Acres)*	Today's Conditions (Acres)*
Non-Lethal Effects	23,300 – 34,000	10,677
Mixed Effects	1,700 – 10,700	17,946
Stand Replacement Effects	3,300 – 14,200	10,984

*Acre figures are approximate.

Fire Hazard

Another way to characterize the watershed is by looking at relative fire hazard for the forested areas within the watershed. Fire hazard is defined by a combination of vegetation type, fuel arrangement, fuel abundance, and location that leads to a special threat of ignition, spread, and difficulty to control. Approximately 70 percent of the area within the Deep Watershed is forested. A method developed to determine fuel hazards on the Paulina Ranger District (Reinarz 1999) was used to determine fire hazards on forested stands within the watershed. This analysis used fuel models, slope, aspect, crown closure, and the distance from an open road as variables that influence fire behavior and the ability to control its spread.

Figure 3-7 (page 3-35) provides a spatial representation of current fire hazard of upland forests. This can be compared with the Historic Fire Regimes (Figure 3-6, page 3-31) to approximate how the landscape is currently susceptible to more severe effects than would have been expected under historical fire regimes. Table 3-14 displays these hazard ratings for the Deep Planning Area.

Table 3- 14 Fire Hazard Analysis for Forested Lands Within Deep Planning Area

Fire Hazard	Current Acres	% of Forested Lands
Low Hazard	10,538	26
Medium Hazard	20,870	51
High Hazard	9,683	23

The advantage of this methodology is it displays fire hazards spatially for the watershed landscape. Nearly 75 percent of the forested landscape is currently rated as medium to high hazard.

Fire Risk

Fire risk is defined as the chance of various ignition sources (lightening or human-caused) igniting a fire that threatens valuable resources, property, or life. The risk in the Deep Planning Area has been characterized as high (USFS 1999) based on the history of fire in the area. Updated to include data from 2000, the risk of fire remains high.

Summary

Historically, the Deep Planning Area was influenced by frequent (<25 year return interval), low severity wildfire. The majority of the watershed experienced fires of non-lethal effects. Excluding naturally occurring fire has been a primary factor for the increase in fire hazard in the Deep Planning Area. Both the severity of expected fire effects and the relative fire hazard has shifted upward over the last century. Overall, the risk of fire occurring within the planning area is high.

Figure 3- 7 Current Fire Hazard of Upland Forests

Air Quality

The Federal Clean Air Act directs federal agencies to comply with all federal, state and local air quality regulations. The State of Oregon has been delegated authority for attainment of standards set by the Clean Air Act. To do this, the State of Oregon has developed a Smoke Management Plan (Petersen 1995). The Forest Service has adopted this plan for National Forest lands in Oregon.

The Oregon Smoke Management Plan established designated areas, which are principal population centers, and Class I airsheds, that include wildernesses and other sensitive airsheds. One purpose of this plan is to protect air quality in these high priority areas. The closest designated areas to the Deep Creek Plan Area are Bend (73 air miles to the southwest) and Baker City (125 air miles to the northeast). The closest Class I airsheds are Three Sisters, Mt Washington and Mt Jefferson Wilderness Areas (108 air miles west of the planning area), Mount Hood (131 air miles to the northeast), Strawberry Wilderness (70 air miles to the east), and the Eagle Cap Wilderness (113 air miles to the northeast).

Cultural Resources

Prehistoric

Native Americans have been occupying the Ochoco uplands for thousands of years and their use is evident across the landscape. The archaeological record shows a high density of prehistoric cultural sites with over seventy known locations where stone tools were manufactured. These sites are called lithic scatters, and their presence indicates a clear pattern of use of this area of the Ochoco Mountains.

Members of The Confederated Tribes of the Warm Springs Reservation continue to use the Ochoco uplands and the Tribes hold off-reservation treaty rights for fishing, hunting, gathering roots and berries, and pasturing livestock under the Treaty with the Tribes of Middle Oregon of 1855.

Plants of Cultural Significance

Members of the Confederated Tribes of the Warm Springs Reservation, the Burns Paiute, Umatilla, and Klamath Tribes use a wide variety of plant species found within the Deep Planning Area. Many of the root crops, such as onions, bitterroot and *Lomatium* spp., occur on scabland habitats. *Bryoria fremontii* is a black macrolichen forming long, thick beards that hang from the bark or wood substrate of trees. It occurs primarily in open pine and Douglas-fir forests. Dogwood, willows, and *Scirpus* (bulrush) provide materials for baskets.

The primary gathered plant species for this area are listed in Table 3-15.

Table 3- 15 Primary Plant Species Gathered within Deep Planning Area

Scientific name	Common Name	Habitat
Lewisia rediviva	bitterroot	Scablands
Lomatium cous	biscuitroot	Scablands
Lomatium canbyi	desert parsley	Scablands
Lomatium nudicaule	wild celery	Scablands
Camassia quamash	camas	Moist meadows and seepages
Perideridia gairdneri	yampah	Moist to dry meadows and shrub lands
Bryoria fremontii	black lichen	Pine forests

The top six species listed above are very common in the Deep Creek watershed. Twenty-six percent of the analysis area, or 14,377 acres, is non-forested scablands. Three percent, or 1,671 acres, is dry, moist, and wet meadows. This amount of potential cultural plant habitat in one watershed is uncommon in the Ochoco National Forest.

The continuing tradition of root gathering is of cultural importance to the Tribes, and there are many gathering sites in the planning area. Sites change through time with plant abundance, and preference of the gatherers. Driving access to gathering areas is a continual concern with respect to road closures.

Historic Sites

Present knowledge of the Deep Planning Area indicates that utilization of this part of the Ochoco Mountains by Euro-Americans began in the 1840s. The earliest physical remains of presence within the Deep Planning Area is an 1848 carved and dated aspen within a large stand along Happy Camp Creek, presumably left by a trapper or hunter. In the 1860s military camps were established to provide a military presence in the area. In 1864, the Camp Watson Military Road was constructed across the Ochocos connecting Camp Maury on the Crooked River with Camp Watson in the John Day country. Reportedly, this wagon road was built in order that feed could be obtained from the farm lands to the south for military stock at outposts to the north, and also to reach The Dalles Military Road (outside of this planning area) and appears to have been nothing more than an unimproved wagon-width track through the trees. Today, this linear site is reflected by faint tracks or merely a tree-free route marked by occasional blazed trees. This early day travel route traverses north to south almost mid-center of the Deep Planning Area. In 1988, visible segments of this road were rated for their historical value, and only one segment within the Deep Planning Area was rated as high; this segment is north and south of Forest Road 3000 in Section 15 of Township 13 South, Range 23 East and is reflected by a fairly distinct, level grade with three blazes on adjacent trees. This travel route was deemed eligible for inclusion within the National Register of Historic Places. The Ochoco National Forest Plan does not define this linear site as needing particular management, nor has there been a separate management plan written for this site.

Grazing associated with Anglo settlement became the primary use in the area in the 1880s. Evidence of these activities are reflected in the archaeological record with over eighty historic sites including the Paulina drift fence, telephone lines, log troughs, salt logs, stock driveways, and scribed aspens. The large stand of aspen, which includes the 1848 dated tree mentioned above, contains approximately 265 carved aspens with dates, names, and messages left by hunters, and the many sheepherders who followed their flocks in this area of the Ochocos before and after the turn of the century. The historically dated trees in this stand range from 1848 to the 1950s, with the majority from the 1910s to 1930s. This site has been deemed eligible for inclusion within the National Register of Historic Places. There are 27 other aspen stands within the Deep Planning Area with carved trees but all are on a much smaller scale. Twenty-six of these carved aspen sites are either eligible for inclusion or potentially eligible (insufficient information) within the National Register of Historic Places. All aspen stands are reflecting differing degrees of degradation due to age, encroachment of true firs, and disease. The large stand with the 265 carved trees is especially showing signs of decay and encroachment with carved and non-carved trees sloughing their bark and toppling over.

The Ochoco National Forest was created from the earlier Blue Mountain Reserve in 1911. Forest Service administrative activities are represented by several Forest Service guard stations and fire lookout points located in the Deep Planning Area. The Summit Trail, an early Forest Service travel corridor, traverses the far northern boundary of the Deep watershed. This 70 linear mile travel route was constructed between 1907 and 1909 in the Blue Mountain Reserve in the Ochoco Mountains from the South Fork of the John Day River to the western boundary of the Reserve and was used by horse rider and pack trains to connect guard stations and lookouts. Present day physical evidence of this travel route include trail tread, trees with blazes, ax-hewn logs, magnetic telephone line remnants consisting of Number 9 telephone wire, ceramic or glass insulators, wooden pegs on trees to hold the lines, and stock/driveway signs. The Summit Trail came to mirror the economic development of the Ochoco Mountains as it evolved from a pack trail and stock driveway to a motorway, and finally, in some segments, to a modern-day Forest Road.

In 1986, the Historic Summit Trail was deemed eligible for inclusion within the National Register of Historic Places, and in 1988 a management plan was written for the Trail. In addition, the Ochoco National Forest Plan addresses the management of this linear historic site. This Plan states that pristine segments of the Summit Trail will be managed to preserve their historic qualities. Using the Summit Trail Survey and Evaluation (USFS 1986), there are no pristine segments of the Trail within the Deep Planning Area. There is one high value segment of the Trail within the northwest corner of the Planning Area from the Keeton Trailhead west to Porter Spring (T13S, R22E, Sections 13 and 14). This high value segment is an improved motorway (Forest Road 2630) in current use today for vehicles but which exhibits physical evidence of the Summit Trail such as blazed trees and telephone line remnants.

Noxious Weeds

The Forest Service broadly defines noxious weeds as all invasive, aggressive, or harmful non-indigenous plant species (PNW Weed Management Strategy 1999). These species have the ability to spread into natural habitats where they displace native species. Most infestations begin on disturbed areas, such as roads, harvest landings, and recreation areas. Since these species are introduced to the United States, there are no native biological control agents to keep the plants from rapidly invading native plant communities.

Most infestations begin on disturbed areas, such as roads, harvest landings, and recreation sites. The primary introduction of noxious weeds is through vehicles. Other sources of introduction and spread include water, wind, livestock, and heavy equipment used for logging, road maintenance and "spyders" used for riparian projects. Of increasing concern is hay, brought in for horses by recreationists, that contains noxious weed seed.

Noxious weed infestation within the Deep Planning Area is considered low. Currently there are 45 sites of weed infestation encompassing approximately 20 acres. These weed sites range from a handful of plants to acres of scattered individuals. Table 3-16 lists the weed status within the Deep Planning Area.

Some noxious weeds are being treated under the 1995 and 1998 Ochoco National Forest Integrated Weed Management Environmental Assessments (Weed EA). Control methods include manual hand pulling and grubbing, herbicides, and biological agents. The Weed EA identified some treatment sites along major roads where the use of herbicides is allowed to control certain species of noxious weeds. Of the 285 miles of system roads within the Deep planning area, 31.5 miles can be treated. The roads included in the treatment sites are: 42, 42-470, 30, 4250 to the 4256 junction, 4256-010, and 4250-100. Species available for treatment along these roads is limited to the knapweeds. The largest and most concentrated infestations are being treated (see Table 3-16). The Weed EA does not allow herbicide treatment of whitetop, sulfur cinquefoil, or Canada thistle. Species other than knapweeds, and new infestations are not available for treatment through the Weed EA.

Many small weed sites are located along roads running parallel to Little Summit and Thornton Creeks, which are not covered by the Weed EA. Most weeds occur along the road shoulders, although some are beginning to invade the surrounding native habitat. These creeks contain major populations of sensitive plants, notably, Peck's mariposa lily (*Calochortus longebarbatus* var. *peckii*). Canada thistle is of particular concern because it readily grows in riparian zones, and has the ability to form large patches of rhizomatous growth. There is no effective manual control and limited chemical control of this species. Biological control of the species is being tried elsewhere with limited success.

Whitetop, Russian knapweed, dalmatian toadflax, 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. Teasel and common houndstongue are biennial plants that can be reduced in numbers with diligent, twice-yearly manual pulling. The remaining species listed in Table 3-16 are perennial plants, and manual control is ineffective, but will not necessarily increase the population.

Table 3- 16 Noxious Weeds within the Deep Planning Area

Scientific Name	Common Name	Gross Acres Infested	Acres Available for Treatment
Cardaria draba	Whitetop	0.1	0
Centaurea diffusa	Diffuse knapweed	0.5	0.1
Centaurea maculosa	Spotted knapweed	15.0	12.4
Centaurea repens	Russian knapweed	0.1	0.1
Cirsium arvense	Canada thistle	3.0	0
Cynoglossum officinale	Common hound's-tongue	0.75	0
Dipsacus sylvestris	Teasel	0.1	0
Hypericum perforatum	St. John's-wort	0.5	0
Linaria dalmatica	Dalmatian toadflax	0.4	0
Potentilla recta	Sulfur cinquefoil	0.2	0
Total		20.65 acres	12.6 acres

Of the weed infestations within the Deep Watershed, the Russian knapweed, St. John's-wort, dalmation toadflax, and teasel populations are considered stable, and are not increasing at this time. The infestations being treated with herbicides are decreasing in size and number of plants. Untreated infestations of all other species are slowly increasing in size.

In addition to the weeds listed above, there are several noxious weed locations adjacent to the planning area that have the potential to spread into the Deep Creek watershed. *Salvia aethiopis*, Mediterranean sage, and *Taeniatherum caput-medusae,* medusahead rye, are species with that potential. South of the watershed, in the Roba and Paulina Creek drainages, is a large continuous infestation of common hound's-tongue. It is anticipated that this population will soon move into the Deep watershed and invade the Little Summit Creek drainage.

Range

In Fiscal Year 1999 the Monitoring Task Team (MTT) completed The Grazing Implementation Monitoring Module (GIMM). The MTT is an interagency team established by the Interagency Implementation Team (IIT) and chartered by the Regional Executives. Their task was to establish a reporting process that would meet the Biological Opinions issued by the National Marine Fisheries Service (NMFS) and the U. S. Fish and Wildlife Service (USFWS) for salmon, steelhead, and bull trout. The goals are to improve monitoring efforts and increase efficiency, to ensure the level of monitoring is commensurate with the level of on-the-ground activities, and to provide feedback on the efforts of activities. Agreements between the land management and the regulatory agencies are documented in the Biological Opinion and therefore, are not discretionary.

Three types of monitoring are required for the purpose of strengthening the implementation of PACFISH (Category I), INFISH (Category II) and the attendant salmon, steelhead and bull trout Biological Opinion. These include implementation, effectiveness, and validation monitoring. This module is designed to provide a consistent process for land management agencies to collect and report results of implementation monitoring on grazing allotments. This module covers implementation of livestock grazing activities only.

All allotments within the Deep Planning Area have been monitored.

In 1999 the Ochoco National Forest developed a Programmatic Biological Assessment (PBA) that would meet the monitoring requirements set forth in Biological Opinions. This PBA identifies Project Design Criteria (PDC) that utilizes the Final Range Resource Implementation Monitoring Module, with additions/modifications to meet a "Not Likely To Adversely Affect" (NLAA) determination for Mid-Columbia River steelhead and their critical habitat. The Paulina Ranger District applies these PDCs in both Category I and Category II pastures.

Since 1999 the PDCs have been adjusted as a result of monitoring data and end of year reporting. The PDCs are based on Forage Utilization/Stubble Height threshold within the greenline and upper terraces at steam channels and other springs (these are identified as key areas). Seasonal pasture moves are based on 2, 3, and 4 inch stubble height requirements. All pasture stubble height requirements must be 4 inches at the end of growing season. Adjustments in grazing will occur if end-of-growing season stubble height requirements are not met (e.g., Rest the west pasture in Happy Allotment in 2002).

Objectives for PDC implementation include: maintain and improve stream bank stability in association with adequate riparian vegetation, maintain and improve existing hardwood and other riparian vegetative shade components, and minimize stream bank trampling, trailing, postholing and other undesired impacts to stream channels.

The Deep Watershed contains all or part of four grazing allotments: Deep, Little Summit, Happy, and Derr Allotments. Livestock control and distribution is primarily dependent on forage quality, location, availability, fences, herding practices, water developments, salting, and pasture rotation. Ninety-eight miles of fence and 34 water developments exist within these allotments.

Records indicate intensive unregulated sheep grazing in the Deep Planning Area occurred from 1880-1907, which contributed to the loss of topsoil, amount of bare soil, compaction of soils, stream bank degradation, and channel erosion. Beginning in 1907 through the 1930s, livestock grazing became regulated due to the overuse and the inception of the Forest Service in this area. A significant change occurred in the early 1960s when many of the allotments were converted from sheep to cattle. Cattle grazing continues today in all of the subwatersheds within the Deep Planning Area.

Deep Creek Allotment - consists of 17,672 acres with 200 permitted cow/calf pairs. The grazing season is from mid-June to the end of September and uses a two-pasture rotation. Several improvements have occurred in this allotment over the past few years. Toggle Meadow fence was built in conjunction with head cut and channel restoration. Little Summit fence was constructed to improve channel restoration and vegetative recovery. It will also be used as a riparian pasture and a full-time rider has also been established to help with disbursement of cattle throughout the allotment and end of season removal. The Programmatic Biological Assessment and the Grazing Implementation Monitoring Module created a new monitoring protocol that was implemented in 1999. Deep Creek has met the end of growing season (EGS) stubble height monitoring requirements of four inches since the implementation of the "Permittee Monitoring of Forage Utilization Protocol." This protocol asks permittees to monitor stubble height on key species in the key areas designated in the Annual Operating Instructions. This monitoring data is used to initiate pasture moves throughout the grazing season and requires that at least four inches of residual stubble height be present at the end of the growing season.

Little Summit Allotment - consists of 14,649 acres with 200 permitted cow/calf pairs. The grazing season is from mid-June to the end of September and is a single pasture. Improvements to Little Summit Allotment management have included the incorporation of a full-time rider since the 2000 grazing season, which helps in the disbursement of cattle throughout the allotment and the removal at the end of season. The new monitoring module protocol was also implemented in 1999. Little Summit met the monitoring requirements since their implementation in 1999.

Happy Allotment - consists of 19,532 acres with 230 permitted cow/calf pairs. The grazing season is from mid-June to the end of September and uses a three pasture rotation (the North pasture is not in the Deep Planning Area). Improvements to Happy Allotment include the reconstruction of all the fences in the three pastures. A new corral was built in 2000 and a full-time rider was required for 2001 and 2002. There was non-use taken in Happy in 1999. The new monitoring module protocol was implemented in 2000 and Happy met all requirements.

The north pasture was rested in 2000. The west pasture did not meet stubble height requirements at the end of the growing season in 2001 and is planned for rest this year. Actual numbers were reduced to 180 cow/calf pairs in 2001 and 200 in 2002.

Derr Allotment - consists of 13,254 acres with 150 permitted cow/calf pairs. The grazing season is from July 1 – September 30, and uses a two-pasture rotation. Improvements to Derr Allotment have been the relocation of water troughs to improve the water supply and the fencing of Toggle Meadow to help protect head-cut and channel restoration work. Derr meadow will be fenced in 2002 to improve headcuts along Derr and Jackson Creeks. A full-time rider was added in 2001. The new monitoring module protocol was implemented in 1999. Derr met the monitoring requirements since their implementation.

Recreation Experience and Scenic Quality

Recreation

Recreation use within the Deep Watershed primarily focuses on dispersed recreation. People enjoy sightseeing, camping, fishing, hunting, wild flower viewing, bird watching, horseback riding, off highway vehicle use, mountain biking, cross country skiing, and other activities. The Fry Trail is located, in part, in the north end of the planning area. The trailhead is located off of Forest Service road 2630 within the Deep Planning Area.

Dispersed recreation occurs throughout the year but periods of highest activity are during summer and fall months (July into early December). Antelope, deer, and elk hunting are especially important from August through November. A high percentage of dispersed recreation occurs in, or is adjacent to riparian areas and tree/meadow/scabland habitats. Forest Plan emphasis for Dispersed Recreation is to provide and maintain a near-natural setting for people to utilize while pursuing outdoor recreation experiences. There are a total of 54 inventoried dispersed recreation sites in the planning area (see Figure 1-3, page 1-14).

The only developed recreation site in the Deep Planning Area is Big Springs Campground. This campground is used primarily by hunters in the fall. There are campsites and restroom facilities, but no potable water. Forest Plan emphasis for Developed Recreation is to provide safe, healthful, and aesthetic facilities for people to utilize while they are pursuing a variety of recreational experiences within a relatively natural outdoor setting.

The Deep Creek Recreation Area is located in the southwest portion of the planning area. Emphasis is to provide a near natural setting for recreational pursuits within the area where management activities are not visually evident.

Scenic Quality

Two Forest Plan Management Areas within the Deep Planning Area have visual emphasis. These include the North Fork Crooked River Scenic River Corridor that is located in the extreme southwest portion of the watershed and Visual Management Corridors located along major travel routes. The respective emphasis for these areas is to maintain and enhance the natural appearing landscape and protect the scenic river designation, and to maintain the natural appearing character of the Forest along major travel routes where management activities are not evident, or are visually subordinate to the surrounding landscape. The Summit National Historic Trail has an emphasis on managing to protect, interpret, and preserve the historic qualities of pristine segments.

Roadless Areas

No roadless areas are found within or immediately adjacent to the planning area. North of Forest Service Road 2630, a small portion of the Deep Watershed is located within an area formerly referred to as the Broadway RARE II area. The character of the entire Broadway area was modified as a result of the Fry Timber Sale (1985 – 1989). The Ochoco Forest Plan FEIS addressed the Broadway RARE II area as being no longer considered a roadless area (Appendix C, page C-46). Since the Forest Plan was completed, Rainier, Fryton, and Barn Timber Sales have been sold from this area. An additional 8.5 miles of roads were constructed under the Rainier Timber Sale in 1990. Six and one half miles of roads were reconstructed under the Fryton Timber Sale in 1998. The majority of this area is allocated to the General Forest Management Area.

The existing natural integrity and appearance in the Broadway area has been altered as a result of management activities. A number of large created openings (clearcuts and shelterwood harvests) exist and are visible over much of the area. Roads, skid trails, landings, slash treatment, and evidence of other management actions are apparent over much of the area. Current road density is 1.88 miles per square mile. Recreation opportunities provided by much of the area would be road modified.

No areas within the Deep Planning Area are identified in the Roadless Area Conservation Final Environmental Impact Statement as inventoried roadless areas (Roadless Area Conservation Final Environmental Impact Statement, Volume 2). There are no contiguous unroaded areas of more than 1000 acres within the planning area that meet the criteria in FSM 7712.16a, WO Amendment effective 1/12/2001.

Social/Economics

The economy of local communities, including Paulina, Dayville, Prineville and John Day have some level of timber, wood products, ranching, recreation, or other manufacturing industries. Tourism and recreation have been on the increase in recent years on the Ranger District. Heavy influxes of hunters visit the area from August through November, contributing to local economies. Timber harvest levels over the last decade have dropped dramatically from levels produced in the late 1980s to early 1990s. The decrease in the sale of wood products from federal lands has contributed to recent declines in timber jobs, revenues and associated returns to Crook and Wheeler Counties over the last decade.

Soils

Slopes within the watershed are gentle with 98 percent of the planning area at less than a 30 percent slope. Eighty-five percent of the planning area is at less than a 15 percent slope. The steeper slopes are associated with side slopes concentrated along drainages in the Lower Deep Subwatershed (southwest portion of the planning area). Most of the erosion in this watershed is associated with severe bank erosion associated with drainway bottoms and associated sideslopes. Table 3-17 displays the slope ranges for the subwatersheds within the Deep Planning Area.

Table 3-17 Acreage by Slope Classes for Subwatersheds within Deep Planning Area

Subwatershed Name	0-15% Slope	15 to 30% Slope	31 to 50% Slope	51 to 70% Slope
Happy Camp	5,027	682	78	0
Jackson Creek	16,462	1,874	79	1
Lower Deep	10,945	2,445	1,104	65
Little Summit	14,468	2,051	86	0
Total	**46,902**	**7,052**	**1,347**	**66**

Landtype is used to characterize the soils. Within the Deep Planning Area, the major landtypes are P (73%) and Y (22%). Additional minor landtypes are M (4%) and S (1%).

The P landtypes are found on flatter basalt plateaus and include the majority of the scablands (shallow soils) and the stringers (moderately deep to deep soils). These soils are characterized by mixtures of ash and loess over basalt bedrock. The Y landtypes are found on steeper plateaus and escarpment edges and are comprised of mixtures of ash and loess over colluvium. Soil depths vary from north to south aspects. North and leeward aspects have deeper soils. South aspects typically have shallower soils that contain more rock and less ash. An acreage summary by major landtype is provided below:

Table 3- 18 Landtypes

Landtype Group	Acreage	Percent of Watershed- USFS Lands	Parent Material
P Landtypes	40,614	73	Basalt
Y Landtypes	12,376	22	Basalt
M Landtypes	1,983	4	Alluvium – meadows
S Landtypes	408	1	Basalt

Most of the land area in the watershed is scab stringer terrain. This terrain typically has an average of 30 percent scabland plateaus dissected by timbered stringers. Soils within the stringer sides and bottoms have deeper ash soils. Deeper ash soils are typically classified as P1, P2, P9 and Y2 landtypes. These deep soils are also found on alluvial meadows (M landtypes). Approximately 16,650 acres (30%) within the planning area are deeper ash soils. Approximately 28% of the area is in non-forestlands. These include scablands, meadows and shrub lands. Scabland soils (largely P5, P54, P5Y, P85 and S1) are very shallow and shallow (<20 inches to bedrock). Scrubland soils range from moderately deep to deep (from >20 to 60 inches). Most meadow soils (M landtypes) are deep to very deep (greater than 40 inches). The remaining land area is shallower ash soils or residual soils derived from basalt parent material.

Table 3-19 Acres by Individual Soil Type (versus group) with Selected Management Interpretations

Landtype	Acres	Ash Depth (>7 inches)	Surface Rock-%	Soil Depth (Inches)	Compaction Hazard Range	Mixing and Displacement Hazard / Rge
M1	507	MIXED	0-5	60-80	High	Low
M13	1,476	MIXED	0-5	60-80	High	Low
P1	1,607	18-39	0-5	20-60	High	High
P12	1,458	15-55	0-5	20-60	High	Mod- High
P19	1,419	16-39	0-5	20-40	High	High
P2	5,027	20-55	0-5	20-60	High	Mod- High
P3	1,973	7-14	0-5	14-40	Mod. -High	Mod- High
P32	452	7-55	0-5	14-40	Mod. High	Mod - High
P35	3,422	7-14	0-35	7-40	Low – Mod.	Low- High
P4	38	-------	0-15	7-20	Low – Mod.	Low- Mod.
P5	14,982	-------	0-35	7-14	Low	Low
P54	536	------	0-35	7-20	Low- Mod.	Low- Mod.
P5Y	2,668	------	0-35	7-60	Low - High	Low - High
P8	3,336	-------	0-15	14-40	High	Low
P85	570	--------	0-35	7-40	Low - High	Low
P9	3,126	16-21	0-5	14-40	High	High
S1	408	-------	30-50	7-14	Low	Low
Y1	123	--------	0-15	14-60	High	Mod- High
Y17	1,884	--------	0-15	14-60	High	Mod- High
Y2	1,810	4-30	0-5	20-80	Mod - High	Mod- High
Y3	2,290	----------	15-35	14-40	High	Moderate
Y34	158	---------	15-35	14-40	Mod - High	Low- Mod.
Y4	180	---------	15-35	14-40	Mod - High	Low- Mod.
Y49	287	--------	0-20	14-40	Mod. - High	Low- Mod.

Landtype	Acres	Ash Depth (>7 inches)	Surface Rock-%	Soil Depth (Inches)	Compaction Hazard Range	Mixing and Displacement Hazard / Rge
Y7	319	---------	0-5	14-40	High	Moderate
Y71	2,373	----------	0-5	14-40	High	Mod- High
Y9	735	--------	0-15	14-40	Mod.- High	Low – Mod.
Y9P	2,217	--------	0-35	7-40	Low - High	Low – Mod.

Several factors have had an effect on the current soil conditions within the watershed.

Beaver removal: Beavers used to be much more common and were an integral part of most of our riparian systems, especially in depositional reaches. Beavers historically helped maintain and create floodplain soils. Beaver were largely trapped for their fur and to drain the boggy areas they maintained to allow for more grass and less bog for cattle to get trapped in.

Through their dams, foraging habits and channel digging, beavers provided hydraulic roughness and extensive pool habitat. They helped trap sediment, slow the flow and create the conditions that allowed many of our former riparian areas to be ten to one hundred times more productive than they are today. Today many of these soils are actively eroding without the influence of beaver. There are many active headcuts throughout this system indicating a system severely out of balance and in a non-functioning condition. Most of the streams in this watershed are in a nonfunctional or functioning at risk condition (USDOT 1993). Beaver, as a process element, helped maintain a sustainable stream dimension, pattern and profile which was much more functional especially during high flow events.

There are many gullied out F and G Rosgen channel types in which the water tables are lowered and wetted perimeters much narrower. One of the few features which has prevented even further degradation has been the fact that there is vertical bed control provided by Picture Gorge Basalts. Many streams have eroded laterally and have removed much of the productive alluvial soils.

Livestock: Grazing has had an impact on effective ground cover, bank stability and infiltration resulting in increases in sheet/rill erosion and channel erosion. As documented by Buckley (1992), most of the impacts occurred during the period around 1870-1880s. The main stem of Deep Creek was significantly impacted during this time frame. Impacts included movement of hydric soils and channelization of the drainage. See pages 3-40 to 3-41, for recent changes to range management that have occurred.

Logging Activities and Fuel Treatment: In the DEIS and FEIS it was reported that roughly 38,000 acres have been harvested since 1950 and it was assumed that 35% or 13,300 acres of this estimate was detrimentally compacted. It was recognized that compacted soils do recover over time, but often at a slow rate and that the surface horizons recover more rapidly due to the freeze-thaw action and biopedoturbation via worms, insects and rodents. This results in some natural healing. These figures are presented as estimates to help approximate the cumulative effects of past treatments, not to imply that every acre within the watershed is currently 30-40% detrimentally compacted.

Past practices often involved more intensive treatments. Stands were often harvested using regeneration cuts and overstory removals followed by machine piling of slash. To put this into better context, nearly 11 miles of soils transects were conducted on units proposed for commercial harvest in this management proposal. The results showed 85% of the area currently met Forest Plan Standards and Guidelines of less than 20% detrimental soil conditions. But seventy-three percent of the sample was less than Forest Plan objectives of less than 10% detrimental soil conditions. A unit-by-unit summary is found in Appendix G.

Road Impacts: There are a total of 285 miles of road within the Deep planning area. Road acreage is approximately 692 acres or 1.2 percent of the total USFS watershed acres. Roads can increase the drainage network and accelerate erosion within the watershed. See water quality section for additional discussion of sedimentation. These acres are viewed as part of the long term dedicated harvest and transportation system and are unavailable for timber production.

Fire Suppression Impacts: Ninety years of fire suppression has allowed unnatural levels of fuels to accumulate in many areas. These heavy fuel loadings create higher severity fire conditions if these areas do burn. The fire suppression itself has increased production by up to 40 percent according to studies by Cochran and Hopkins (1991), but this is largely non-sustainable because of the high risk of wildfire. Al Harvey, of the Rocky Mountain Experiment Station, has documented how high severity wildfire can reduce overall site productivity by increasing volatilization, mineralization, and leaching of nutrients. See fire section for additional discussion of potential fire impacts based on the current conditions. Approximately 11,000 acres of the planning area are in a condition that would have stand-replacing effects in the event of wildfire.

Threatened, Endangered and Sensitive (TES) Species

Fish

Historically, the Crooked River basin supported native populations of anadromous Chinook salmon (*Oncorhynchus tshwaytacha*) and steelhead trout (*Oncorhynchus mykiss spp*). The lower and upper falls on the North Fork Crooked River (below the confluence of Deep Creek) are considered impassable to historic migrations of Chinook salmon and steelhead. The construction of main stem dams on the Deschutes (Pelton/Round Butte) and Crooked Rivers (Bowman) have cut off these native runs of Chinook salmon and steelhead throughout the basin. Due to the natural migration barriers at lower and upper falls on the North Fork Crooked River and the downstream dams, summer steelhead and spring Chinook salmon (including essential fish habitat) are not considered further in the Deep Planning Area analysis. Westslope cutthroat trout (*Oncorhynchus clarki lewisi)* do not occupy habitats within the Deep Creek Watershed.

Bull trout (*Salvelinus confluentus*) is a federally listed threatened species that historically occurred in various drainages throughout the Crooked River basin. Bull trout have been documented and occur on the Crooked River National Grassland in Squaw Creek (Deschutes River Basin). Bull trout no longer utilize tributaries within the Crooked River basin due to degradation in aquatic habitats.

The redband trout (*Oncorhynchus mykiss gairdneri*) is identified as a sensitive species and is a management indicator species in the Ochoco Forest Plan. Redband trout habitat includes freshwater streams, rivers, and lakes. Redband trout are widely distributed across the Ochoco National Forest stream network including Deep Creek and the majority of its perennially flowing tributaries. Stream habitats for redband trout are characterized by clear, cool water with relatively stable flows. Streams with healthy redband trout populations show an abundance of in-stream cover, well-vegetated stable stream banks, relatively stable temperature regimes, and abundant macroinvertebrates. The Deep Creek watershed represents the most interconnected habitat for redband trout in the basin. Over time, road development and associated road crossings, harvesting of timber, and livestock grazing have contributed to degradation of instream habitats and reduced salmonid production.

A redband trout study to assess population condition and migratory behavioral patterns has been ongoing since 1997 (Grover and Hodgson 1999). Preliminary population estimates show Deep Creek, Little Summit Creek, Happy Camp Creek, and Double Corral Creek have higher densities of individuals as compared to the other streams in the watershed. Seasonal migration data suggests redband movement to be very little. A genetic study conducted by Currens (1994) indicated this particular population did not group with other populations from streams in the immediate vicinity, reflecting a unique resident population.

In1998, a large-scale fish kill occurred on Little Summit Creek. The estimated fish loss was 660 redband trout and 2904 speckled dace, which later showed to be one third of the fish within the two mile long affected reach. The cause of this event was an outbreak of the external parasite, *Ichthyoptherius multifilis,* that favors warm water temperatures and high fish densities.

The Malheur mottled sculpin has been documented on the Ochoco National Forest. Sculpin prefer clear, cool water in streams with moderate to rapid currents and summer temperatures of 55 to 65 degrees. During the Redband trout study, sampling indicated mottled sculpin presence in Deep, Jackson, and Happy Camp Creeks (Currens 1994). Sculpin specie variation during this sampling period was not determined. Past sampling efforts showed presence within Harney basin tributaries and in Smyth, Riddell, Poison, and Devine Creeks, and in parts of the Silvies and Blitzen Rivers (Grover 1990).

Ochoco National Forest and Eastern Oregon data collection suggest that Blue Mountain Cryptochian caddisfly appears to range from 4,000 to 6,700 feet in elevation. A preliminary, non-statistical analysis of data from 24 streams suggests that stream gradients ranging from 5-10 percent, 15-20 pieces of LWM per riffle/run, a gravel-cobble substrate, and a canopy cover of at least 40 percent may be important factors in determining appropriate habitat (Betts 1992 and Betts 1993). There is a high probability that Cryptochian caddisfly habitat occurs in, but is not necessarily limited to, most north facing streams with high gradients within Deep Creek. It has not yet been determined to what extent or density any Blue Mountain Cryptochian caddisfly populations occur in Deep Creek.

Brook trout (*Salvenlinus fontinalis)* is not a TES species, but is a management indicator species identified in the Forest Plan. Brook trout are a non-native species that were introduced by the Oregon Department of Fish and Wildlife and now reside within limited stream segments in the Upper North Fork Crooked River Basin. Brook trout compete with native redband trout for available habitat and food. They have been known to predate on these fish. Brook trout have not been found during any fish assessment efforts and do not occur within the watershed. Therefore, redband trout, using similar habitats, is a better management indicator species for Deep Watershed.

Plants

There are no known occurrences of federally listed endangered or threatened plants within the Deep Planning Area. There are 25 species on the Regional Forester's Sensitive Species List that are known to occur or have habitat on the Ochoco National Forest. Of these, 12 species have suitable habitat within the Deep Planning Area. These species are listed in Table 3-20.

Table 3- 20 Sensitive Plant Species with Suitable Habitat or Known Locations within Deep

Species	Habitat
Achnatherum hendersonii	Sagebrush scablands
Achnatherum wallowensis	Sagebrush scablands
Astragalus tegetarioides	Sagebrush steppe/Ponderosa pine forest
Botrychium ascendens	Wet meadows/streams, springs, seeps
Botrychium crenulatum	Wet meadows/streams, springs, seeps
Botrychium minganense	Wet meadows/streams, springs, seeps
Botrychium montanum	Wet meadows/streams, springs, seeps
Botrychium paradoxum	Wet meadows/streams, springs, seeps
Botrychium pinnatum	Wet meadows/streams, springs, seeps
Carex hystericina	Stream banks
Calochortus longebarbatus* var. *peckii	Seasonally wet meadow and stream margins
Cypripedium calceolus var. parviflorum	Moist forest/riparian areas
Cypripedium parviflorum	

Extensive surveys for sensitive plants have been conducted between 1991 and 2000 within the Deep Creek Watershed area. Surveys were done by limited focus, intuitive control, and complete survey methods. The Botany Report contains more detailed information on the survey techniques used in the project area. The five species in bold face in Table 3-20 have been documented within the planning area. The 12 sensitive species that occur, or are presumed to occur, within the analysis area are grouped by similar habitats. These groups include riparian, upland forest, and non-forested habitat.

Riparian Habitat

Calochortus longebarbatus* var. *peckii's, Peck's mariposa lily, primary habitat occurs within open meadows and partially shaded to open riparian edges along seasonal and perennial streams. The Deep Planning Area contains 34 known populations and substantial habitat, most of which are located near Little Summit Prairie. Some of thee populations are quite large, with approximately 1,300 total acres of scattered individuals.

The Draft Species Management Guide for *Calochortus longebarbatus var. peckii* (Kagen 1996) selected six populations in the Deep Planning Area to manage with a goal of maintaining a stable or increasing overall population. Several of the six areas were chosen due to their geographical significance. They are located on the upper end of the watershed, at higher elevations. It is important to preserve these populations for the viability of the species since most bulblet dispersal is presumably downstream.

There are six species of ***Botrychium*** (moonworts) on the Regional Forester's Sensitive Species List that occur or are presumed to occur within the Deep Planning Area. *Botrychiums* are considered rare species that have wide, scattered distributions, but occur in small isolated populations (Zika, et al. 1995). Moonworts are found in a great variety of sites from marsh to xeric open meadows, seeps, and springs, to lightly shaded forested riparian areas. Research suggests that moonworts are early successional species that may require natural disturbance to stay ahead of successional changes (Zika, et al. 1995).

The Deep Planning Area contains 12 known occurrences of moonworts, which include nine locations of *Botrychium crenulatum,* two locations of *Botrychium montanum,* and one location of *Botrychium ascendens* together with *B. crenulatum*.

Carex hystericina, porcupine sedge, occupies a variety of habitats including wet meadows, riparian forest, and wetlands in sagebrush steppe. A common feature of these sites is perennially saturated soils. Most of the locations throughout the northwest indicate this species is nearly always present in wetlands under natural conditions (Newhouse, et al. 1995). This species is documented to exist on one location on the Ochoco National Forest, and one site on Bureau of Land Management lands in the Bridge Creek watershed. The Ochoco National Forest site is located on the Paulina Ranger District on Black Canyon Creek near the confluence of the South Fork John Day River.

Upland Forest Habitat

Astragalus tegetarioides, Deschutes milkvetch, occurs in open stands of low and big sagebrush, and in openings, swales, and canyon bottoms in ponderosa pine forests. There is one known location of Deschutes milk-vetch on the Paulina Ranger District; however, it is outside the Deep Planning Area. It is the northern-most known population in the species' range, making it an important population for species viability.

Cypripedium calceolus var. parviflorum**,** yellow lady's-slipper, is globally widespread but thought to be extirpated from Oregon. A population of *Cypripedium* with yellow flowers has since been found in the Ochoco National Forest on the Prineville Ranger District. It has tentatively been identified as *Cypripedium calceolus var. parviflorum.* This species usually occupies very moist woods and bogs. The primary habitat types for the species is the moist grand fir plant association group, mainly, grand fir/queen's cup beadlily, and grand fir/twinflower plant associations. Although the moist grand fir plant association group is quite common in the Ochoco National Forest, there is very little of it in the Deep Planning Area (324 acres). Of this, just 52 acres falls in the grand fir/queen's cup beadlily plant association (no grand fir/twinflower), making it an unusual habitat for the planning area.

Non-forested Habitat

Two ricegrass species, ***Achnatherum hendersonii*** **and** ***Achnatherum wallowensis***, were recently split from one former species, *Oryzopsis hendersonii*. These species occupy the same type of habitat, comprised of dry, shallow, stony lithosols subject to frost action in the winter. The major associated species include *Artemesia rigida*, *Poa sandbergii,* and *Danthonia unispicata*. There are approximately 12 populations of *Achnatherum hendersonii* on the Paulina Ranger District. All of them occur in the southern part of the District, outside the Deep Planning Area.

Wildlife

Species listed as threatened by the USDI Fish and Wildlife Service include the northern bald eagle and Canada lynx. Species listed as sensitive by the USDA Forest Service, Region 6, that are suspected or documented on the Ochoco National Forest (USFS 2000) include the bufflehead, tricolored blackbird, upland sandpiper, western sage grouse, American peregrine falcon, pygmy rabbit, California wolverine, Columbia spotted frog, and the gray flycatcher.

Threatened Species

A brief description of the affected environment for each threatened species follows:

Northern Bald Eagle (*Haliaeetus leucocephalus*) is a resident species. The planning area is in the High Cascades Bald Eagle Recovery Zone described in the Pacific Bald Eagle Recovery Plan (USDI FWS 1986). Currently there are 86 occupied territories within the recovery zone. The recovery goal was 33 pairs. At the end of the statewide survey season of 2001, there were 0.93 young produced/occupied territory (Isaacs 2001). The five-year average was 0.90 young/occupied site. The five-year average goal for the entire seven-state recovery area is 1.00 young/occupied territory (Frank Isaacs, Pers. Comm. 2001). There are no known nesting or roosting areas within the planning area, nor are there any habitats designated 'critical' or 'essential' for the bald eagle within the Deep Planning Area. Incidental sightings have been recorded by Forest Service personnel in the past. Wildlife surveys conducted during the 1998, 1999, and 2000 field seasons did not provide new sightings, nests, or roosts within the planning area.

Bald eagles are usually associated with rivers, lakes and marshes. They require nearby tall trees or cliffs for nesting (Csuti et al. 1997). The Deep Planning Area provides potential suitable bald eagle foraging and nesting habitat. The historic range for eagle reproductive habitat within the planning area ranges from a low of 20,791 acres to a high of 40,799 acres. Currently there are 14,519 acres of suitable reproductive habitat and 7,708 acres of foraging habitat. Reproductive habitat is below the historic range due to a lack of large tree structure within the planning area. This large structure is needed for eagles to roost, nest and perch. Of the suitable habitat is available, it is well distributed across the planning area. Little Summit Prairie (privately owned) and Deep Creek provide potentially suitable foraging habitat. Deep Creek also has potentially suitable nesting habitat.

Canada Lynx (*Lynx canadensis*), a threatened species, is considered an uncommon transient (Federal Register, Vol. 65, No. 58). There are no habitats designated 'critical' or 'essential' for the lynx within the Deep Planning Area. Surveys for lynx were conducted in 1999 to USFWS protocols. No lynx were detected. Additional surveys were conducted in 1999-2001. No lynx were detected from hair samples collected in 1999-2001.

Lynx habitat is often defined in terms of its primary prey, the snowshoe hare. Dense thickets of young conifers interspersed with small patches of grasses and forbs seem to be prime habitat for snowshoe hare in Oregon (Verts, et al. 1998). Canada lynx prefer spruce/sub-alpine fir where lodgepole pine is a major seral species. The Deep Planning Area does not contain any spruce/sub-alpine fir plant associations. Verts and Carraway (1988) contend that there is no information to suggest that lynx have ever been a resident, reproducing species in the state of Oregon. Because of the lack of lynx habitat, there are no identified Lynx Analysis Units on the Ochoco National Forest. For additional information on habitat mapping, see the Wildlife Specialist Report.

Sensitive Species

Bufflehead (*Bucephala albeola*) nest near deep mountain lakes surrounded by open forested areas containing snags (Csuti et al. 1997). Natural nesting sites are cavities in trees close to water. The preferred nest tree is aspen, but they will also nest in ponderosa pine and Douglas-fir (Marshall et al. 1992). In Oregon, breeding occurs primarily in the central Cascade lakes region (Marshall et al. 1992). There have been no sightings of Bufflehead within the planning area. It is unlikely that Bufflehead would breed within the planning area as it contains no reproductive habitat. There are no lakes but only small stock ponds (less than ½ acre) or reservoirs that would not provide suitable nesting or brooding habitat for a pair of buffleheads and their young.

Tricolored Blackbird (*Agelaius tricolor*) breeds in freshwater marshes with emergent vegetation, in thickets of willows or other shrubs, or in Himalayan blackberry bushes (Csuti et al. 1997). There are no known sightings for tricolored blackbirds on the Paulina Ranger District. No reproductive habitat is found within the planning area. Colony locations vary and are unpredictable from year to year. Stock ponds represent the best potential habitat for tricolored blackbirds, however, these are considered marginal at best. Stock ponds, usually less than 1/2 acre in size, generally do not contain adequate water levels or emergent vegetation to support a blackbird nest, nor do they produce insect populations necessary for rearing young during the breeding season.

Upland Sandpiper (*Bartramia longicauda*) breeds in partially flooded meadows, grasslands and prairies, usually with a fringe of trees, and often in the middle of higher elevation sagebrush communities (Csuti et al. 1997). Meadows favored by this sandpiper are little grazed and are comprised of grasses, sedges, and herbaceous plants (Marshall et al. 1992). There are no known sightings of sandpipers on the Paulina Ranger District. However, historically, sandpipers bred in Big Summit Prairie just west of the planning area. The planning area contains potentially suitable breeding habitat for upland sandpipers, specifically at Little Summit Prairie. The majority of this prairie is privately owned and is grazed each year by livestock. However, along the edges of the prairie are areas that may be suitable for breeding sandpipers that are under Forest Service ownership. Extensive statewide surveys conducted in 1984 and observations through 1991 account for fewer than 100 upland sandpipers in Oregon (Marshall et al. 1992). It would be extremely rare to find sandpipers breeding or incidentally using habitat within the planning area.

Western Sage Grouse (*Centrocercus urophasianus phaios*) inhabits large expanses dominated by big sagebrush. It prefers areas where big sagebrush covers 15-50 percent of the ground. Communal breeding occurs in areas that are more open, called leks (Csuti et al. 1997). The sage grouse is dependent on sagebrush for winter survival. There have been numerous sightings of sage grouse on the Paulina Ranger District; however, no sightings have been recorded within the planning area. In the Spring of 2000 The Oregon Department of Fish and Wildlife conducted an aerial lek survey along the southern boundary of the east half of the Paulina Ranger District. No new leks were discovered on the district. There is estimated to be 475 acres of potential reproductive habitat within the planning area, however, they are located outside the historic distribution and range of sage grouse.

Gray Flycatcher *(Empidonax wrightii)* prefers relatively treeless areas with tall sagebrush, bitterbrush, or mountain mahogany communities, but will occupy communities within open forests of ponderosa and lodgepole pine. It also inhabits juniper woodlands with a sagebrush understory (Csuti et al. 1997). As described above for the sage grouse, there are only 475 acres of sagebrush habitat within the planning area. These areas are small in size and are highly fragmented. Most sites have juniper encroachment and are of the low sagebrush variety. Big sagebrush habitats here are small in size, area, and density. They are marginal to poor habitat for flycatchers. Flycatchers were not found on the Paulina Ranger District during the breeding bird surveys conducted during 1995-1999.

American Peregrine Falcon (*Falco peregrinus anatum*) use of the planning area is considered migratory at best. The falcon's most critical habitat component for reproductive use is the availability of suitable nest sites. Sites are usually large cliff faces in conjunction with riparian zones overlooking a fairly open area with an ample food supply (Csuti et al. 1997). There are no known falcon nesting sites within the planning area or on the Paulina Ranger District. No cliff habitats have been located within the

Deep Planning Area. Due to the lack of suitable cliff habitat within the planning area or within a mile of the boundary, it is unlikely that peregrine falcons would be using habitats within the planning area. A survey of marginal cliff habitat was made in the southwest portion of the area in May of 2002 where a potential sighting had been reported from the public, but no birds or use was detected.

Pygmy Rabbit (*Brachylagus idahoensis*) is closely tied to habitats dominated by big sagebrush on deep, friable soils (Verts et al. 1998). Occupancy of areas is likely related to 'availability of forage, security from predation, and ease of burrow construction'. (Shrub cover and height have been higher in occupied sites compared to unoccupied sites. The principal food is big sagebrush, with grasses and forbs making up the rest of the diet. Current distribution of pygmy rabbits does not include the Paulina Ranger District (Marshall et al. 1992, Csuti et al. 1997). There are no known sightings of pygmies within the planning area, and the area lacks habitat.

California Wolverine (*Gulo gulo*) is typically found in open forests at higher elevations in Oregon (Csuti et al. 1997). Critical components to wolverine habitat seem to be an absence of human activity, ample forage availability, and low road densities (Butts 1992). California wolverine sightings have been documented within the planning area and elsewhere on the Paulina Ranger District. Sightings have also been documented on the Deschutes and Malheur National Forests and elsewhere on the Ochoco NF. Bait stations with remote cameras did not detect wolverines in 1992, 1993, or in 2002. It is estimated that 71 acres of suitable reproductive habitat exists within the planning area. This is within the upper range of the historic condition. Habitat that provides the appropriate structures for forested denning areas include large cavities and large woody material. However, information is not available on the number of natal or maternal dens or rendezvous sites required (Ruggiero et al. 1994). Until more information becomes available, habitat management prescriptions that successfully provide for the life needs of species such as American marten, fisher, and lynx and their prey will also provide for the needs of wolverine at the stand level (Ruggiero et al. 1994).

Reproduction may be occurring on the district, but has not been confirmed. Denning areas are likely the limiting factor for wolverines on the Paulina Ranger District, as they can forage in many areas searching for big game carrion and other foods. These untreated areas should provide structural components needed by wolverine for breeding. Most of the denning habitat is located in the Middle Mountain Creek subwatershed directly north of the planning area. This north slope habitat offers the best potentially suitable habitat and occurs west to east across the north end of the district. All wolverine sightings documented on the district have been associated with this north slope area.

Columbia Spotted Frog (*Rana luteiventris*) is found in ponds, springs, marshes and slow-flowing streams and appears to prefer waters with a bottom layer of dead and decaying vegetation (Csuti, et al. 1997). It is found in aquatic sites in a variety of vegetation types, from grasslands to forests. Columbia spotted frog populations are known within the planning area at two locations (Jim David, Pers. Communication). These populations were discovered in the early 1990s and have been monitored annually. Monitoring indicates that both populations are stable. Surveys for this species have been and continue to be conducted within the planning area in association with stream surveys.

Transportation

Forest Development Roads provide access to National Forest lands and are classified as arterial, collector, and local roads. Arterial roads serve large land areas, primarily provide the main access into the Ochoco National Forest, and usually connect to public highways. Collector roads simply "collect" traffic from forest local roads. Generally, roads can be categorized depending on the type of travel for which they are maintained. The following table displays the number of miles of each road category within the planning area.

Table 3-21 Miles of Roads

Road Category	Miles
Storage or closed category primarily for resource protection and safety reasons.	95
High clearance vehicles (pickups, all purpose vehicles).	163
Suitable for use by low clearance vehicles (passenger cars).	27
Total	285

A Roads Analysis was recently completed for the Deep Creek Watershed (USFS 2002). The following information is summarized from that document. The Deep Planning Area has approximately 45 miles of arterial and collector roads. Local roads connect terminal facilities with forest collector, arterial, or public highways, and provide minor linkage with other roads. A total of 285 miles of system roads are located in the planning area. Of the 285 miles of system roads, approximately 190 are open, for an open road density of 2.19 miles per square mile. Table 3-22 displays the open road densities within the Deep Planning Area by Subwatershed. The Ochoco National Forest Plan provides open road density direction of 3 miles per square mile. The open road density within the General Forest MA in the Deep planning area is currently 1.97 miles per square mile.

Table 3- 22 Open Road Densities by Subwatershed

Subwatershed	Open Road Density (miles/square mile)
Happy Camp Creek	2.06
Jackson Creek	2.59
Little Summit Creek	2.47
Lower Deep Creek	1.42

To date, approximately 47 miles of roads within the Deep Planning Area have been decommissioned. No long-term need was identified for these roads and there are no plans to re-use these roads in the future.

Wildlife and Wildlife Habitat

Goshawk Habitat within Post Fledgling Areas (PFA)

The goshawk uses a variety of forest types, forest ages, structural conditions, and successional stages during its annual life cycle. It preys on small to medium sized birds and mammals, which it captures on the ground, in trees, or in the air (Reynolds et al. 1992).

The amount, condition, and distribution of habitat suitable for reproduction are thought to be the factor limiting goshawk numbers in the planning area. Reproductive habitat includes habitat suitable for initiating and completing nesting activity and for fledging young birds. This habitat is described in Reynolds (1992) as:

1) Sixty percent of the reproductive area in the VEMG structure size 4 and 5 categories (9-20.9" and > 21" dbh) with the majority in the 5 class (LOS).
2) The remaining 40%, with 20% in VEMG structure size 3 (5-8.9" dbh), 10% in VEMG structure size 2 (< 5" dbh), and 10% in VEMG structure size 1 (grasses, forbs and shrubs).
3) LOS that would include: snags, downed logs, and mature and old, live trees in clumps or

stringers with interlocking crowns, and a developed herbaceous and shrub under story that would be present with an emphasis on native grasses.

The WILDHAB excel model analysis showed there are 16,775 acres of currently suitable reproductive habitat within the planning area. The historic range of variability for goshawks reproductive habitat within the planning area ranges from 20,819 to a high of 40,799 acres. Currently habitat is below the low end of the HRV by 4,044 acres. This is due to past timber harvest activities and the lack of large tree structure, similar to that described below for the pileated woodpecker.

There are seven known goshawk territories within the planning area. For six of the seven territories, actual nest sites have been discovered. All known active and historic goshawk nest stands have 30 acres designated with the most suitable habitat. The Eastside Screens defer harvest within these 30-acre nest stands. In addition, a 400-acre post-fledgling area (PFA) has been designated around active known nest sites. Objectives for management within the PFAs are to retain late/old structure (LOS) and enhance younger stands towards LOS conditions.

Management recommendations for the northern goshawk from the Southwestern United States (Reynolds et al. 1992) were used in conjunction with the Ochoco National Forest's Draft Viable Ecosystems Management Guide to assess the existing condition of the PFAs within the planning area. The following table describes the existing condition of the PFAs.

Table 3- 23 Post Fledging Areas (PFA) Structural Stage Distributions

Structural stage	Desired Percentages	Post-Fledgling Area					
		Toggle	Haypress Creek	Little Summit Creek	Summit Camp	Happy Camp Creek	Happy Jack Camp Creek
Grass/Forb/Shrub	10%	7%	23%	11%	9%	11%	16%
Seedling/Sapling (< 5" dbh),	10%	0%	0%	0%	0%	0%	0%
Poles (5-8.9" dbh),	20%	34%	24%	47%	33%	27%	29%
Small Trees (9-20.9" dbh)	*	50%	40%	40%	47%	55%	47%
Medium/Large Trees(> 21" dbh)	60%*	9%	13%	2%	11%	7%	8%
Total	**100**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

* Small and medium/large trees combined should make up the remainder of the acreage within the PFAs with the majority in the medium/large structure class.

The majority of the stand structure within the PFAs is in the small sawtimber size class. Pole sizes are the most abundant in the Little Summit Creek PFA. None of the PFAs within the planning area are meeting the desired conditions: they all are lacking large structure.

Connectivity and Fragmentation

Connectivity in the planning area consists of a combination of riparian habitats (6,332 acres are located within Riparian Habitat Conservation Areas (RHCAs)) and upland habitats to maintain and enhance the current level of connectivity for species that use older forested habitats between LOS habitats. Within the Deep Planning Area, the landscape is naturally fragmented due to the relatively high percentage of non-forestland (the watershed is not comprised of large contiguous blocks of forestland). RHCAs are the primary means of providing connective habitat, because historically, this is where most of the forested lands existed in the planning area. Connections were identified between designated old growth areas and all LOS stands greater than five acres in size, totaling 3,966 acres of upland connections.

Fragmentation refers to the breakup of large habitat areas into smaller islands (Perry 1994). The process of fragmenting forested landscapes has been widely acknowledged by ecologists as reducing ecosystem stability and increasing the risk of species extinction. Fragmentation reduces the quantity and quality of available habitat for interior forest species and is a particular concern for west side forests of Oregon. However, east side forests do not have interior old forest obligate species, or old growth dependent species, and historically had fire regimes of frequent low intensity disturbances, unlike west side forests. The Deep area has a significant amount of naturally-caused fragmentation of the landscape due to the geomorphology. Much of the landscape is fragmented by scablands and forested stringers. Historical disturbances from fire, insects, and disease created natural openings and a variety of successional vegetative stages.

Snags/Down Wood

Snags and logs are important wildlife habitat components used by a variety of species. There are 39 bird and 23 mammal species that use snags for nesting or shelter (Thomas 1979). Snag and log levels vary across the planning area. The Forest Plan, as amended by the Eastside Screens require managing snags at 100% potential populations levels for primary cavity excavators in areas of commercial timber harvest, precommercial thinning sales, or salvage sales, and to use the best science available to determine how many snags constitute what this 100% rate is. By agreement with the Pacific Northwest Regional Office of the Forest Service, the Ochoco NF is to use the VEMG to describe snag levels. The caveat that the Regional Office issued was that where VEMG prescribed less than minimum levels contained in *Managed Forests of the Blue Mountains* (Thomas et al. 1979), which is 2.25 snags per acre, those levels would be used. Table 3-24 shows the desired snag levels snag by PAG as described in VEMG.

Table 3- 24 Desired Snag Levels

Plant Association	Snag Range
Moist Grand Fir	5-12/acre <20"dbh 2-6/acre >20"dbh
Dry Grand Fir	2-6/acre <20" dbh .2-2/acre >20" dbh
Douglas Fir	2-4/acre <20" dbh .2-2/acre >20" dbh
Xeric Ponderosa Pine	2.25/acre >20" dbh
Mesic Ponderosa Pine	2-4/acre <20"dbh .2-2/acre >20" dbh

Based on snag surveys done in two sub-watersheds (Lower Deep and Little Summit) and upon Current Vegetation Survey (CVS) plot data taken within the planning area, areas with a previous history of commercial harvest are likely to not contain sufficient snag habitat to currently meet Forest Plan requirements. Conversely, forested stands within the planning area where no commercial harvest has occurred are *likely* to meet Forest Plan requirements for snag habitat. The following table portrays the portion of the analysis area with previous history of commercial timber activity.

The following information shows the results of two different analyses of snag levels and log levels in the planning area.

This data supports the hypothesis that previously harvested areas are not meeting Forest Plan standards, while those areas with no previous harvest do meet the Forest Plan standards for providing 100% maximum potential for primary cavity excavators.

Table 3-25 CVS Plot Data from *Previously Harvested* Stands Throughout the Analysis Area

Plot Number	Plant Ass'n	Snags/Ac 2-10"	Snags/Ac 10.1-16"	Snags/Ac 16.1-22"	Snags/Ac > 22.1"	Total Snags/	Logs/Ac < 12"	Ave. Length	Logs/Ac > 12"	Ave. Length
2105280	CP	4.0	0.0	0.0	0.0	4.0	712.7	6.6	20.6	13.0
2104270	CW	4.0	0.0	0.0	0.0	4.0	787.4	12.8	38.3	7.0
2104278	CW	16.0	0.0	0.0	0.0	16.0	0.0	0.0	0.0	0.0
2103280	CW	0.0	0.0	0.0	0.0	0.0	280.0	10.4	0.0	0.0
2102274	CW	4.0	0.0	0.0	0.0	4.0	44.6	6.0	29.8	9.0
2103274	CP	67.9	4.0	0.0	0.0	71.9	700.8	3.5	67.0	4.0
2103276	CP	83.9	0.0	0.0	0.4	84.3	324.1	20.4	0.0	0.0
2103278	CP	4.0	0.0	0.0	0.0	4.0	170.4	11.7	6.5	41.0
Std. Dev.		**33.3**	**1.4**	**0.0**	**0.1**	**34.2**	**314.8**	**6.3**	**24.0**	**13.7**
Median		**4.0**	**0.0**	**0.0**	**0.0**	**4.0**	**302.1**	**8.5**	**13.6**	**5.5**

Table 3-26 CVS Plot data from *un-harvested stands* throughout the analysis area

Plot Number	Plant Ass'n	Snags/Ac 2-10"	Snags/Ac 10.1-16"	Snags/Ac 16.1-22"	Snags/Ac > 22.1"	Total Snags/	Logs/Ac < 12"	Ave. Length	Logs/Ac > 12"	Ave. Length
1104280	CP	0.0	19.9	1.1	1.1	22.1	1272.6	5.1	6.2	43.0
2105276	CW	95.8	2.2	2.2	2.1	102.3	720.0	12.3	74.9	9.2
2105278	CP	8.0	5.1	4.4	1.9	19.4	222.5	15.5	0.0	0.0
1104272	CD	19.9	3.2	1.1	2.2	26.4	53.6	5.0	7.9	34.0
1104276	CD	8.0	1.1	0.0	0.0	9.1	1248.9	17.0	7.5	80.5
2103272	CD	0.0	4.0	7.5	4.0	15.5	54.3	15.3	20.6	13.0
1102280	CP	0.0	0.0	1.1	0.4	1.5	29.8	9.0	0.0	0.0
1106276	CP	4.0	0.0	2.2	0.0	6.2	0.0	0.0	0.0	0.0
2106270	CW	4.0	0.0	0.0	4.3	8.3	425.6	12.2	12.7	48.5
1106272	CW	0.0	0.0	0.0	3.2	3.2	43.0	18.0	34.9	53.2
Std. Dev.		**29.4**	**6.0**	**2.4**	**1.6**	**29.6**	**503.3**	**6.0**	**23.2**	**27.9**
Median		**4.0**	**1.7**	**1.1**	**2.0**	**12.3**	**138.4**	**12.3**	**7.7**	**23.5**

Surveys within Little Summit Creek and Lower Deep Subwatersheds showed that overall, Lower Deep currently meets this standard for a subwatershed total, but Little Summit Prairie does not. (Only snags that were 15" in dbh or greater were counted in these surveys). Additionally, an analysis of CVS plot data showed similar numbers in all four of the sub-watersheds in the analysis area. Stands that were not harvested generally met this standard, whereas stands that have been previously harvested under different snag retention requirements did not. The standard of meeting 100 percent population potential has been incorporated into management prescriptions since 1993.

Table 3-27 Information from Snag Surveys (> 15" DBH) Conducted in 1998 in the Lower Deep and Little Summit Prairie subwatersheds. Information was gained through the methodology developed by Bates (1999).

Survey Results	Happy Camp	Jackson Creek	Little Summit	Lower Deep
Harvested Stands	N/A	N/A	0.12/acre	0.68/acre
Unharvested Stands	N/A	N/A	N/A	3.34/acre
Unharvested Stands <55% CC	N/A	N/A	0.18/acre	N/A
Unharvested Stands >55% CC	N/A	N/A	3.32/acre	N/A
Subwatershed Results Snags/Acre	**N/A**	**N/A**	**0.377/acre**	**2.364/acre**

Table 3-28 Previous Commercial Timber Activity within the Deep Project Area

Acres Harvested/PAG(%)	Subwatershed			
	Happy Camp	Jackson Creek	Little Summit	Lower Deep
Dry Grand Fir	2,017 (59%)	6,457 (59%)	2,937 (42%)	417 (17%)
Douglas-Fir	36 (8%)	475 (16%)	1,213 (27%)	1,286 (25%)
Moist Grand Fir	10 (4%)	0 (<1%)	0 (<1%)	0 (<1%)
Non-Forest	395 (26%)	548 (17%)	887 (23%)	2,312 (40%)
Ponderosa Pine	3 (2%)	88 (7%)	62 (6%)	25 (4%)
Western Juniper	0 (<1%)	0 (<1%)	1 (<1%)	25 (4%)
Total Acres Treated	2,461 (43%)	7,568 (41%)	5,100 (31%)	4,065 (28%)

The above table shows that at least 28% of each subwatershed has received commercial harvest activities in the past. This results in a total of 38% of the watershed. Based upon the analysis of plot data presented above showing that a previous harvest activity is likely to prevent an area from meeting 100% of biologic potential, it is likely that approximately 15,052 acres (38%) of the 39,674 forested acres in the analysis area are not meeting the original Forest Plan standards for snag levels.

New science regarding dead wood habitat is available through the recently released draft of the Decayed Wood Advisor (DecAID) by Marcot et al. (2002). This work is an advisory tool to help land managers evaluate effects of forest conditions and existing or proposed management activities on organisms that use snags, down wood, and other wood decay elements. In this publication, it is possible to relate the abundance of dead wood habitat, both snags and logs, to the frequency of occurrence of various wildlife species that require dead wood habitat for some part of their life cycle. This publication includes information on primary cavity excavators as well as a host of other organisms that use dead wood habitat. DecAID shows levels based upon "percentage of tolerance". Basically this tolerance can be viewed as representing levels of "assurance" or confidence of providing for a particular species. Information is given at the 30, 50 and 80 percent tolerance levels. Following is data from the Blue and East Cascade Mountains, Eastside Mixed Conifer Forest for the and from the Douglas Fir/ Ponderosa Pine habitat types for both large and small tree dominated sites:

Eastside Mixed Conifer Forest

Snag size: ≥ 9.85 inches DBH

Species	30% t.l. Snag Density (#/acre)	30% t.l. Sample size		Species	50% t.l. Snag Density (#/acre)	50% t.l. Sample size		Species	80% t.l. Snag Density (#/acre)	80% t.l. Sample size
AMMA		0		AMMA	16.2	1785		AMMA		0
LLMY		0		LLMY	10.2	31		LLMY		0
PIWO		0		PIWO	30.4	105		PIWO		0
SHBA		0		SHBA	56.4	14		SHBA		0
WHWO	0.3	43		WHWO	1.9	43		WHWO	4.3	43

Snag size: ≥ 19.7 inche DBH

Species	30% t.l. Snag Density (#/acre)	30% t.l. Sample size		Species	50% t.l. Snag Density (#/acre)	50% t.l. Sample size		Species	80% t.l. Snag Density (#/acre)	80% t.l. Sample size
AMMA		0		AMMA	5.0	1785		AMMA		0
CNB		0		CNB	2.4	84		CNB		0
PIWO		0		PIWO	7.32	134		PIWO		0
SHBA		0		SHBA	16.8	14		SHBA		0
WHWO	0.0	13		WHWO	1.5	13		WHWO	3.8	13

Douglas Fir/Ponderosa Pine Forest

Snag size: ≥ 9.85 inches DBH

Species	30% t.l. Snag Density (#/acre)	30% t.l. Sample size		Species	50% t.l. Snag Density (#/acre)	50% t.l. Sample size		Species	80% t.l. Snag Density (#/acre)	80% t.l. Sample size
PIWO		0		PIWO	30.4	105		PIWO		0
WHWO	0.3	149		WHWO	1.7	149		WHWO	3.7	149

Snag size: > 19.7 inches DBH

Species	30% t.l. Snag Density (#/acre)	30% t.l. Sample size		Species	50% t.l. Snag Density (#/acre)	50% t.l. Sample size		Species	80% t.l. Snag Density (#/acre)	80% t.l. Sample size
PIWO		0		PIWO	7.6	105		PIWO		0
WHWO	0.5	75		WHWO	1.8	75		WHWO	3.8	75

By using the Current Vegetation Survey plots established within the Deep Analysis Area, current snag densities can be estimated. Based upon these plots, currently there are 2 snags greater than 10 inches DBH of which 1.7 of these snags are greater than 16 inches DBH per acre in the Eastside Mixed Conifer DecAID habitat type. Currently in the Douglas Fir/Ponderosa Pine DecAID habitat type there are 5.9 snags greater than 10 inches DBH of which 2.5 of these snags are greater than 16 inches DBH per acre. At the landscape scale, which is how DecAID is to be applied, currently the analysis area is providing habitat for the following species, by habitat type, at the following tolerance levels:

Species	**Habitat Type**	**Current Tolerence Level within the Analysis Area**
AMMA (American Martin)	Eastside Mixed Conifer Forest	< 50% t.l. for all snag sizes (no data is available below the 50% level)
LLMY (Long-legged Myotis)	Eastside Mixed Conifer Forest	< 50% t.l. for all snag sizes (no data is available below the 50% level)
PIWO (Pileated Woodpecker)	Eastside Mixed Conifer Forest	< 50% t.l. for all snag sizes (no data is available below the 50% level)
PIWO (Pileated Woodpecker)	Douglas Fir/Ponderosa Pine Forest	< 50% t.l. for all snag sizes (no data is available below the 50% level)
CNB (Cavity nesting birds)	Eastside Mixed Conifer Forest	< 50% t.l. for snags > 19.7" (no data is available below the 50% level and no data available for snags < 19.7")
SHBA (Silver-haired Bat)	Eastside Mixed Conifer Forest	< 50% t.l. for all snag sizes (no data is available below the 50% level)
WHWO (White-headed Woodpecker)	Eastside Mixed Conifer Forest	Provides habitats at the 50% tolerance level

WHWO (White-headed Woodpecker)	Douglas Fir/Ponderosa Pine Forest	Provides habitats at the 50% tolerance level

The abundance of large down logs is directly related to the number, size, and distribution of snags (and replacement trees) within the watershed.

Table 3-29 Log levels as prescribed in the Regional Forester's Forest Plan Amendment # 2

Species	PCS. Per Acre	DIA. Small End	Piece Length and Total Lineal Length
Ponderosa Pine	3-6	12"	> 6 ft. 20-40 ft.
Mixed Conifer	15-20	12"	> 6 ft. 100-140 ft.

Based on CVS plot data (Tables 3-25 and 3-26), it appears that again, previously harvested areas do not meet Forest Plan standards for down logs, while un-harvested areas are meeting the Forest Plan standards (Table 3-28). Harvested areas had a median value of 74.8 lineal feet with an average piece length of 5.5 feet. Un-harvested areas had a median value of 180.95 lineal feet with an average piece length of 23.5 feet, which is above the most stringent Forest Plan standard of 100-140 lineal feet with a piece length greater than 6 ft.

Pileated Woodpecker

The pileated woodpecker is a Management Indicator Species (MIS) listed in the Ochoco National Forest Land and Resource Management Plan (LRMP EIS 3-21). The WILDHAB excel model analysis showed there are 16,775 acres of currently suitable pileated woodpecker reproductive habitat within the planning area. The historic range of variability for pileated reproductive habitat within the planning area ranges from 20,819 to a high of 40,799 acres. Habitat is currently below HRV. Suitable reproductive habitat for this bird is generally defined as mixed conifer stands that meet single and multi-strata LOS definitions. As specified in the Forest Plan, 300 acre blocks were designated for pileated reproductive habitat (MA-F6 Old Growth).

Within the planning area there are four Forest Plan designated old growth areas, totaling 1,267 acres (Figure 1-1). In addition to this, and as required by the Forest Plan, (LRMP 4-251,) an additional 300 acres of foraging habitat has been identified as part of this project to provide feeding areas adjacent to the designated old growth areas. Plan standards require that foraging habitat provide at least 2 snags/acre greater than 10" DBH. Feeding habitat is basically LOS stands that are similar to those required for reproductive activities. Currently, there are approximately 13,312 acres of suitable pileated woodpecker foraging habitat. That represents pileated feeding areas within a ½ mile radius of each of the four designated old growth areas.

Primary Excavators

Primary cavity excavators are also MIS identified in the LRMP EIS (p. 3-21). The pileated woodpecker, discussed above, represents the guild specialist for primary cavity excavators that feed primarily on dead wood insects. The remaining species include those listed below (Thomas, et al. 1979). The species with an asterisk (*) are also dead wood insect users and the analysis of these species has been covered through the analysis of the pileated woodpecker.

Common Flicker	Lewis' Woodpecker*	Red-naped Sapsucker*
Williamson's Sapsucker*	Hairy Woodpecker*	Downy Woodpecker*
White-headed Woodpecker	Black-backed Woodpecker*	Three-toed Woodpecker*
White-breasted Nuthatch*	Red-breasted Nuthatch*	Pygmy Nuthatch*

The white headed woodpecker prefers areas with an open overstory of large pine and snags (Frenzel 2001). It feeds primarily on live tree insects and utilizes pine seeds. Currently there are 14,683 acres of reproductive habitat for the white headed woodpecker within the planning area. The historic range for white headeds is from 19,367 to 38,764 acres. This existing condition results from past management activities, which have reduced the large trees and caused overstocked stand conditions.

The common flicker is an MIS representing species that utilize old growth juniper habitats. There are 781 acres of juniper woodland and steppe plant association groups within the area.

Big Game Habitat

Rocky Mountain Elk and Mule deer use the planning area year round. Forest Plan standards and guidelines provide for the management of habitat for deer and elk, while meeting the primary emphasis for the specific management area (LRMP 4-256). The Habitat Effectiveness Index (HEI) is a tool used to assess the habitat capability for big game. Quantity and quality of cover and open road density are the main factors influencing the HEI.

The following analysis was conducted in accordance with the Ochoco National Forest Plan HEI process to determine the habitat effectiveness for the management areas located within the Deep Planning Area (USFS 1990). The majority of the area, 48,666 acres, is in the General Forest management area (MA-F22). Within the Deep planning area, Forest Plan HEI standards apply to only this management area (LRMP 4-258). Although there are 6,702 acres of habitat capable of contributing to HEI that are in other land allocations, they have not been included in this analysis, because the HEI standards in the LRMP do not apply to them. The desired future condition is to provide satisfactory distribution of quality thermal cover as outlined in the Forest Plan. Table 3-29 summarizes the HEI analysis for the planning area.

Table 3- 30 Habitat Effectiveness Index (HEI) Summary

Watershed	Existing	Decade 2	Decade 3	Decade 4	Cover (acres)	General Forest Open Road Density
Deep Creek	43	35	18	14	12,732	1.97

At present, the Forest Plan is in the beginning of the 2nd decade. HEI is currently at 43, which exceeds the target HEI of 35.

In the LRMP, HEI was translated into a number of animals that could be supported in an area if the habitat was maintained at optimum effectiveness. This resulted in an estimated management objective for deer and elk population numbers. The management objective estimated for deer was 18,300, and elk ranged from 3,000 in the first decade to 2,600 in the 5th decade for the Ochoco Forest planning horizon (LRMP 4-44).

For further perspective, a portion of the Ochoco National Forest is located in the Ochoco Wildlife Management Unit administered by the Oregon Department of Fish and Wildlife (ODFW). Beginning in 1989, ODFW population estimates for Rocky Mountain elk within the Ochoco Unit were 1,500 animals. Mule deer were estimated at 13,300. In 2001, elk were estimated at 5,200, and deer at 18,300 animals. Currently, the management objective for elk is a herd of 2,600 animals, and for deer 20,500. These management objectives are higher than those of the Forest Plan because the herd unit includes more land outside of the Forest boundary. Approximately two-thirds of the Forest, excluding the Snow Mountain

Ranger District, occurs within the ODFW management unit and is currently supporting more animals than estimated in 1989 when the Forest Plan was signed, which included Snow Mt. Elk and deer sign, as well as visual observations are abundant throughout the planning area.

In 1989, ODFW began an elk telemetry study on the district. Thirty-nine elk were radio-collared and monitored until June of 1994. Nineteen elk were originally captured in the vicinity including the Deep Planning Area. Eight elk were used to define a herd boundary that included the southern portion of the planning area (Ferry 1998).

The majority of elk and deer use occurs during the snow-free months. In winter, big game move to lower elevations, generally in all cardinal directions. Locations of elk during the calving season are associated with riparian areas. In the northern part of the planning area, wildlife surveys record sightings of calves along riparian areas. Wallows are expected to be present within the planning area, however specific sites are not known. Wallows are generally found in association with seeps, springs, and other riparian habitats.

Neotropical Migratory Birds

Management strategies for neotropical migratory birds are described in the Partners In Flight - Northern Rocky Mountains Bird Conservation Plan (Altman 2000). Partners In Flight (PIF) is a cooperative effort to manage for long-term viability of neotropical migratory birds and involves partnerships among federal, state and local government agencies, philanthropic foundations, professional organizations, conservation groups, industry, the academic community, and private individuals. PIF lead the effort to complete a series of Bird Conservation Plans for the entire continental United States. PIF Landbird Conservation Planning provides the framework to develop and implement landbird conservation strategies by recommending conservation actions on the ground that would insure long-term species viability. These plans included priority setting, establishment of objectives, necessary conservation actions, and evaluation criteria necessary for bird conservation in the Western Hemisphere.

The PIF plans guide the analysis of proposed projects and their effects upon neotropical migratory birds using guidelines for priority habitats and bird species by subprovince. The conservation strategy does not directly address all landbird species, but instead uses numerous "focal species" as indicators to describe the conservation objectives and measure project effects in different priority habitats for the avian community found there. The Ochoco National Forest is within the Blue Mountains Subprovince. The following list shows the habitats and species listed for the Blue Mountains Subprovince.

Table 3- 31 Focal Species for the Blue Mountains Subprovince

Priority Habitats	Species
Dry Forest	White-headed woodpecker, flammulated owl, chipping sparrow, Lewis’ woodpecker
Mesic Mixed Conifer	Townsend’s warbler, Vaux’s swift, varied thrush, MacGuillivary’s warbler, olive-sided flycatcher
Riparian Woodland	Lewis’ woodpecker, red-eyed vireo, veery
Riparian Shrub	Willow flycatcher
Subalpine Forest	Hermit thrush
Montane Meadows	Upland sandpiper
Steppe Shrublands	Vesper sparrow
Aspen	Red-naped sapsucker
Alpine	Gray-crowned rosy finch

Wild and Scenic Rivers

The segment of the North Fork of the Crooked River that extends from Deep Creek Campground south to the Forest boundary has been included in the National Wild and Scenic Rivers System, designated as Scenic. The purpose of this designation is to protect the North Fork of the Crooked River as a free-flowing river with a diverse, dynamic, sustainable ecosystem, ranging from wet prairies to basalt canyons. According to the North Fork Crooked River Management Plan (USFS 1993), all future river management or activities occurring within its boundaries will maintain and enhance the outstandingly remarkable and significant river values for which the river was designated, including scenic, wildlife, botanical, fish, and recreational values. Primary use of the area includes dispersed camping, hunting, fishing, and rafting during spring runoff. Access from the east side of the river is south of the Deep Watershed Area. Only 1 percent (46 acres) of the total Wild and Scenic River management area is located within the Deep Creek Planning Area (page 1-10).

CHAPTER 4

ENVIRONMENTAL CONSEQUENCES

This chapter analyzes, compares, and explains the effects of the alternatives. Direct effects of the alternatives and, where appropriate, indirect and cumulative effects of past, present, and future actions are described in terms of the issues that were identified in Chapter 1. A summary of the effects of the alternatives related to the key issues is provided in Chapter 2 (page 2-56).

KEY ISSUES

Water Quality and Fish Habitat

Some of the discussions presented here are summarized from the Fisheries and Hydrology Specialist Report. Refer to this report, located in the analysis file at the Paulina Ranger District offices, for more detailed discussion on direct, indirect and cumulative effects of all proposed, past, present and reasonably foreseeable future activities.

The following environmental components will be used to assess the effects to water quality and fish habitat from each alternative:

1. Stream temperature
2. Sedimentation
3. Peak flows

This analysis considers the potential for both positive and negative effects of individual treatments and how design elements and Best Management Practices (BMPs) reduce the potential for effects. These three environmental components are closely related. For example, stream temperature can be affected by changes to channel morphology, which can be influenced by flood events or significant increases in peak flows. The following effects analysis incorporates consideration of these interrelationships. A brief discussion of the measurements and models used to assess these three components follows.

Stream Temperature: Stream shade is used to display the *indirect* effects of the alternatives on stream temperature. The potential effect of proposed treatments on shade to Class I-III streams (perennial and/or fish bearing) during critical summer months is used to make an assessment on measurable increases or decreases to stream temperature.

Sedimentation: Sedimentation combines the discussion of the potential for individual treatments to produce sediment and deliver it to streams with the use of a Relative Erosion Rate (RER) model. The RER model is not intended to be an absolute measure of sediment. It provides a relative comparison of the alternatives based on anticipated ground disturbance, slope/erosion class, and disturbance to stream channels. It focuses on roads, harvest, and prescribed fire management activities that are within 600 feet of streams. The Relative Erosion Rate model does not take into account design elements, BMPs, culvert replacements, or other activities that are expected to decrease long-term sediment output. It does not include other ongoing management practices such as grazing and their relation to sediment delivery. Consequently, this model is used in conjunction with some qualitative discussion to determine effects.

Peak Flows: The risk of effects from increased peak flows is estimated using the Equivalent Harvest Area (EHA) model. The EHA model is used to determine the relative cumulative effects of timber harvest activities and forest vegetative conditions within the watershed. The EHA model tracks the rate of vegetation change (timber harvest and hydrologic recovery) to help evaluate the risk of detrimental impacts on water quality. EHA is defined as an area which, when harvested, produces hydrologic effects similar to one acre of clear-cut. A threshold value of 25% for EHA was established in the Forest Plan. This value represents a point where risk becomes high for this watershed (Anderson 1989). It should not be interpreted as a point where detrimental impacts *would* occur but as a point above which, detrimental impacts *may* occur should a 10-year or greater storm or runoff event take place. Based on the current condition of the Deep watershed (see pages 3-1 to 3-5), measurable increases in flow are likely to be present when EHA values reach 20 percent (Hibbert 1965). This figure is lower than the Forest Plan threshold of 25% because the current conditions in the watershed as described in Chapter 3 and the Fisheries/Hydrology Report, show a continued decline in watershed condition. Conclusions of effects consider EHA values, existing conditions within the watershed, and the effects of past, present, and reasonably foreseeable future actions.

ALTERNATIVE A (NO ACTION)

Under this alternative only on-going (e.g. fire protection, livestock grazing, and road maintenance) land management practices would continue. It proposes no commercial timber harvest, road construction or reconstruction, precommercial thinning, prescribed fire, or other watershed related projects.

Direct/ Indirect Effects.

The present condition of the drainages within the planning area would likely remain unstable through implementation of this alternative. Causal factors such as the number of roads within sediment delivery zones (it estimated that 90% of sediment delivery comes from within 400 feet of streams), number of road crossings, headcut evolution and advancement, and livestock utilization would continue to degrade stream systems.

Stream Temperature, **Stream turbidity, and Sedimentation.** These components would not likely change from current levels. Current stream temperature regimes are expected to be maintained or move slightly toward State of Oregon water quality standards or site potential. This movement toward water quality standards or site potential would be minimal or on small localized scales (i.e. where floodplains and associated riparian vegetation evolve to create shading conditions within a G stream type) and would take decades to achieve. Range utilization, road-crossing density, and channel adjustments, due to responses from past and current management practices, would be the limiting factors for recovery.

Alternative A does not directly increase sediment input into streams through new harvest, new road construction/reconstruction, culvert replacement, or prescribed fire activities. The existing amounts and sources of sediment, such as the number of roads, would not change. Existing timber stands within and outside riparian areas would likely remain in a suppressed condition. Stream reaches within conifer stands having high amounts of insect and disease would benefit from higher than normal large woody material (LWM) input both in the stream channel and on the floodplain. However, these conditions would result in a potential for catastrophic wildfire events. This type of wildfire behavior, within Riparian Habitat Conservation Areas (RHCAs), can potentially result in loss of stream shading and an increase in fine sediment delivery. The Fire and Fuels section in Chapter 3 (page 3-25) contains discussion on the risk and hazard of fire in the Deep Watershed.

Peak Flows. Currently the EHA value is 17.0 percent for the watershed. This figure recognizes past harvest activities that have occurred in the watershed such as the Summit Timber Sale. Under the No Action Alternative, the EHA within Deep Watershed would continue to decline (in the absence of wildfire) over time as the area recovers. Hydrologic recovery, which implies increased infiltration and interception rates, would decrease the likelihood of undesirable adjustments in channel form from higher intensity peak flows. However, current range utilization, road location, road crossing density, and potential wildfire effects would offset recovering channel form. Subsequently, stream turbidity, embeddedness, and the percentage of fine sediment within spawning gravels and pool habitats would be expected to remain at current levels (defined by the existing condition).

Cumulative Effects.

Past vegetation and fuel management projects have had undesirable effects on streams. These include more road crossings, increased sediment, and decreased shade and LWM. Since 1990, several watershed and aquatic habitat improvement projects have been implemented. These include culvert replacements, headcut restoration, riparian planting, road closures and decommissioning, LWM placement, spring development, livestock exclosures, and fencing of riparian pastures. Culvert replacements have occurred on Forest road 42 along Buck Hollow Creek and have effectively reduced stream and road interactions, as well as provided for fish passage. Road closures have occurred in many areas throughout the watershed, however, work remains to be done to ensure that hydrologic considerations such as culverts, drainage, floodplain function, and the ability to move bedload are incorporated into these closures. Riparian planting in Timothy and Toggle Meadows has laid the foundation to restore shade and contribute to bank stability. The long-term success of these plantings would depend on the ability to protect plants from extensive grazing from big game and cattle. LWM placed in the lower reaches of Jackson, Happy Camp, and Deep Creeks have reintroduced floodplain interaction, in-channel roughness, as well as enhanced complex fish habitat. Headcut restoration has stopped their advancement, preserved critical upstream habitat, and provided for fish passage in Happy Camp, Timothy Meadow, and Derr Creeks.

The development of Double Corral Spring (Derr Allotment) was implemented to draw cattle from riparian areas and improve livestock distribution. Livestock exclosure fences have effectively prohibited continued effects to sensitive aquatic habitats in Little Summit Creek, and in Timothy, Toggle, and Derr Meadows. Although these exclosures provide a positive benefit where constructed, they tend to shift cattle utilization to other unprotected riparian or wetland habitats. Within these stream reaches, fish populations have shown positive responses; however, continued stress on fish populations would be expected on reaches where habitat parameters are outside of desired conditions as described in Chapter 3. Dispersed recreation is expected to continue within the watershed. No dispersed sites that are associated with floodplains would be closed.

Since 1999, the Ochoco National Forest has incorporated monitoring requirements set forth in the Grazing Implementation Monitoring Module (GIMM) and the USFWS and NMFS Biological Opinion associated with the Forest's grazing program. Monitoring is based on Forage Utilization/Stubble Height thresholds within the greenline and upper terraces at key areas associated with streams and/or springs. Seasonal movements to pastures are designed based on timing and stubble heights of 4 inches at the end of the growing season. Adjustments to grazing practices are made if these objectives are not being achieved. These new monitoring requirements are intended to maintain and improve streambank stability and riparian shade components, such as hardwoods, and to minimize bank trampling, trailing, postholing and other undesired impacts. The relative effectiveness of these adjustments toward moving riparian areas on an upward trend would be assessed over the long term through continued stream surveys.

Allotments within Deep Watershed have incorporated full time riders to help improve the distribution of cattle (See Chapter 3, Range, page 3-40).

The Paulina Ranger District expects to complete a range analysis to reauthorize grazing permits for allotments in Deep Creek Watershed. The draft proposed action currently proposes to graze livestock under standards that meet or exceed current Forest Plan standards for riparian and upland vegetation and decreases the amount of stream bank disturbance allowed. The grazing standards currently being developed would result in further improvement of riparian habitat and watershed conditions.

The Paulina Ranger District is currently working on an environmental analysis that proposes additional restoration activities to improve watershed health in the Deep Creek Watershed. The following activities are proposed under the Deep Restoration EA (copy available upon request at the Paulina Ranger District Office):

- Close 17.4 miles of road
- Decommission 30.1 miles of road
- Reconstruct 2.5 miles of road
- Replace 32 culverts
- Remove 3 culverts

- Build 4 livestock exclosures (226.6 acres)
- Develop 7 springs to include off-site watering tanks
- Place 3.6 miles of large wood
- Install 18 cutbank revetments (21.49 acres)
- Reconstruct 1 channel reach (10.46 acres)
- Repair 37 headcut complexes (32.32 acres)
- Enhance fisheries pool habitat on 1 channel reach (1.68 acres) with structures

These activities are estimated to reduce sediment yield to streams by approximately 45 tons over the next several years with the assumption of vegetative recovery. Many of these treatments would require working within low-flow stream conditions, hence there is expected to be some short-term (<2yrs) relatively small inputs of sediment to the stream(s). However, mitigation would be in place to minimize any measurable adverse effect(s). Long-term benefits would greatly outweigh any short-term consequences. These treatments, in combination with proposed treatments from the Deep Vegetative Management Project would cumulatively result in at least a 45-ton reduction in sediment delivery to streams over the long term (>2yrs).

Proposed activities within the Deep Restoration EA have also been identified to promote vegetative recovery for improved shade conditions over the short (<2yrs) and long term (>2yrs). Proposed activities are projected to reduce stream temperatures on 303(d) listed streams in an effort to comply with the 1973 Clean Water Act. Stream temperatures are expected to be reduced as vegetation re-establishes along treated road prisms, exclosures, large wood placement areas, cutbank revetments, headcuts, and channel reconstruction sites. Stream temperatures would continue to be monitored on an annual basis for improvements. These treatments, in combination with proposed treatments from the Deep Vegetative Management Project would cumulatively result in a reduction in stream temperatures over the long term (>2yrs), in agreement with the Deep WQRP.

In addition to reducing sediment yield and stream temperatures, activities proposed within the Deep Restoration EA would reduce the potential effects to aquatics from increased peak flows (as measured by EHA in the EIS). Overland flow is expected to be reduced by closing/decommissioning roads and promoting vegetative roughness on adjacent bare slopes through implementation of exclosures, cutbank revetments, large wood placement, and spring developments. Headcut restoration would also prevent accelerated loss of floodplain access, hence keeping peak flows from being concentrated within a gullied channel. Cumulatively the Deep Restoration EA and this EIS would reduce the potential for adverse effects to aquatics from peak flows.

ALTERNATIVES B (PROPOSED ACTION), C, AND D

This section will discuss the effects of the individual treatments being proposed under each of the action alternatives followed by a summary of the effects on temperature, sedimentation, and peak flows. Treatments have the potential to have some positive and/or negative effect on water quality and fish habitat. Treatments may have short-term negative effects, followed by long-term improvement over existing conditions. The following treatments are within RHCAs and would maintain, restore, or enhance watershed health by correcting existing problems through watershed improvements (see Figures 2-3, 2-4, 2-7, 2-8, 2-11, and 2-12 for locations).

Direct and Indirect Effects.

<u>Riparian Planting and Aspen Treatments</u>

Many of the stream reaches throughout the planning area are at, or are moving toward, a deficit condition for riparian hardwoods. Hardwoods such as mountain alder, willow, cottonwood, and aspen provide bank stability and stream shade. Stream segments throughout various parts of the watershed were identified (28 miles under all alternatives) as areas that would benefit from hardwood planting (e.g. increases in shade and increased root strength to hold banks).

Under all alternatives, riparian planting and large woody material (LWM) placement would be accomplished in approximately 67 stream reaches across the planning area. These treatments should increase stream shading, create complex fish habitat, and enhance bank stability.

Watershed conditions related to channel stability, water table interaction, and water quality would benefit from management in aspen stands. Aspen treatments should increase the vigor and size of selected stands by thinning out various conifer species. A total of 77 acres would be treated under Alternatives B and D. Alternative C would treat 81 acres. Reference Appendix H for a detailed list of units, treatments, and protection measures. Site locations are depicted on alternative maps in Chapter 2 (Figures 2-4, 2-8, and 2-12). There are two aspen treatments within Class II stream RHCAs (intermittent, fish bearing) and five stands totaling 23 acres in Class III RHCAs (perennial, non-fish bearing). All other aspen stand treatments lie in ephemeral drainages. Aspen stand treatment within perennial flowing systems would enhance stream shading during critical summer months in the long term, but would reduce shade in the short term. Treatments would provide a source of LWM recruitment and deliver cleaner and cooler water to downstream populations of redband trout. Aspen stand objectives for intermittent flowing systems would enhance water table interaction and improve channel stability.

Commercial timber harvest is proposed in seven aspen stands under all alternatives (see page 2-54). These treatments should enhance stream shade during the critical summer months in the long term, provide a source of LWM recruitment, and improve the density of understory riparian species. Under all alternatives, 13 of the aspen treatment units would be helicopter or winter logged. Conventional tractor logging systems in aspen units would consist of 6 acres. The remaining aspen stands are identified for precommercial thinning.

Roads/Road Inactivation/Culvert Replacements

Currently the Deep Creek watershed has 4.12 mi/mi^2 of road density within 200 feet of stream channels, which influences water quality. Best Management Practices (BMPs) and design elements would be implemented with road projects to help insure that water quality standards are achieved (Reference Chapter 2, Design Elements Common to All Action Alternatives (page 2-43), Watershed/Fisheries). Utilizing BMPs and the design elements during new system, temporary, and reconstruction activities would effectively decrease the amount of sediment input into streams from these activities. These management practices would also improve hydrologic function to existing system roads that would not be decommissioned or closed. However, sedimentation from previously existing and open roads would still be expected to occur at levels identified under the existing conditions. The effects from roads would be similar under all alternatives in the short-term; however, Alternative C proposes to reduce the open road system 10.5 miles more than Alternatives B or D.

There are many road prisms within RHCAs that are in close proximity to stream channels. These roads interact with the floodplain during peak flows and deliver sediment to streams during these periods (e.g. 30/650 road). Reconstruction, decommissioning, and closures of roads range from approximately 44 miles under Alternative D to 55 miles under Alternative C. Road reconstruction (24.4 miles, 23.9 miles, and 22.7 miles under Alternatives B, C and D, respectively), hydrologic road closure, and road decommissioning have the potential to increase sedimentation over the short term (1-3 years). The potential for short-term increases in sedimentation, however, should be minimized by use of BMPs and design criteria. Reference the alternative transportation maps for locations of road reconstruction, closure, and decommissioning activities (Chapter 2, Figures 2-3, 2-7, and 2-11). In the long term, sedimentation from these roads is expected to decrease. Alternative C is likely to have the greatest long-term benefit to sediment delivery from road inactivation as it proposes 10.5 miles more than the other action alternatives.

At this time, Deep Creek watershed has 285 miles of roads (includes 95 miles of closed roads). There are 174 stream crossings. Roads increase runoff efficiencies, contribute sediment to streams, and create fish passage barriers to juvenile and adult Redband trout. A total of 11.7 miles of obliteration and 9.2 miles of road inactivation would occur in Alternatives B and D, while Alternative C prescribes 15.2 miles of obliteration and 16.2 miles of road inactivation. Obliteration would involve eliminating the road prism by removing culverts and fill from floodplains, scarification, deep ripping, or other techniques. All other road improvement practices would involve hydrologic closure. Road restoration would improve existing conditions and would reduce sediment production and delivery from the road system to the streams.

Table 4-1 Miles of Road Obliteration and Inactivation by Alternative

	Alt. A	Alt. B	Alt. C	Alt. D
Road Obliteration (miles)	0	11.7	15.2	11.7
Road Inactivation (miles)	0	9.2	16.2	9.2

Culvert replacements have been identified with vegetation treatments (7 in Alternatives B and D, 8 in Alternative C). These treatments have been identified to compliment the vegetation treatments by improving hydrologic conditions. For example, a culvert replacement is proposed on the 12 Road in conjunction with an aspen treatment that is immediately downstream to assist in the aspen stand recovery. Culverts would be designed to properly handle large flood events (~ 100 year events). Fish passage would be improved on Little Summit and Happy Camp Creeks from the replacement of two culverts under Alternatives B and D, and three culverts under Alternative C. Culvert replacements would have the short-term, moderate effect of increasing sedimentation levels for the first year downstream of culverts. Longer term, increased hydrologic function would enhance the ability of streams to pass bedload and peak flows, improve fish passage, and assist in vegetative recovery within the influence of the culverts. Alternative maps depict the locations of culvert replacements (Chapter 2, Figures 2-3, 2-7, and 2-11).

Large Woody Material Placement

LWM is an important element of fish habitat and there is a shortage in many stream segments. Adding LWM to the streams would decrease hydraulic gradients, reduce potential erosion during high flow events, help develop narrower and deeper channels, catch and retain sediment and organic matter, and may allow fish colonization of previously unused habitat. Placement of LWM was identified as a necessary stream enhancement activity in areas where existing levels are low and direct benefits to channel form have the potential to be realized (USFS 2002c). Implementation would help enhance stream shading, create complex fish habitat, and enhance bank stability. Large wood would be placed along 5.5 miles of the main stems and tributaries of Happy Camp, Double Corral, Jackson, Crazy, Little Summit, and Deep Creeks under Alternatives B and D. An additional 1.9 miles of LWM is prescribed along the main stem of Deep Creek in the southwest portion of the watershed under Alternative C. Locations are shown on the alternative maps (Chapter 2, Figures 2-4, 2-8, and 2-12).

Meadow Enhancement

Meadow systems have lost, or are in the process of losing water storage efficiency. The factor contributing to this condition is channel incision that has occurred from the lack of vegetative stability primarily from road crossing and grazing. As incision has progressed, conifer encroachment has further lowered water tables. Enhancement activities would involve precommercial thinning in and around the edges of these meadows where conifer encroachment is evident. Under all alternatives, 825 acres are proposed for treatment. This treatment should increase understory riparian/wetland species (rushes, grasses, sedges, etc.). Where headcuts are not occurring or have not occurred, there should be a subsequent increase in bank stability by decreasing conifer encroachment and increasing riparian/wetland species. Thinning would occur within RHCAs and design elements have been incorporated to maintain existing shade on channels. The effectiveness of meeting the watershed related objectives of these treatments would be dependent on the future intensity of livestock utilization. Reference the wildlife section for effects of these treatments to wildlife (page 4-70).

Dispersed Recreation Sites

Restoration activities at six dispersed recreation sites under all alternatives would involve hydrologic closure as well as confining usage to avoid impacts to steams and floodplains. Hydrologic closure would include scarification as feasible, slope stabilization, installation of closure devices, and revegetation (See Descriptions of the Treatments for the Action Alternatives, Chapter 2, page 2-55). This treatment would apply to areas along Deep, Toggle, and Happy Camp Creeks to improve undesirable watershed conditions such as compaction, sediment, and runoff (Reference Alternative Maps, Figures 2-4, 2-8, and 2-12).

Forest Vegetation Treatments/Prescribed Fire Activities

Due to increased conifer stocking from past management activities (e.g. fire suppression), many conifer stands would benefit from thinning (commercial and precommercial) and underburning. Prescriptions for thinning and incorporating the design elements (Chapter 2, page 2-36) would increase individual tree growth for stream shading, promote the development of larger trees to increase future LWM recruitment to the stream channels, and raise the density of desirable understory species that are important for channel stability (See Vegetative Diversity section that follows). Prescribed fire activities (fuel reduction and fuel treatment) would not retard infiltration and would decrease the potential for adverse wildfire effects to RHCAs.

Under Alternatives B and C, 24 acres in seven commercial timber harvest units would treat conifer stands in Class III and IV RHCAs (See Appendix F for unit numbers and alternative maps for locations). Prescriptions for these stands would enhance stream shading during critical summer months, provide a source of LWM recruitment, and improve density of understory riparian species (willow, alder, sedges, rushes, etc.). These alternatives include 354 acres of precommercial thinning proposed in RHCAs across the planning area. Precommercial thinning in RHCAs would also improve densities of understory riparian species, enhance stream shading, and provide a source of LWM recruitment. Alternative D proposes 202 acres of precommercial thinning within RHCAs. No commercial timber harvest in conifer stands is planned under Alternative D. A no-treatment zone (with the exception of aspen treatments) within commercial treatment units was established within RHCAs in order to provide sediment storage and protection against undesired sediment migration to streams (See Chapter 2, Design Elements Common to All Action Alternatives, page 2-62). More discussion of the effects of vegetation treatments in RHCAs can be found in the Vegetation Diversity section, page 4-24.

Alternative B proposes 2,163 acres of natural fuels treatment activities, Alternative C proposes 612 acres, and Alternative D proposes 776 acres within RHCAs. Activity-generated fuels would be treated with prescribed fire methods as well. Treatment of fuels through prescribed fire in RHCAs would decrease catastrophic wildfire potential along stream courses while retaining sufficient infiltration values within the riparian zones. Ignition would not occur within the RHCA but be allowed to back into the riparian areas leaving a low severity ($\leq$ 1 foot flame lengths), mosaic burn pattern. Design elements (Chapter 2, page 2-43) have been incorporated to help ensure that stream shading is not reduced and large material along the floodplain would be retained.

Based on proposed severity, area treated, seasonal timing, and a realization that fire is not completely controllable, the potential for negative effects from sedimentation under Alternative B is high with a high potential for site-specific areas (i.e. fish bearing streams). Alternative C proposes fewer acres to be burned than Alternative B and excludes areas along fish bearing creeks such as Crazy, Little Summit, Double Corral, Happy Camp, Jackson, and Toggle Creeks. Less RHCA acreage is included in the burning blocks under this alternative (612 acres) than B (2,163 acres) or D (776 acres). These adjustments were designed to reduce the risk for undesired effects to water quality from prescribed fire activities. As a result, *the potential for negative effects from sedimentation under Alternative C is the lowest*. The potential for negative effects from treatments under Alternative D is low, with a high potential for site-specific areas for the streams mentioned above.

Stream Temperature: Stream temperatures are not expected to increase over the long term (1–5 years) as a result of stand treatment activities. The effects to temperature are related to the potential for activities to reduce vegetative shade within RHCAs. Treatments that are proposed within RHCAs and their potential to reduce shade have already been discussed above. Although there is a concern for reducing stream shade on localized reaches of perennial and fish bearing streams (Class I – III streams) from treatments, commercial and precommercial thinning operations are designed (with the exception of aspen treatments) to have no reduction in stream shade along perennial systems.

The greatest concern is associated with prescribed fire, aspen, and precommercial thinning activities. Project objectives and design elements have been incorporated to reduce or prevent the risk of this occurring: no treatment buffers have been established in RHCAs for all commercial and precommercial treatments (See design elements in Chapter 2, page 2-44); no prescribed fire would be lit in RHCAs and the effects of backing fires would be monitored to ensure shade objectives are successfully met. Future stream shade recruitment is expected to be enhanced with implementation of forest stand and fuel management activities.

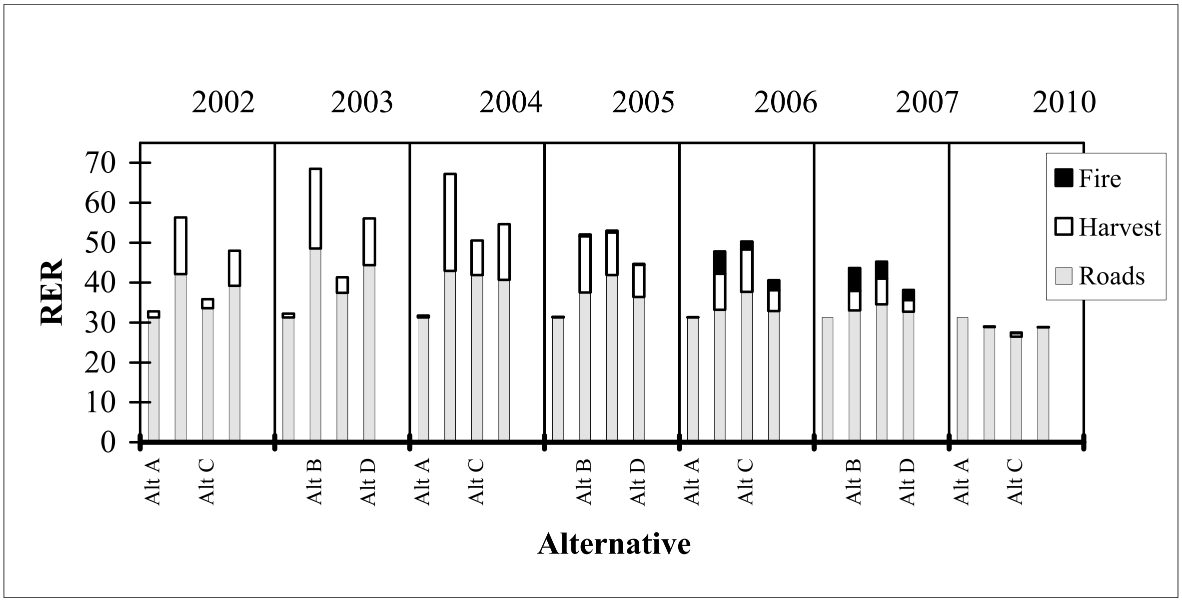
Stream Turbidity/Sedimentation: In conjunction with the discussion of the individual treatments above, the Relative Erosion Model (RER) was used to predict the relative potential of sediment delivery for the alternatives including the No Action Alternative, which is considered the existing condition. As discussed earlier, the design elements and BMPs identified in Chapter 2 are not incorporated into the model and are not reflected in the outputs. The emphasis in the analysis is on fire, timber harvest, and road activities that occur within approximately 600 feet of streams. Sediment delivery is roughly proportional to the number of miles of road construction, reconstruction, and the amount of area harvested within this zone. Roads contribute the most to sedimentation delivery (see Figure 4-1). Table 4-2 shows the amount of construction and reconstruction within 600 feet of stream channels that is proposed under the alternatives.

Table 4-2 Miles of Road Proposed within 600 Feet of Streams

Proposed Management Practices	Alt. A (No action)	Alt. B	Alt. C	Alt. D
Road Reconstruction (miles)	0	16.0	14.3	15.5
New System Roads (miles)	0	0.6	0.6	0
New Temporary Roads (miles)	0	2.9	2.6	2.4
TOTAL ROADS	0	19.5	17.5	17.9

The RER values were calculated on a watershed and subwatershed scale. Figure 4-1 on the following page displays the relative values for the watershed to compare the alternatives. Subwatershed values are contained in the Fish and Hydrology specialist report. The values presented provide a comparative assessment of the alternatives, in the absence of BMPs or design elements. This information is useful for comparison purposes between alternatives. However, the model potentially overestimates the potential for sediment production. By recognizing the potential for sediment production and the source, it provides a means for the Interdisciplinary Team (IDT) to identify specific design elements addressing sedimentation concerns from proposed treatments. These design elements are presented in Chapter 2 (page 2-43). This discussion will focus on the main differences in the relative potential of sediment delivery in the subwatersheds by alternative.

Figure 4- 1 Deep Creek Watershed RER Values



The RER analysis indicates varying degrees of potential increase in sediment delivery within the four subwatersheds. The subwatershed discussion reflects percentages based on peak potential between 2002 and 2007. Jackson, Little Summit, and Lower Deep subwatersheds exhibit higher RER values and account for the majority of the potential sediment delivery in the watershed under all alternatives.

As displayed in Table 4-2, harvest systems, prescribed fire and road activities contribute to the potential increase in sediment (2002-2007) in the watershed. The RER analysis attributes road activities, and to a lesser extent, harvest systems and prescribed fire, as the contributors to sedimentation. Harvest treatments account for a higher potential increase from Alternative B, followed by Alternatives C and D, respectively. Potential sediment delivery decreases over time for all alternatives. Based on the amount of prescribed fire proposed adjacent to RHCAs, Alternative B has the highest potential for sediment delivery. Alternative C proposes the least amount of burning in this zone (See Figures 2-4, 2-8, and 2-12, Chapter 2). The risk associated with burning is addressed through ignition strategy and monitoring. Road construction and reconstruction within 600 feet of streams could potentially contribute higher amounts of sediment. Alternative B suggests 19.5 miles of road activities within this zone, Alternative C proposes 17.5 miles, and Alternative D proposes 17.9 miles. Road density is assumed to be at equilibrium (current condition) by 2008 and less than existing levels by 2010 under the action alternatives, with Alternative C resulting in the lowest density and road-associated sediment.

In summary, based on the potential sediment production from the individual treatments and considering the RER analysis, *Alternative B has an overall potential for higher levels of sediment to be produced*. Alternative C has less potential than Alternative B, but more than Alternative D. With the application of BMPs and design elements as discussed in Chapter 2, the potential for sediment delivery to streams is reduced. With these project design criteria incorporated, Alternatives C and D should meet State Water Quality Standards for turbidity (no more than a 10 percent increase in turbidity). Alternative B may meet State Water Quality Standards, but is at a higher risk than the other action alternatives.

Peak Flows: As stated earlier, the EHA model is used to determine the relative differences between alternatives for effects of timber harvest activities and forest vegetative conditions within the watershed. The EHA value is calculated and compared to a threshold value (25 percent) established for the watershed in the Forest Plan. For analysis purposes, the EHA was calculated at both the watershed and subwatershed scale. Design elements and BMPs are not incorporated into the model and are not reflected in the outputs reported below in Table 4-3. The information presented here is for the watershed values. The discussion of effects will incorporate subwatershed information.

Based on the existing condition within the Deep Watershed, measurable increases in flow should begin to show when the EHA values reach 20 percent (Hibbert 1965). Analysis of the subwatershed EHA values indicate that tributaries in Happy Camp, Jackson, and Little Summit subwatersheds have a higher potential to exhibit local negative responses (turbidity and adjustments in channel form) to increases in peak flow than compared to the watershed EHA values. The condition within these three subwatersheds is due to high levels of bank instability and active headcuts. The potential adjustments to channel form would involve E→C→G→F and/or C→D, thus degrading fisheries habitat, increasing stream temperature, and increasing fine sediment particle distribution. A peak EHA value below 20 percent and existing geomorphic properties suggest a low probability for negative effects within Lower Deep subwatershed. Increased potential for higher sediment transport from contributing tributaries and subwatersheds can have an effect on already limited spawning opportunities for Redband trout in Deep Creek by increasing fine particle concentrations.

Table 4-3 EHA Values for Deep Watershed

Year	Alternative A	Alternative B	Alternative C	Alternative D
2000	17.0	17.0	17.0	17.0
2001	16.8	16.8	16.8	16.8
2002	16.0	17.2	16.4	17.0
2003	15.1	19.4	16.1	18.2
2004	14.2	21.5	16.7	19.3
2005	13.3	22.5	17.4	19.6
2006	12.6	21.9	18.0	19.0
2007	12.2	21.4	17.8	18.5
2008	11.8	20.9	17.3	18.0
2009	11.5	20.5	16.8	17.6
2010	11.1	19.9	16.2	17.1

Under Alternative B, EHA values (22.5%) would remain below Forest Plan threshold levels of 25% for Deep Creek Watershed. Cumulative impacts from the upper subwatersheds including Happy Camp, Jackson, and Little Summit (EHA values exceed 20% coupled with bank instability and headcut activity) exhibit moderate potential for adverse effects to channel form on the main trunk of Deep Creek for Alternative B. Alternative B has high potential for increasing sediment transport in Deep Creek and, subsequently, downstream in the North Fork Crooked River. There is potential for further degradation of fish habitat by adjusting channel form (increases in turbidity, loss of pools, increased width/depth ratios, etc.) within the watershed. Increased sediment production and transport can decrease overall diversity and productivity of the stream environment and increase embeddedness. Riparian planting and large wood placement should assist in stabilizing degraded stream segments against high flow yields. However, these activities would have a minimal effect where accelerated headcut and lateral scour advancement from peak flows has resulted in loss of floodplain connectivity.

EHA values of 18% would also remain below Forest Plan threshold levels of 25% for Deep Creek Watershed under Alternative C. Timber sales were scheduled under Alternative C to better address the risk from increased flows. Activities in Little Summit are planned as two separate timber sales with the first delayed until 2004 for implementation. Peak EHA values remain below 20% in Happy Camp, Jackson, and Lower Deep. Accelerated degradation in channel form is not expected within these subwatersheds from commercial activities. Little Summit has an overall EHA of 20.1% for one year in 2007. Due to the assumptions incorporated into this model, it is anticipated that EHA in this subwatershed would remain below 20% through implementation. Measurable increases in peak flows are not expected. This is the result of two factors: 1) the model assumes precommercial thinning would occur concurrently with commercial harvest (it actually usually occurs 1-3 years later); and 2) implementation of design elements and resource protection measures tend to result in net treatment areas slightly less than proposed. The overall EHA analysis (18%) displays low potential or probability for undesired adjustments in width to depth ratios along stream reaches within all subwatersheds under Alternative C. Reduced risk of peak flows would help the effectiveness of the watershed improvement projects to help pass flows at road crossings and improve watershed function by restoring floodplains, increasing infiltration and stream shade, decreasing sediment production, and stabilizing stream banks.

Under Alternative D, EHA values (19.6%) would remain below Forest Plan threshold levels of 25% for Deep Creek Watershed. Cumulative impacts from the upper subwatersheds (EHA values below 20% coupled with bank instability and headcut activity) have low potential for adverse effects on channel form on the main trunk of Deep Creek. Alternative D has moderate potential (EHA for the watershed at 19.6%) for increasing sediment transport in Deep Creek and, subsequently, downstream in the North Fork Crooked River. There is potential for further fish habitat degradation (increases in turbidity, loss of pools, increased width/depth ratios, etc.) within the watershed. Increased sediment production and transport can decrease overall diversity and productivity of the stream environment and increase embeddedness. Riparian planting and large wood placement could assist in stabilizing degraded stream segments against high flow yields. However, these activities would have a minimal effect where accelerated headcut and lateral scour advancement from peak flows result in loss of floodplain connectivity.

Cumulative Effects

Since 1990, several watershed and aquatic habitat improvement projects have been implemented. These include culvert replacements, headcut restoration, riparian planting, road closures and decommissioning, LWM placement, spring development, livestock exclosures, and fencing of riparian pastures.

Culvert replacements have occurred on Forest road 42 along Buck Hollow Creek and are effectively reducing stream and road interactions, as well as providing fish passage. Road closures have occurred in many areas throughout the watershed. However, work remains to be done to ensure that hydrologic considerations such as culverts, drainage, floodplain function, and the ability to move bedload are incorporated into closures.

Riparian planting in Timothy and Toggle Meadows has laid the foundation to restore shade and contribute to bank stability. The long-term success of these plantings would depend on the ability to protect plants from extensive grazing from big game and cattle. LWM placed in the lower reaches of Jackson, Happy Camp, and Deep Creeks have re-introduced floodplain interaction, in-channel roughness, and enhanced complex fish habitat. Headcut restoration has stopped their advancement, preserved critical upstream habitat, and provided fish passage in Happy Camp, Timothy Meadow, and Derr Creeks.

The development of Double Corral Spring (Derr Allotment) has been an attempt to draw cattle from riparian areas and improve cattle distribution. Livestock exclosure fences have effectively prohibited continued effects to sensitive aquatic habitats in Little Summit Creek, and in Timothy, Toggle, and Derr Meadows. Although these exclosures provide a positive benefit where constructed, they tend to shift cattle utilization to other unprotected riparian or wetland habitats. Within these stream reaches, fish populations have shown positive responses as areas move toward desired conditions. Dispersed recreation is expected to continue within the watershed. The action alternatives propose closing several dispersed recreation sites that are associated with floodplains. Preventing vehicle access to these areas may lead to new sites being used or increased use of other sites resulting in increased impacts to these areas.

Since 1999, the Ochoco National Forest has incorporated monitoring requirements set forth in the Grazing Implementation Monitoring Module (GIMM) and the USFWS and NMFS Biological Opinion associated with the Forest's grazing program. Monitoring is based on Forage Utilization/Stubble Height threshold within the greenline and upper terraces at key areas associated with streams and/or springs. Seasonal pasture moves are designed based on timing and stubble heights (4 inches of stubble at the end of the growing season). Adjustments are made in grazing if these objectives are not being met. Objectives of these new monitoring requirements are to maintain and improve streambank stability and riparian shade components such as hardwoods, and to minimize bank trampling, trailing, postholing, and other undesired impacts. The relative effectiveness of these adjustments to move riparian areas on an upward trend would be assessed over the long term through continued stream surveys. Allotments within Deep Watershed have incorporated full time riders improve the distribution of cattle (see Chapter 3, Range, page 3-39).

The Paulina Ranger District expects to complete a range analysis to reauthorize grazing permits for allotments in Deep Creek Watershed. The interdisciplinary team associated with the AMP revisions is reviewing grazing management in respect to other resources and will develop alternatives and adjustments to address key issues associated with range in 2004. The draft proposed action currently being developed proposes to graze livestock under standards that meet or exceed current Forest Plan standards for grazing.

The Paulina Ranger District is currently working on an environmental analysis that proposes additional restoration activities to improve watershed health in the Deep Creek Watershed (as discussed under the Deep Creek Water Quality Plan). The following activities are proposed under the Deep Restoration EA (copy available upon request at the Paulina Ranger District Office):

- Close 17.4 miles of road
- Decommission 30.1 miles of road
- Reconstruct 2.5 miles of road
- Replace 32 culverts
- Remove 3 culverts
- Build 4 livestock exclosures (226.6 acres)
- Develop 7 springs to include off-site watering tanks
- Place 3.6 miles of large wood
- Install 18 cutbank revetments (21.49 acres)
- Reconstruct 1 channel reach (10.46 acres)
- Repair 37 headcut complexes (32.32 acres)
- Enhance fisheries pool habitat on 1 channel reach (1.68 acres) with structures

These activities are estimated to reduce sediment yield to streams by approximately 45 tons over the next several years with the assumption of vegetative recovery. Many of these treatments would require working within low-flow stream conditions, hence there is expected to be some short-term (<2yrs) relatively small inputs of sediment to the stream(s). However, mitigation would be in place to minimize any measurable adverse effect(s). Long-term benefits would greatly outweigh any short-term consequences. These treatments, in combination with proposed treatments from the Deep Vegetative Management Project would cumulatively result in at least a 45-ton reduction in sediment delivery to streams over the long term (>2yrs).

Proposed activities within the Deep Restoration EA have also been identified to promote vegetative recovery for improved shade conditions over the short (<2yrs) and long term (>2yrs). Proposed activities are projected to reduce stream temperatures on 303(d) listed streams in an effort to comply with the 1973 Clean Water Act. Stream temperatures are expected to be reduced as vegetation re-establishes along treated road prisms, exclosures, large wood placement areas, cutbank revetments, headcuts, and channel reconstruction sites. Stream temperatures would continue to be monitored on an annual basis for improvements. These treatments, in combination with proposed treatments from the Deep Vegetative Management Project would cumulatively result in a reduction in stream temperatures over the long term (>2yrs), in agreement with the Deep WQRP.

In addition to reducing sediment yield and stream temperatures, activities proposed within the Deep Restoration EA would reduce the potential effects to aquatics from increased peak flows (as measured by EHA in the EIS). Overland flow is expected to be reduced by closing/decommissioning roads and promoting vegetative roughness on adjacent bare slopes through implementation of exclosures, cutbank revetments, large wood placement, and spring developments. Headcut restoration would also prevent accelerated loss of floodplain access, hence keeping peak flows from being concentrated within a gullied channel. Cumulatively the Deep Restoration EA and this EIS would reduce the potential for adverse effects to aquatics from peak flows.

All subwatersheds within the planning area exhibit cumulative effects from past and current management activities. The action alternatives could produce some localized effects to the aquatic ecosystem from increased sediment yield and hydrological risk of detrimental impacts if a 10-year or greater flow event occurred. Past vegetation and fuel management projects have had undesired effects on streams. These include more road crossings, increased sediment, and decreased shade and LWM.

Livestock utilization in riparian areas has the potential to be modified as a result of commercial harvest, precommercial thinning (PCT), and prescribed fire where proposed in RHCAs. Alternative B proposes 75 acres (51 acres are aspen stands) of commercial harvest, 380 acres (26 acres of aspen) of PCT, 825 acres of meadow enhancement, and approximately 2,163 acres within prescribed burning units. These treatments are likely to increase the amount of available forage within the RHCAs. Best Management Practices have been incorporated as design elements to help reduce the potential of effects from grazing on riparian vegetation (shade) and stream bank stability (sedimentation) as follows (see pages 2-43-2-46): No-harvest buffers of 100 feet have been identified along perennial streams for commercial timber harvest (Unit 189); The remaining six units are adjacent to ephemeral streams and have a 20-foot buffer identified; All precommercial thinning and meadow enhancement units have incorporated similar measures (15 foot buffers) to assist in decreasing the likelihood of undesired channel adjustments along perennial flowing tributaries; Aspen treatments incorporate protection measures such as brush barriers or fences (See Appendix H).

In consideration of the direct and indirect effects and the above discussion, Alternative B has been found to exhibit the highest risk to fish and aquatic habitats for a 5-year period between the years 2004 through 2009 when EHA values would exceed 20%. EHA values incorporate past activities such as the Summit Timber Sale. Because of Alternative B's higher risk (compared to Alternative C and D) for negative impacts should a 10-year event occur, other watershed improvement projects and management practices (design elements and BMPs) would have the lowest potential to offset potential impacts than with the other action alternatives. Should a 10-year event occur during this 5-year time period, Alternative B is likely to have larger scale impacts on streams as a result of vegetation management activities in RHCAs than Alternative C and D. There is a slight potential to increase sediment, decrease shade, adjust channel form, and the potential to increase livestock utilization along stream courses. Based on this risk, *Alternative B is the least likely to comply with Oregon State water quality standards and meet INFISH management direction*. Implementation of future watershed improvement projects identified in the WQRP (Appendix D) would be less effective than the other action alternatives toward moving streams and riparian areas on an upward trend (i.e. Deep Creek Restoration EA and AMP updates).

Similar to Alternative B, livestock utilization in riparian areas has the potential to be modified under Alternative C, however, at a much lesser scale. RHCA treatments under Alternative C are the same as B with the exception that only 612 acres are within prescribed burning units and 4 more acres of aspen treatment have been incorporated. The design elements identified under Alternative B would apply to treatment areas under this alternative as well. Alternative C has reduced burning in fish-bearing drainages such as Crazy, Little Summit, Double Corral, Happy Camp, Jackson, and Toggle Creeks and incorporated unit boundaries along roads to avoid fire backing down into some of the drainages.

Alternative C exhibits the lowest risk to fish and aquatic habitats (EHA values are 18% and below the point where measurable increases in flows might be expected). Although Alternative C incorporates actions that have the potential to increase sediment, decrease shade, adjust channel form, and enhance livestock grazing conditions, it is expected to best comply with Oregon state water quality standards and meet INFISH direction. Utilizing and implementing the identified BMPs and design elements for vegetation and fuel management projects and integrating Alternative C's stream and watershed improvement projects are expected to be more effective because measurable increases in peak flows are not expected. Under Alternative C, an upward trend in stream and riparian conditions is expected. This is a result of future actions proposed that incorporate watershed improvement projects identified in the WQRP (Appendix D) through the proposed restoration EA and updating the AMPs with improved grazing schemes to better address water quality.

Similar to Alternative B, livestock utilization in riparian areas has the potential to increase under Alternative D, however, at a much lesser scale. Unlike Alternative C, Alternative D does propose burning in fish bearing drainages. Although Alternative D has less overall commercial harvest and precommercial thinning, it has a higher overall potential for impacts from livestock due to the prescribed burning proposed in Crazy and Little Summit Creeks. Alternative D proposes 51 acres of aspen for commercial harvest, 228 acres (26 acres of aspen) of PCT, 825 acres of meadow enhancement, and approximately 776 acres within prescribed burning units. The design elements identified under Alternative B and C would apply to treatment areas under this alternative as well.

Alternative D has been found to exhibit higher risk than Alternative C to fish and aquatic habitats (EHA value of 19.6%). It incorporates actions having the potential to increase sediment, decrease shade, adjust channel form, and enhance livestock grazing. However, because the risk of measurable increases in peak flow is reduced, other watershed improvement projects and management practices (design elements and BMPs) would effectively offset this potential. By incorporating these measures under Alternative D, it would comply with Oregon State water quality standards and meet INFISH management direction. When considering these and future actions as identified above, Alternative D would be less effective toward moving the watershed's stream and riparian conditions on an upward trend than Alternative C.

Stand replacement fire effects on aquatic habitat and water quality have the potential to surpass risks indicated for the action alternatives in both magnitude of area affected and intensity of impacts. Vegetation conditions have changed such that a greater percentage of the watershed is at risk to adverse impacts from stand replacement fire than under historical conditions: historic conditions 21%, existing conditions 74% (see Tables 3-12 and 3-13) (Reinarz 1999). Loss of vegetation canopy cover, large down wood, and soil exposure from high severity wildfire have the potential to severely degrade habitat conditions and result in increased levels of sedimentation (Eastside Forest Ecosystem Health Assessment, Volume I, Everett, Hessburg, Jensen, Bormann). Alternative B reduces the potential for stand replacement fire the most, followed by Alternatives C, and D based on the amount of prescribed fire, commercial harvest, precommercial treatments, and other treatments (See Fire Hazard and Fuels, page 4-29). Alternative A does not reduce the current risk.

Vegetative Diversity

Measures used to determine the environmental consequences of the alternatives include:

1. Post-treatment seral/structural stage abundance as compared to historic conditions
2. Acres of late and old structure (LOS) developed post-treatment and at 50 years compared to historic conditions
3. Acres treated that are currently at risk due to high densities
4. Acres of riparian and upland communities that are protected or enhanced

ALTERNATIVE A (NO ACTION)

Alternative A does not meet the Purpose and Need objectives identified for this analysis which are 1) modification of seral/structural stages to move toward the Historic Range of Variability (HRV); 2) increase levels of single-stratum LOS; 3) modify stand densities to reduce risk of moderate to high severity fire; 4) reduce risk from adverse insect and disease impacts; and 5)enhance conditions of aspen, riparian, upland shrub, and meadow communities.

Direct and Indirect Effects.

Seral/Structural Abundance and Distribution: Current vegetation trends are likely to continue within the Deep Planning Area. Fire would continue to be suppressed and play no role in vegetation management. Current stand conditions would not support historic non-lethal fire effects. As a result, seral/structural stage distributions and abundance would continue to move outside the historic range of variability. Stands would continue to develop and stand densities would increase to where competition-induced stress, and insects and disease would cause increased levels of tree mortality.

Understories would continue to develop with late seral species. Stand and crown densities would continue to develop, further reducing understory herb, grass, and shrub cover. With increased crown densities, late seral species would comprise a higher percentage of the watershed, moving the area farther from the historic range of variability for species diversity. Multi-strata conditions would continue to dominate over time, further contributing to the current deficits of single strata LOS conditions.

Additional vegetation activities previously analyzed and incorporated into the existing condition within the watershed include the Summit Timber Sale. The Summit Timber Sale was completed in the spring of 2001. Approximately 598 acres (less than 2 percent of the forested landscape) within the watershed would have stand densities reduced to levels within 35-47 percent of the maximum stand density index (SDI). Canopy covers would be reduced and a higher percentage of early seral species would remain after treatment. Seral species composition would be moved toward favoring ponderosa pine, western larch and Douglas-fir. After harvest, 598 acres of precommercial thinning treatments would move stands toward more open, single-story conditions and these conditions would be sustainable over the next 15-20 years. Most stand structures treated were multi-story before receiving the intermediate thinning treatments. They would retain multi-story conditions after treatment, although each of the lower canopy layers (middlestory and understory) would have reduced tree densities. The younger ponderosa pine stands thinned, that were single-stratum, would remain as single-stratum but at reduced densities and crown cover. In addition to the change in species composition and reduced densities, increased tree growth and improved vigor is expected in Summit Timber Sale units.

LOS: The table on the following page is a general summary of LOS projections with no vegetation treatments. Detailed summaries of these LOS projections can be found in the specialist’s report.

Table 4- 4 LOS Projections for Alternative A (No Action)

PAG	LOS Type	HRV Range (Acres)	Existing Condition (Acres)	Condition in 50 Years (Acres)
Moist Grand Fir	Multi-stratum	36--97	157	281
	Single-stratum	78--175	124	0
Dry Grand Fir	Multi-stratum	2,093--5,815	6,718	8,237
	Single-stratum	10,700--20,004	2,044	528
Douglas-fir	Multi-stratum	203--760	999	1,297
	Single-stratum	2,431--3,798	224	31
Mesic Ponderosa	Multi-stratum	73--509	542	1,012
	Single-stratum	4,289--6,179	153	0
Xeric Ponderosa	Multi-stratum	29--145	41	209
	Single-stratum	727--1,570	0	0

Trends in stand development under the no-action alternative show a continuation of current stand development processes at work in the watershed. Over time, one could expect additional losses of single-stratum large structure stands as understory tree development continues. Current deficits in open, single-stratum stands increase in nearly every plant association group. Some additional, smaller diameter stands would be expected to grow into large structure (relatively small amount projected due to 60 percent of the forested lands having high stand densities with slow growth rates). Some amount of multi-stratum LOS is expected to continue to develop over the next 50 years adding to the current disproportionate levels of multi-stratum structure across the landscape.

Insect and disease disturbances would remain at high endemic levels under these conditions. Risk of an epidemic outbreak from spruce budworm, mountain pine beetle, or tussock moth would increase over time as multi-stratum stand conditions increased. Risk of stand replacing fire effects would remain at high levels and continue with increasing amounts of multi-stratum stands.

Ongoing prescribed fire activities that reduce natural fuels are planned under the Summit Environmental Analysis. Effects from prescribed fire are not expected to change stand conditions, however, there is a low potential for small-scale changes to stand structure. Loss of large trees can occur during underburning activities where duff layers have built up and form a mound at the base of large trees. Tree roots under these mounds are susceptible to long-term smoldering and root damage from fire can contribute to mortality directly or indirectly through secondary effects from insects attacking a weakened tree. Through observation of past natural fuels reduction activities, estimates of tree mortality from prescribed fire indicate low numbers of tree mortality in size classes greater than 5 inches in diameter. This tree mortality is generally distributed in patches.

Stand Densities: In the short-term, insect and disease disturbances would be expected to remain at high endemic levels under the No Action Alternative. Risk of lethal fire effects would remain at high levels and increase with increasing numbers of acres of high density, multi-stratum stand conditions. The current 14,369 acres of forested land identified as being at high stand densities would continue to have stand conditions that result in slow tree growth, high levels of inter-tree competition and low tree vigor. Overtopped intermediate and suppressed trees in the understory will continue to die due to competition mortality. This will increase the amount of dead fuels available for stand replacement fire events.

LOS currently identified as being at upper levels of site occupancy (approximately 8,052 acres) would also have continued inter-tree competition at levels resulting in reduced tree and stand vigor and increased mortality in both the understory and overstory trees. Old, large diameter ponderosa pine will continue to decline and succumb to western bark beetle as these trees are particularly sensitive to competition from the overstocked understory.

Long-term effects of high stand densities include an increase in the number of acres of this condition across the landscape. The numbers of large diameter ponderosa pine trees will continue to decrease as the rate of mortality exceeds replacement due to overstocking effects on tree growth. Stand replacement fire events would be expected to occur within the watershed in stands exhibiting high stocking, increased levels of dead fuel and multi-canopy conditions.

Riparian and Upland Hardwood Communities: Under Alternative A, no conifer stands would be treated by commercial or precommercial thinning to increase shade, promote long term large wood development, stabilize soils, and reduce the risk of catastrophic fire within RHCAs inside the Deep Planning Area. Riparian Management Objectives to increase shade and develop large woody debris in the long term would be delayed and are not expected to occur within the next 30 years in approximately 1,945 acres of stands identified as highly dense (within or greater than upper 1/3 of site potential). This represents 41 percent of the upland conifer RHCAs. Stand conditions would undergo little change from their current trends or conditions. Increased soil and channel stabilization would not be expected to occur under stands where tree densities remain in the upper one third of site potential and canopy cover remains high. Understory vegetation would not be expected to increase in abundance under conditions of high shade and moisture competition from trees. Risk of stand replacing fire would also remain high where dense multi-structure canopies exist. Stands that are currently at high densities would continue to have conditions that promote low tree vigor, slow tree growth, reduce crown volumes and cause high risk to adverse fire effects.

Where stands are currently developing toward late seral stages, they would continue to lose large diameter, early seral trees from competition with the predominantly late seral understory. Development of multi-canopy stand conditions would continue, thus the risk of adverse fire effects would remain high.

The No Action Alternative would allow the further decline and degradation of riparian communities. Most of the aspen and cottonwood stands are over-mature, diseased, and dying. There are no mid-story saplings with crowns above the browse line to replace the mature trees and perpetuate the stand. The willows would continue to become more isolated, existing only in wet, open meadows. There would be no stream channel improvements helping floodplain interaction.

Upland shrub habitat would continue to degrade. Fire suppression would cause conifer encroachment to continue. Over browsing by big game and cows would hinder the achievement of juvenile plant recruitment and establishment. Under Alternative A, upland hardwood habitat would continue to degrade.

ALTERNATIVES B (PROPOSED ACTION), C, AND D

Alternatives B, C, and D address the Purpose and Need identified for this analysis area, to varying degrees, in order to address resource needs. The effects of the alternatives are described below for seral/structure abundance and distribution, late and old structure, stand density, throughout the watershed and specifically for conifer stands within the RHCA.

Direct and Indirect Effects on Seral/Structural Abundance and Distribution: Treatments proposed under this analysis address the Purpose and Need to modify the current distribution and abundance of seral and structural conditions. Currently, 43 percent of the forested land base in the watershed is within HRV when considering both seral and structure stages together.

Table 4-5 shows the types of treatments proposed by each alternative (See Chapter 2, Descriptions of Treatments for the Action Alternatives, page 2-52). The table is followed by a brief discussion of the effects of each type of treatment prescribed. All treatment acres in the tables below include all upland conifer treatments both within and outside the RHCA.

Table 4- 5 Selected Vegetation Treatments Proposed in the Action Alternatives (Acres)

	Alternative A	Alternative B	Alternative C	Alternative D
Regeneration Harvest	0	482	131	257
Intermediate Harvest	0	6,630	6,260	4,910
Precommercial Thinning	0	3,550	3,757	2,007
Prescribed Burning for Juniper Reduction	0	8,339	4,549	5,183

Regeneration Treatments

Approximately 482 acres of regeneration treatments are proposed under Alternative B ((HSG, HCR, HSH). Of these treatments, approximately 86 acres are clear-cut with reserve trees, approximately 327 are group selection with reserve trees, and approximately 69 acres are shelterwood with reserve trees. Alternative C proposes to treat 131 acres of regeneration with 60 acres being clear-cut with reserve trees, 57 acres as group selection with reserve trees, and 14 acres as shelterwood with reserve trees. Alternative D proposes to treat 257 acres of regeneration with 59 acres being clear-cut with reserve trees, 184 acres as group selection with reserve trees, and 14 acres as shelterwood with reserve trees. See Appendix F for tables showing specific treatments by unit and maps in Chapter 2 (Figures 2-1, 2-5, 2-9).

Regeneration treatments are proposed in stands that do not meet short-term or long-term vegetation management goals due to the current severity of Indian paint fungus, bark beetles, and in some cases, root disease. Intermediate and understory trees in most of these stands are predominantly grand fir having high infection rates from Indian paint fungus and low live crown ratios (indicating low tree vigor). Understory true fir trees that have been in shaded conditions for long periods typically sun scald when released and are exposed to full sun. This causes wounding to the trees, increases risk of insect infestation, and further lowers resistance to diseases present in these stands. Live crowns must shed needles suited to absorbing sunlight under shaded conditions and develop new “sun” needles to fully capture the increased sunlight from more open stand conditions. Understory trees that have low vigor are poorly suited physiologically to respond to environmental changes that increase sunlight and decrease inter-tree competition. The viability of trees with these characteristics is poor and treatment options for these stands are limited. For the above reasons, regeneration is the recommended optimum silvicultural method to reduce the incidence of disease in these stands. Regeneration harvest would provide for the establishment of tree species such as western larch and ponderosa pine that are not susceptible to Indian paint fungus and have a higher resistance to root diseases.

All sites proposed for regeneration under each alternative are identified as suitable for timber management under the Ochoco National Forest Plan. The units proposed for regeneration are moderately high productivity sites, are similar to other areas that have been successfully regenerated on the District and Forest, and are considered capable of being successfully regenerated within the 5-year period required by NFMA.

The common effects of each of these regeneration treatments would be to alter the species composition and structure of the stands. Changes in seral species would be accomplished through the cutting of late seral fir species and planting early seral species (75% or higher mixture of ponderosa pine and western larch with minor amounts of Douglas-fir). Where ponderosa pine, western larch, and lodgepole pine will be left as seed trees, shelter trees, or as additional structure for wildlife, later establishment of natural seedlings is expected to occur supplementing the planted seedlings.

Changes in stand structure range from relatively closed, multi-stratum canopies to open conditions with residual tree structure ranging from 10-35% of site potential. Group selection treatments would create openings up to 5 acres in size. All regeneration treatments would retain trees 21 inches and greater in diameter. Additional leave islands (10 percent of the unit area) are to be left untreated to provide for stand diversity. Individual reserve trees would also be left scattered within the treated part of the unit for species and structural diversity as well as long-term snag replacements.

By retaining additional overstory structure in regeneration units, the expected effects on seedlings are reduced growth rates and slower stand development. As a result, the next silvicultural treatment (precommercial thinning) to the new stand may need to be scheduled sooner where additional tree structure is left to compete with seedlings.

Approximately 482 acres of site preparation would occur after regeneration harvest for alternative B; 131 acres for Modified Alternative C; and 257 acres for Alternative D. Site preparation of whip falling is prescribed before planting. Whip falling of small diameter, seedlings, saplings and poles would occur where a stagnated or shade tolerant understory existed after commercial harvest. These trees would be cut so that they would not compete with newly planted seedlings for light, moisture and nutrients during the first few critical years of seedling establishment. Some understory trees may be infected with diseases such as mistletoe or Indian paint fungus and would need to be removed so as to not infect the planted seedlings. Whip falling would not remove desirable trees needed as part of the regeneration system or trees left as additional structure for wildlife purposes.

Broadcast burning, jackpot burning or grapple piling would occur after harvest and whip falling primarily to reduce the activity fuels. Where burning is planned, an additional benefit of site preparation could occur that removes or reduces competing grass vegetation. This benefit may be short term and occur only during the first growing season after burning. After the first year, grass competition could become a limiting factor for seedling survival or growth as reduced tree canopy cover and fire disturbance could stimulate grasses. For broadcast burning to be effective in grass competition reduction, the unit would need to have up to 60-70% of the site burned at an intensity that kills the roots of the established grasses and sets back grass competition for several growing seasons.

Planting would occur on all regeneration sites to assure adequate stocking within the 5-year time period. The species mix of seedlings to be planted would depend on the site and the presence of root diseases but generally, the species of trees to be considered for planting would include western larch, ponderosa pine and Douglas-fir. On some sites, some amount of natural regeneration is expected to occur during the first 10-15 years after disturbance from the initial harvest and post sale activities. However, the level of natural seeding and establishment is not expected at levels necessary to adequately restock the site within the required 5-year time frame.

In stands where soil compaction exceeds the Forest Plan standards, soil amelioration would take place to reduce the compaction levels to within plan standards. Depending on the extent of the soil compaction and the tillability of the site, sub-soiling would occur in identified areas having compaction and would give added site preparation benefits for seedlings. Further evaluation after harvest activities by the soil scientist and silviculturist would determine the need for soil amelioration and the degree to which it would occur within each stand. See Appendix G for unit specific sub-soiling and compaction survey information for each alternative.

Additional reforestation activities planned include animal damage control for big game and pocket gophers. Browse protection from big game would include use of netting or big game repellent (BGR). Netting provides a physical barrier to browsing that protects the seedling's terminal bud. Netting is usually applied during the first 1-5 years of establishment after which it is removed from the seedling and the site. BGR is a solution made from putrefied chicken egg that is applied to the terminal bud and upper whorl of needles of the seedling. The odor of the substance deters big game from browsing. BGR is highly biodegradable and has not shown any adverse effects to surrounding vegetation or animals that have ingested treated plant matter.

Control of pocket gophers would be implemented following monitoring that reveals 20% or more of the seedlings are being killed by gopher related damage. The primary effect of reducing pocket gophers would be reduced mortality to seedlings and higher seedling survival rates. Method of control of pocket gophers would either occur through trapping or by baiting.

For all reforestation units, a preplant survey, 1st, 3rd, and 5th year stocking surveys would be done to monitor growth, survival and competing vegetation.

Intermediate Treatments

Intermediate treatments proposed under alternative B include approximately 5,906 acres of improvement cuttings, 11 acres of sanitation, and 713 acres of commercial thinning. Alternative C proposes approximately 5,681 acres of improvement cuttings, 11 acres of sanitation, and 562 acres of commercial thinning. Alternative D proposes approximately 4,120 acres of improvement cuttings, 11 acres of sanitation, and 779 acres of commercial thinning. Intermediate treatments would retain all trees 21 inches and greater in diameter. See Chapter 2 for a description of the harvest treatments, and Appendix F for tables showing specific treatments for each unit.

Intermediate treatments in the moist grand fir, dry grand fir, and Douglas-fir plant association groups are expected to incrementally shift species composition to a higher percentage of early seral species, such as ponderosa pine and western larch. Most treatments would reduce density of trees within each canopy layer and in some cases, reduce canopy layers and move stands toward single-stratum. However, depending upon the current mix of early seral species present, the stand may need several treatments over an extended time to achieve an earlier seral status.

Stands in ponderosa pine plant association groups would be treated to promote a late seral species mix of ponderosa pine. Changes in stand structure would also depend on current stand conditions and other resource objectives. Some stands being treated by intermediate thinning that are in goshawk feeding areas would be maintained in a multi-stratum condition but at lower, sustainable stand densities. Stands located inside of RHCAs (24 acres) would be treated to create the tree growth response necessary to achieve the site specific RMOs. Additional discussion of RHCA treatments are included under the "Upland Conifer Forest within RHCA" section on page 4-24.

Generally, intermediate harvest treatments would alter species composition, reduce stand densities, and reduce the incidence of insect infestation and disease such as mistletoe. Cutting overtopped and intermediate trees acting as ladder fuels alters stand structure. Removal of these stems reduces the risk of wildfire. The degree of reduction in stand density would depend upon the resource emphasis identified for a given stand, such as visual emphasis, RHCAs, PFAs, connectivity, and general forest.

Precommercial thinning and cleaning following harvest activities would further reduce stand density and alter the seral species composition in treatment stands. Alternative B proposes 6,615 acres of post-sale treatments; Alternative C proposes 6,234 acres and D proposes 4,895 acres. With precommercial thinning and cleaning, understory trees would be removed where adequate stocking exists with the larger trees left after harvest. This would tend to reduce the number of canopies for that stand as well as stand density. Changes in seral species conditions would occur depending on the current percentage of late seral species and the number of trees removed by a post-sale treatment. Again, the mesic ponderosa pine stands would be treated to favor the retention of ponderosa pine over western juniper and would retain or promote a late seral condition.

See tables in Appendix I for a unit summary by alternative of seral/structural effects of commercial treatments.

Precommercial Thinning and Other Vegetation Treatments

Additional timber stand improvement activities are planned outside harvest units under all alternatives. Approximately 3,550 acres are proposed under Alternative B; 3,757 acres are proposed under Alternative C; and 2,007 acres are proposed under Alternative D.

The primary purpose of these treatments would be to reduce stand density and manage the species composition. Diseases such as western gall rust and mistletoe would also be reduced with these treatments. As previously described, precommercial thinning would reduce stand densities and the amount of late seral fir species present. Where precommercial thinning is proposed in stands that are fully stocked with larger diameter trees, the smaller diameter understory would be removed, thereby reducing the number of tree canopy layers. Stand structure in these cases would be moved towards single stratum conditions where one or two tree canopies remain after treatment.

Juniper reduction is proposed under each alternative to enhance wildlife habitat for forage. The method of treatment being proposed is a combination of underburning followed by mechanical treatment with a chainsaw. Alternative B proposes to reduce juniper on approximately 8,339 acres; Alternative C proposes 4,549 acres; and Alternative D proposes 5,183 acres. Prescribed underburning is expected to occur in a patchy or mosaic pattern, be low intensity, and result in a minor reduction of juniper in the smaller size classes. In some areas, a follow -up treatment removing additional juniper by chainsaw is expected due to the lack of continuity of fuels to carry the fire. This treatment is not anticipated to result in changes to seral and structure conditions of conifer stands as treatments would be focused on smaller diameter juniper (less than 10 inches in diameter at breast height). Dry shrub communities (sagebrush) would undergo structure changes due to a reduction in tree numbers.

Natural fuels reduction using fire is being proposed under each alternative. No quantitative effects to stand structure or species composition are expected through these activities as no silvicultural objectives have been incorporated into the fuels reduction objectives. However, small pockets of tree mortality in smaller diameter trees and individual larger trees are expected. When present, small diameter fir and western juniper would be more susceptible to bole damage and be expected to have a higher incidence of mortality than ponderosa pine or larger diameter trees. Fuels objectives include not only a reduction in ground fuels but removal of a portion of the live crowns of trees when live crowns are within 12-20 feet of the ground. This “pruning” effect would reduce ladder fuels.

Comparisons of the differences for seral/structure stage effects of treatments between alternatives are displayed in a series of tables below. Table 4-6 displays the acres treated by seral stage. Table 4-7 shows the acres treated by structure class. These tables reflect gross unit acres for HSG (group selection) treatments.

Table 4-6 Acres of Treatment for each Alternative by PAG and Seral Stage

PAG:	Seral Stage	Alt. (Acres)	Alt. B	Alt. C	Alt. D
Moist Grand Fir	Early	0	0	0	0
	Mid	0	27	0	0
	Late	0	20	20	20
Dry Grand Fir	Early	0	1935	826	1037
	Mid	0	5133	3744	3365
	Late	0	1125	582	468
Douglas-fir	Early	0	751	9	778
	Mid	0	881	460	816
	Late	0	0	0	0
Mesic Ponderosa Pine	Early	0	55	23	55
	Mid	0	1299	624	699
	Late	0	438	278	509
Xeric Ponderosa Pine	Early	0	0	0	0
	Mid	0	0	0	0
	Late	0	0	0	0

Table 4-7 Ac. of Proposed Treatments /Structure Stage /PAG by Action Alternative

Alternative B				
Structure:	**G/F/S, Seed/Sap**	**Pole**	**Small**	**Medium/Large**
Moist Grand fir	0	20	0	27
Dry Grand Fir	92	1980	2747	3378
Douglas-fir	28	1085	179	340
Mesic PP	32	677	535	548
Xeric PP	0	0	27	0
Alternative C				
Structure:	**G/F/S, Seed/Sap**	**Pole**	**Small**	**Medium/Large**
Moist Grand fir	0	20	0	0
Dry Grand Fir	92	359	2159	2576
Douglas-fir	0	102	127	342
Mesic PP	0	331	239	397
Xeric PP	0	0	0	0
Alternative D				
Structure:	**G/F/S, Seed/Sap**	**Pole**	**Small**	**Medium/Large**
Moist Grand fir	0	20	0	0
Dry Grand Fir	92	519	1978	2280
Douglas-fir	28	1066	199	302
Mesic PP	32	642	352	237
Xeric PP	0	0	0	0

Cumulative Effects on Seral/Structural Abundance and Distribution: The HRV analysis and existing condition presented in Chapter 3 includes the cumulative effects from all past vegetation management activities in the watershed, including the Summit T.S., the most recent past sale inside this watershed. Post sale precommercial thinning activities planned in the Summit units is also considered in summaries of cumulative change in seral species and structure for upland conifer associations. Precommercial treatments under Summit will further reduce understory tree densities and favor removal of late seral species such as white fir. No other timber vegetation management activities are planned within this watershed within the foreseeable future. Activities proposed under the Deep Restoration EA and Deep/Roba Allotment updates will not affect upland conifer stand attributes within the watershed as no activities for conifer stands are proposed.

Effects from the Summit Timber Sale stand treatments of intermediate harvest followed by pre-commercial thinning include changes in stand structure and species composition similar to the description of intermediate treatments discussed previously. Canopy layers were reduced shifting stand conditions towards a more open stand. Late seral fir species such as grand fir and Douglas-fir were reduced leaving the stands with a higher percentage of ponderosa pine than before treatment. Most stand structures were multi-story before receiving the intermediate thinning treatments and have retained a multi-story condition after treatment although each of the lower canopy layers (middlestory and understory) has reduced tree densities and therefore appears more open. The younger ponderosa pine stands thinned that were single-stratum before treatment remains as single-stratum but at reduced densities and crown cover.

Other ongoing activities within the watershed affecting forest vegetation include natural fuels reduction activities from the Summit Environmental Analysis. Effects from prescribed fire are not expected to change stand conditions, however there is a low potential for stand structure change. Loss of large trees can also occur during underburning activities where duff layers have built up and form a mound at the base of the tree. Tree roots under the duff and needle cast is susceptible to long-term smoldering common to these mounds under certain burning conditions. Estimates of tree mortality from observing past natural fuels reduction activities using prescribed fire indicate low levels of mortality in size classes greater than 5 inches in diameter. Tree mortality is generally distributed in relatively small patches that do not result in changes to overall stand structure.

Appendix I shows effects by alternative for seral/structure stages for each plant association group from all commercial and non-commercial stand treatments proposed under this analysis for each alternative. The following table displays the cumulative summary of individual effects on the overall distribution and abundance of seral/structural conditions within the watershed from all past, current and reasonably foreseeable stand treatments.

Table 4 -8 Overall Acres within HRV for Deep Planning Area after Treatment

	Alt. A	Alt. B	Alt. C	Alt. D
Acres Within HRV	17,000	21,503	20,725	19,961
% Within HRV	43%	54%	52%	50%

In summary, each action alternative moves a portion of the land base closer to being within HRV. Alternative B shows the highest relative gain toward HRV. For comparison, Alternative A represents the existing condition. Alternative B increases the amount of the land within HRV by 11 percent, Alternative C increases the portion of the land base within HRV by 9 percent, and Alternative D increases the portion of the land base within HRV by 7 percent. Although future vegetation management has not been proposed or identified at this time, continued movement toward HRV would likely require additional future management actions. When proposed, effects of future actions would be analyzed under a new environmental analysis.

Late and Old Structure (LOS) Direct and Indirect Effects: Stand treatment designs proposed for LOS stands would contribute toward meeting several of the stated Purpose and Needs identified for the Deep Analysis. Treatments proposed for LOS structure are intermediate improvement cuttings and thinnings that would remove small diameter, understory trees. Reducing the understory tree density in LOS stands would in turn reduce canopy layers, decrease ladder fuels and reduce inter-tree competition. Treatments in late and old structure would incrementally move landscape conditions towards the HRV range for single-stratum stands without loss of current LOS; reduce LOS susceptibility to stand replacement wildfire events; and reduce the susceptibility to insects and disease so that current LOS levels may be maintained in the short-term (5-10 years).

Alternative B proposes to treat approximately 4,293 acres of LOS while Alternative C proposes to treat 3,315 acres. Alternative D proposes to treat approximately 2,819 acres. The proposed intermediate vegetation treatments would increase the proportion of early seral species and reduce stand densities without reducing the number of large trees. In addition, some treatments would move multi-stratum stands to single-stratum within the dry grand fir, Douglas-fir, and mesic ponderosa pine plant association groups. See Table 4-9 for acres of treatment proposed by plant association group.

Table 4- 9 Proposed Acres of LOS Treatments by Alternative

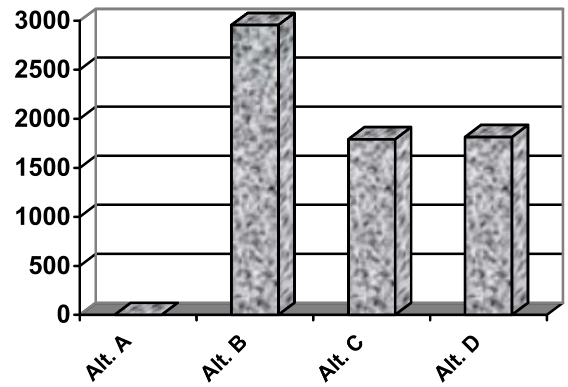
	Alt. B	Alt. C	Alt. D
Moist Grand Fir	27	0	0
Dry Grand Fir	3,378	2,576	2,280
Douglas-fir	340	342	302
Mesic Ponderosa Pine	548	397	237
Xeric Ponderosa Pine	0	0	0
Total Acres	4,293	3,315	2,819

Vegetation treatments for dry grand fir and Douglas-fir associations will increase the amount of early seral species by favoring their retention and removing a proportion of the late seral Douglas-fir and grand fir. This change in species composition would also reduce wildfire effects by favoring fire resistant species such as western larch and ponderosa pine. Incremental reduction of understory fir species would move landscape conditions towards the HRV seral stage ranges that are currently outside HRV by 72 percent. Treatments reducing fire hazards would occur on approximately 3,718 acres of LOS stands under Alternative B; 2,909 acres under Alternative C and 2,582 acres under Alternative D. The risk of insect and disease effects within these LOS stands would be reduced.

For mesic ponderosa pine associations, ponderosa pine is late seral and would be favored for retention over early seral species such as western juniper. Treatments for LOS in the mesic ponderosa pine associations would occur on approximately 548 acres under Alternative B; 397 acres under Alternative C; and 237 acres under Alternative D. No LOS structure in the xeric ponderosa pine is proposed for commercial treatments, as little LOS currently exists.

Approximately 8,052 acres of LOS are rated as high priority due to high stand densities. These high densities are due to understory tree development over the last 80-150 years and contribute to the imbalance between single-stratum and multi-stratum LOS conditions when compared to HRV. Alternative B proposes to reduce understory tree density on 2,957 acres of high priority LOS stands; Alternative C, 1,792 acres of LOS stands; and Alternative D, 1,814 acres of high density LOS stands (Figure 4-2).

Figure 4-2 Acres of High Priority LOS Stands Treated for Density



Where stand densities are above sustainable levels for the site, treatments would reduce stand density primarily through thinning from below and removing the smaller diameter trees. Large diameter trees 21 inches and larger would be retained.

Dense stands promote competition-related stress that reduces the vigor of trees, thus promoting an elevated risk of adverse impacts from inter-tree competition, insects, and disease. Large diameter, older ponderosa pines are especially sensitive to high stand densities. Western pine beetle often attacks older ponderosa pines under these conditions. Treatments would reduce stand densities to lower the risk of insect and disease disturbances to within the range of historic occurrences. Moving stands toward a more open, single-stratum condition would also reduce ladder fuels and lower the risk of fire effects above natural disturbance levels. Overall, under all action alternatives, treatments would help maintain and enhance existing LOS, reduce the risk of loss, and accelerate the development of future LOS.

Table 4- 10 Comparison of Acres of LOS Stands after Treatment

PAG	HRV Range (Acres)	Alt. A No Action	Alt. B Proposed Action	Alt. C	Alt. D
Moist Grand Fir					
Multi-stratum	36--97	157	157	157	157
Single-stratum	78--175	124	124	124	124
Dry Grand Fir					
Multi-stratum	2,093--5,815	6,718	3,886	4,916	4,962
Single-stratum	10,700--20,004	2,044	4,876	3,846	3,800
Douglas-fir					
Multi-stratum	203--760	999	802	786	801
Single-stratum	2,431--3,798	224	421	437	422
Mesic PP					
Multi-stratum	73--509	542	147	192	305
Single-stratum	4,289--6,179	153	548	503	390
Xeric PP					
Multi-stratum	29--145	41	41	41	41
Single-stratum	727--1,570	0	0	0	0
Totals					
Multi-stratum	2,434--7,326	8,457	5,033	6,092	6,266
Single-stratum	18,225--31,726	2,545	5,969	4,910	4,736
Grand Total		**11,002**	**11,002**	**11,002**	**11,002**

No net loss of LOS would occur under any of the action alternatives. None of the action alternatives bring the single-stratum LOS within the range of variability for the watershed; however, all action alternatives do bring the overall abundance of multi-stratum LOS within the range. *Alternative B moves single-stratum LOS closest to the desired ranges, followed by Alternative C, and finally Alternative D.*

Table 4-11 displays the effects of treatments of LOS stands and younger stands on LOS structures over time. Projections assumed that no additional vegetation treatments would occur. The table contains growth projections for stands treated by the Deep project and untreated stands.

Table 4- 11 Comparison of Acres of LOS Stands after 50 Years

PAG	HRV Range (Acres)	Alt. A No Action	Alt. B Proposed Action	Alt. C	Alt. D
Moist Grand Fir					
Multi-stratum	36-97	281	281	281	281
Single-stratum	78-175	0	0	0	0
Dry Grand Fir					
Multi-stratum	2,093-5,815	8,237	9,355	9,982	9,350
Single-stratum	10,700-20,004	528	1,189	846	851
Douglas-fir					
Multi-stratum	203-760	1,297	1,536	1,548	1,518
Single-stratum	2,431-3,798	31	0	0	0
Mesic PP					
Multi-stratum	73-509	1,012	681	726	826
Single-stratum	4,289-6,179	0	566	458	320
Xeric PP					
Multi-stratum	29-145	209	209	209	209
Single-stratum	727-1,570	0	0	0	0
Totals					
Multi-stratum	2,434-7,326	11,036	12,062	12,746	12,184
Single-stratum	18,225-31,726	559	1,755	1,304	1,171
Grand Total		**11,595**	**13,817**	**14,050**	**13,355**

For each alternative, a general pattern of increases in LOS can be seen at 50 years for the dry grand fir, Douglas-fir, and mesic ponderosa pine plant association groups. For the action alternatives, this increase reflects additional stands that have since grown into LOS due to treatments. Alternative B projects approximately 13,817 acres of LOS in 50 years. Alternative C projects approximately 14,050 acres and Alternative D projects 13,355 acres. The No Action Alternative results in approximately 11,595 acres of LOS on the landscape within 50 years. Managing stand densities under the action alternatives would promote higher rates of growth and higher levels of LOS development over the next 50 years.

Additional multi-stratum stands of LOS are created through the loss of single-stratum stands resulting from understory tree development, and over time, additional losses of single-stratum LOS structure could be expected. The deficit in single-stratum LOS increases in almost every plant association group. Mid-seral LOS for dry grand fir and Douglas-fir show such a decrease in acreage that their status is expected to change from within to below HRV over the next 50 years.

Some additional non-LOS stands would be expected to grow into large structure (a relatively small amount projected due to current stand densities and slow growth rates). Multi-stratum LOS is expected to continue to develop over the next 50 years, thus increasing the current disproportionate levels of multi-stratum structure across the landscape.

Cumulative Effects for LOS: The deficit in single-stratum LOS within the watershed would be reduced after vegetation treatments under each of the action alternatives. However, based on the relatively low number of acres proposed for treatment and the size of the existing deficit, single-stratum LOS will remain below HRV. The historical range of single-stratum LOS for this watershed is between 18,225 and 31,726 acres. Currently, there are 2,545 acres of single stratum LOS conditions. Alternative B would move 3,424 acres of multi-stratum LOS to single-stratum LOS for a total of 5,969 acres of single-stratum LOS. Alternative C would move 2,365 acres of multi to single-stratum LOS for a total of 4,910 acres of single-stratum LOS. Alternative D would move 2,191 acres of multi to single-stratum LOS for a total of 4,736 acres of single-stratum LOS.

The vegetative change over the last 80-150 years is due to the absence of fire and past timber management activities. This would be adjusted incrementally over time with additional vegetation restoration to lower risk and help develop and maintain LOS. Any future vegetation management proposals would analyze the effects on LOS in an environmental analysis. No future upland vegetation management projects are presently planned.

Stand Density Direct and Indirect Effects: Proposed treatments address the Purpose and Need for density management for all stand structural stages to reduce susceptibility to insects, disease and wildfire. Current vegetation conditions indicate 37 percent (14,369 acres), of the forested lands within the watershed are at stand densities within the upper third of their site potential. Understory tree establishment and development over the last 100-150 years has resulted in these stands reaching the upper levels of site potential. These upper density levels are not sustainable over time and are rated as high priority for treatment due to reduced tree vigor and the increased potential for competition-related tree mortality. Stands with low vigor trees are more susceptible to insects and disease. Elevated levels of tree mortality also contribute to fuel loads and the risk of stand replacing wildfire.

Table 4-12 Acres at Risk Treated by each Alternative

	Alt. A – No Action	Alt. B – Proposed Action	Alt. C	Alt. D
Overall Acres at Risk Treated	0	4,519	3,134	2,842
LOS Acres at Risk Treated	0	2,957	1,792	1,814

Treatments under each of the action alternatives would reduce stand densities to levels considered low to moderately low risk. Generally, these densities would be between 35-47% of maximum density for the site. Where treatments are designed to meet other resource objectives, such as visual corridors, Riparian Management Objectives (RMOs), Post Fledgling Areas (PFAs), and connectivity (Reference Chapter 2, Design Elements by stand), silviculture treatments would leave densities between 47-66+% of the maximum density of the site. Where densities are left at higher levels, in order to maintain desired stand conditions, the next treatment entry would need to occur sooner than in stands managed at lower initial densities.

Where stands are currently at high risk, reducing stand densities would reduce the risk of moderate and high severity wildfires. Tree and crown density and continuity would be altered; therefore fire would not carry as rapidly through the stand. Smaller trees that contribute to both stand density and ladder fuels would be removed. Tree vigor would improve with decreased tree competition and trees would have more resistance to insects and disease. As stand density is reduced, species composition is altered to improve the overall stand's susceptibility to insects and disease. Stand density may also alter some stand structures thus reducing the canopy layers that promote favorable conditions for insects and disease.

Cumulative Effects on Stand Density: Alternative B proposes treatment of 32% of the existing high-risk stands within the watershed. Alternatives C and D, respectively, propose treatment of 22%, and 20% of the existing high-risk stands inside the watershed.

In summary, 37% of the stand densities in the watershed are at high risk and are not sustainable at their current condition. Density treatments under Alternative B would result in a 12% reduction, Alternative C, 9%, and Alternative D, 8%.

RHCA Vegetation Treatments Direct and Indirect Effects: Vegetation treatments within the Riparian Habitat Conservation Areas (RHCAs) address the Purpose and Need to improve and enhance aspen, riparian shrubs, and meadow communities. The Purpose and Need to increase the amount, distribution, and growth of riparian associated plants, increase stream shading, reduce sedimentation, and increase recruitment of LWM, is also addressed.

Upland Conifer Forest within RHCAs

Restoration treatments using commercial thinning and precommercial thinning of conifers have been proposed in Alternatives B, C, and D. Treatment prescriptions are site specific and are designed to meet site specific RMOs. Implementation of these treatments will include the design criteria for RHCAs.

Commercial Thinning Treatments. Under Alternatives B and C, 24 acres out of 6,333 acres of existing RHCAs would receive commercial harvest. These acres represent approximately .03% of the total RHCAs. The treatment types would be a combination of commercial thinning followed by post-sale precommercial thinning. Riparian Management Objectives (RMOs) have been identified for the proposed commercial thinning treatments for each of the seven different sites within stream class III and IV RHCAs. A prescription design has been planned with the Fisheries Specialist to meet the RMOs.

For commercial harvest treatments, additional design criteria establish a 100-foot no harvest buffer for the Class III and a 20-foot no harvest buffer for the Class IV streams. Harvest operations would either be over snow for ground-based equipment or by cable or helicopter to further minimize soil disturbance within the treatment area. Seven sites are proposed for treatment. Alternative D has no commercial harvest thinning treatments proposed within RHCAs. Table 4-13 below shows the commercial thinning acres (by RMO) that are proposed within each stream class.

Table 4- 13 Acres of RHCA Commercial Treatments by Alternative by Objective

Alternative	Increase Shade/LWM	Decrease Adverse Fire Impacts	Increase Understory Development To Promote Channel Stability
Alt. A	0	0	0
Alt. B	4	8	12
Alt. C	4	8	12
Alt. D	0	0	0

Under Alternatives B and C, in order to increase shade and develop future LWM, commercial thinning treatments followed by post-sale precommercial thinning, are proposed on 4 acres within the RHCA of a Class III stream. The commercial treatment would start 100 feet from the stream edge. To lessen competition, thinning would reduce the number of smaller, subordinate trees present in the middle and understory. Trees would benefit from increased growing space, moisture and nutrient availability, and solar radiation to the crown. This would result in a positive-growth response for crown characteristics that increase canopy cover and shading (Cochran and Barrett 1999; Long 1985). Trees would increase height and crown ratio thereby cumulatively increasing overall effective shading for the stream. These same growing conditions would stimulate growth responses in diameter and promote long-term development of LWM (Cochran 1998; Cochran and Barrett 1998; Cochran and Seidel 1999). The degree of tree removal from thinning the smaller trees within the stand would vary inside the treatment area but, generally, the density of trees to be retained would range from 30-50 percent of the maximum stand density index (SDI) to achieve the RMOs. As thinning starts 100 feet away from the channel edge, no reduction in shade on the stream is expected. The site potential for trees at 100 years for these sites ranges from 68-83 feet (Plant Associations of the Blue and Ochoco Mountains).

Treatments designed to decrease adverse impacts from fire are proposed for 8 acres within the RHCA of a Class IV stream for Alternatives B and C. The treatment would start 20 feet from the channel edge and would decrease the understory and middlestory component of the stand canopy. Selecting smaller trees for removal that have dead and live limbs in close proximity to the ground would accomplish this. Select tree removal would result in "lifting" of the lower crown canopy. Lifting of the lower crown canopy reduces the potential of a ladder effect of fire moving from the ground into the lower crowns and later into the higher canopy layers.

Thinning treatments that increase understory development and promote channel stability are proposed for 12 acres inside the RHCA of a Class IV stream. Tree canopy cover influences the potential understory herbaceous cover by reducing the amounts of sunlight reaching the forest floor (Hall 1989; Oliver and Larson 1990; Kimmins 1987). Commercial thinning would reduce the tree canopy cover on these 12 acres, allowing increased sunlight to reach the forest floor and stimulating understory development. As grass and sedge plants develop and spread, their fine root systems increase the stability of the soils. These treatments would start 20 feet from the channel's edge along Class IV streams and would have a limited potential to produce a grass response that promotes soil stability inside the 20 foot buffer area where tree densities remain untreated.

In summary, the length of time after treatment until stand conditions contribute to meeting RMOs would vary by the desired vegetation characteristics described by the RMO and treatment. Objectives for reducing adverse fire effects would be achieved immediately after harvest, post harvest, and fuels treatments were completed. Objectives for increasing understory development to increase channel stability could be reached in a relatively short time. Improved conditions for growth of the understory vegetation would occur after treatment with plant growth response expected within the first two growing seasons. The process of stabilizing the soils and channel would be expected to occur over a slightly longer period of 1-5 years as the grasses and sedges continue to increase their influence on the site. The time expected to meet RMOs for increased shading and LWM would be relatively longer. These objectives are dependent on the current tree conditions and the ability of individual trees to take advantage of increases in site resources and sunlight. It is expected that crown growth objectives could be met within 20 years after treatment.

Precommercial Thinning Treatments. Alternatives B and C propose the same RHCA precommercial treatments for a total of 354 acres (representing 6 percent of the RHCA) and Alternative D proposes 202 acres (representing 3 percent of the RHCA). During field reconnaissance, multiple RMOs were developed which applied to specific sites. A detailed list of these RMOs by unit can be found in the analysis file. Treatment acres by stream class for each alternative are displayed in Table 4-14 below.

Table 4- 14 Acres of Precommercial Thinning with RHCAs by Stream Class

Stream Class:	Alt. A	Alt. B	Alt. C	Alt. D
I	0	41	41	28
II	0	203	203	125
III	0	40	40	8
IV	0	70	70	41
Total Acres	**0**	**354**	**354**	**202**

Precommercial thinning treatment (PCT) would move the existing stand to a desired condition that promotes the RMO. PCT of small trees would occur outside a 15 foot no treatment zone. Thinning would be from below so that the dominant seedlings or saplings would be left. The smaller trees cut would not be of a size capable of casting shade on the stream. Stream shade would not be reduced. RMOs identified for these areas are similar to those listed above for commercial thinning treatments with the addition of increased infiltration. To reach desired stand conditions that achieve the RMOs, site specific prescriptions use the same ecological concepts for inter-tree and tree-site relationships described above under commercial thinning. The major difference between the type of treatments is that precommercial thinning would only remove trees under 7 inches in diameter whereas the commercial thinning, followed by a post-sale precommercial thinning, would remove a wider range of diameters of trees including trees over 7 inches (but not over 21 inches). Treatments would reallocate the site's resources to trees capable of contributing to shading and future large woody material.

Hardwood Communities within RHCAs

The Deep EIS proposes treatments on 77 acres of aspen stands in Alternatives B and D, and 81 acres in alternative C, in an attempt to rejuvenate declining populations. See Alternative Maps (Chapter 2, Figures 2-4, 2-8, and 2-12) for locations and Appendix H for a table of treatments. Normally, aspen stands rejuvenate themselves through suckering. Current habitat conditions (e.g. encroaching conifers), grazing pressure from cattle, and increased numbers of native ungulates are preventing this from happening. Refer to page 3-23 for a description of the condition of these plant communities. Water tables have dropped and suckers are continually being hedged back to stand 1-2' tall, therefore never becoming replacements for the mature stand. The proposed action is to remove competing conifers to allow light necessary for a vigorous stand to reach the forest floor. The suckers would be protected from browsing through fencing, cages, or slash barriers (See Appendix H). Most treatment stands were chosen by the recovery potential estimated for the stand. The number and vigor of sprouts, condition of overstory trees in relation to insects and disease, and proximity of the water table, were used to estimate the recovery potential. The treatment of aspen stands is part of several proposed vegetation activities that are interrelated to improve riparian conditions. Several of the stands would have undersized culverts replaced. Large wood placement in stream channels, and planting woody shrubs in areas devoid, would help slow stream velocities. Road closures and dispersed recreation site rehabilitation would keep traffic out of riparian areas.

The black cottonwood site off Happy Camp Creek along with Aspen Unit #20 would be treated. The conifer competition would be removed, including limited trees up to 21" in diameter, and the area protected by a fence.

The Sa*lix drummondiana*, Drummond's willow, site is proposed for fencing and planting. There are several large groups of mature plants within the meadow, including scattered small, hedged plants along the Jackson Creek stream channel traverses the meadow. Drummond willow is a highly palatable browse species for big game, thus fencing the area would help protect this unusual population of willow from browsing. Cuttings taken from the mature plants can be planted along the channel to augment the established plants. An additional two-acre willow site is being treated under Alternative C. The site is a dense patch of *Salix lucida* var. *caudata,* and *Salix monochroma* surrounded by a conifer precommercial thinning unit. Conifers under 12" dbh would be removed and the site protected by a fence.

The proposed treatments in Alternative B and D would help restore 27 sites, or 45%, of the existing aspen stands within the analysis area (Alternative C treats the most at 29 sites). Removing conifer competition for light, water, and nutrients, is an important step to preserving riparian communities. Stream channel improvements require time to improve the physical condition of the stream. The immediate effect of competition removal and protection would help maintain the hardwood component until the beneficial effects of raising the water table are realized. (See Appendix H for protection measures).

Riparian communities provide important diversity on the landscape. They support more wildlife species than virtually any other habitat in the west (Tewksbury 1996). Fragmentation reduces the ability of these habitats to support a diversity of plants and wildlife. Any efforts to maintain, and hopefully increase, these remnant stands would help reduce fragmentation and increase the genetic diversity of hardwoods. The effects from all of the action alternatives would be beneficial for riparian communities.

Cumulative Effects of RHCA Vegetation Treatments: Alternatives B and C propose to treat a total of 378 acres, or 6 percent, of the RHCA while Alternative D proposes to treat 202 acres, or 3 percent, of the RHCA. Treatments would reduce stand density, promote tree vigor, crown and diameter growth, and understory grass and sedge development, and reduce fire risk on 3-6 percent of the RHCA acres under the action alternatives. When 77-81 acres of aspen treatments are added to the total RHCA treatment acres for all alternatives, another 1 percent, or a total of 4-7 percent of the RHCA, would have treatments promoting riparian vegetation and RMOs.

The cumulative effects of fire suppression, roads, conifer invasion, and browsing by cattle and native ungulates have had detrimental effects on hydrology (See Water Quality and Fish Habitat, page 4-1) and riparian vegetation. Aspen habitat in general has been reduced to some isolated clones consisting of decadent overstory with little healthy reproduction. A properly functioning hydrologic system is required to produce vigorous stands of riparian shrubs and trees. In turn, healthy reproduction of riparian shrubs and trees is necessary to expand the density of the vegetation and to replace the overstory through succession. Browsing of the reproduction by native ungulates is one of the chief factors resulting in the lack of replacement shrubs and trees.

Recent timber harvest, precommercial thinning, and prescribed burning have reduced the trend of multi-story dense conifers, which encroach upon riparian vegetation. Summit Timber Sale and the Rager Aspen Treatment Project treated several aspen stands where conifers were removed and fences were to be installed. Cumulatively, these actions provide a short-term benefit for riparian vegetation. Long-term benefits would only be realized through improvements to hydrologic processes within the watershed. Several projects in the recent past have corrected head-cuts on Derr Creek and within Timothy and Toggle Meadows. Projects such as these are the types that would result in a long-term benefit for the physical environment and eventually, the vegetative communities. (See Cumulative Effects under Water Quality and Fish Habitat, page 4-2).

Direct and Indirect Effects on Upland Shrub Communities: There are no activities proposed within the 29 acres of upland shrub dominated plant associations in alternatives B and D.

Alternative C proposes to treat 16 acres in the western juniper/mountain-mahogany/Idaho fescue-bluebunch wheatgrass plant association. Juniper, and the occasional ponderosa pine in the transition zone, are natural components of this particular plant association. However, the amount of cover is greatly increasing due to fire suppression. The treatment proposed includes juniper removal up to 12” in diameter and mechanical skidding to the nearest road to be used for firewood. Young plants would be protected with cages until they get to a size that can survive browse pressure. The effects of the proposed treatment would be beneficial to maintaining an uncommon and important plant association in a healthy condition within the watershed. Deer would benefit in the long-term by the increase of mountain mahogany, an important winter browse species.

Alternative B proposes 1,760 acres of timber harvest, prescribed natural fuels burning, precommercial thinning, and meadow enhancement projects within potential upland shrub habitat. Alternatives C and D propose roughly the same amount of treatment (1,470 acres), within potential upland shrub habitat. Most of these activities in the action alternatives are prescribed natural fuels treatments.

Timber harvest, precommercial thinning, and meadow enhancement activities would be beneficial to upland hardwoods. Conifers compete with hardwoods for water, nutrients and growing space; hardwoods benefit from a more open canopy.

Prescribed burning can be both detrimental and beneficial to upland shrubs. Detriments of fire to upland shrubs lie in the fact that both mahogany and bitterbrush are very susceptible to fire, especially during fall burning when soil moisture is low (Gruell 1985). All of the burning proposed is fall burning. However, fuel loading on upland hardwood sites is generally low. The mahogany is usually large enough to withstand low intensity fire, such as prescribed natural fuels burning, whereas bitterbrush is usually decumbent, therefore is more susceptible. Another detrimental factor is the long period needed for regeneration. Loss of plants in the short term, with uncertain regeneration results is a possibility. Adding slash from harvest and precommercial thinning would increase burning intensity, therefore increasing the risk of affecting upland hardwoods.

Silviculture prescriptions would incorporate burning standards to benefit mahogany and bitterbrush. These standards include: allowing the fire to back into shrub areas, rather than direct lighting underneath them, to reduce fire intensity. Slash lopping standards of less than two feet, and allowing the activity fuels to cure for a few seasons can also reduce intensity by having the fine fuels on the ground rather than up in the air.

Benefits can include conifer reduction, seedbed preparation through litter reduction, and killing decadent mature shrubs. Upland shrubs can be regenerated by fire under the right conditions. Both mountain-mahogany and bitterbrush have weak sprouting capabilities; and sprouting potential declines with shrub age. Mahogany regenerates through wind blown seed on mineral soil, and less often, through a seed bank already present in the soil. Bitterbrush usually regenerates through rodent caches after the litter layer is reduced by fire.

Cumulative Effects on Upland Shrub Communities: The cumulative effect of fire suppression, conifer invasion, and browsing by cattle and native ungulates has had detrimental effects on upland shrubs. Recent burning within the juniper/shrub ecotone would have a long-term benefit to shrubs, as would the actions proposed in Alternatives B, C, and D. Browsing by native ungulates would continue and would have a negative effect on the rate of recovery of these species.

Fire Hazard and Fuels

The measurements used to assess and compare the effects of the alternatives include:

1. Amount of prescribed burning to emulate natural disturbances;
2. Reduction of overall fire hazard;
3. Change in expected fire effects.

All fuel treatments would comply with the Forest-wide Standards and Guidelines for Fire (LRMP, page 4-129-138), Forest Residues (LRMP, page 4-154-158), and the Management Area Standards and Guidelines for all management areas within the planning area. Unit-specific objectives and effects for each prescribed fire unit are presented in Appendix E (pages E-6 to E-9).

ALTERNATIVE A (NO ACTION)

Direct and Indirect Effects: This No Action Alternative does not treat existing fuels nor does it create activity fuels. Direct and indirect effects expected from the No Action Alternative would be the continued accumulation of natural fuel levels. Higher density stands would continue to develop, contributing to overall fuel abundance as well as horizontal and vertical continuity of fuels. As fuel levels increase the severity of any wildfire would increase. This alternative proposes no treatments that would reduce the hazard of active crown fire initiation. This would result in higher suppression costs and increased loss to resources. This alternative does not address the Purpose and Need.

Cumulative Effects: Additional activities to reduce fuel levels are ongoing from the Summit Timber Sale. Precommercial thinning identified in the Summit Environmental Assessment has already begun, and a total of 1,085 acres is planned. Thinning would contribute to a short-term increase in horizontal fuel continuity. The Summit Environmental Analysis also proposed 8,744 acres of prescribed natural fires. Burning would be low intensity and would reduce natural fuel loads within the Deep Planning Area. Cumulative effects under Alternative A for this watershed would be approximately 9,429 acres of hazard and fuels reduction.

ALTERNATIVES B (PROPOSED ACTION), C, AND D

Direct and Indirect Effects: Appendix E provides unit-specific objectives and effects of all fuels treatments. The long-term effects of prescribed fire include increased stand vigor, reduced fuel loading, and reduced risk of higher severity fire effects.

Natural burning would target existing reproduction that is less than two feet in height and juniper encroachment within conifer stands. This will be accomplished by using natural barriers along the proposed boundaries, and constructing containment lines only if a natural barrier is not available or the fire jumps intended boundaries. Fire would not be used as a tool for large-scale vegetation management of tree species, and would not change stand structure above the seedling or sapling size. These burns would be allowed to back into RHCAs to produce a mosaic burn pattern near stream boundaries. The Burn Boss and the District Fisheries Biologist would closely monitor burns to ensure that RMOs are being met and. Prescribed fires would take place during the fall since higher elevations are generally not dry enough for the spring burning period. Stands would be monitored to ensure that fuel moistures, weather conditions, and fire behavior are appropriate to meet burning objectives. These fires would be a low to moderate severity (<4' flame lengths), with little effect on existing vegetation. Some scorching may occur but should be limited to less than 30 percent of crown area to ensure survival of existing trees.

Post harvest treatments would be reviewed by an interdisciplinary team to ensure that the proposed treatment meets objectives of the prescription. All burning would be covered under a Burn Plan, describing the prescription and objectives of the burn in detail.

Re-introduction of Fire to Emulate Natural Disturbances: Each of the action alternatives includes prescribed fire that would be implemented at low intensities to address the objectives for this project. The treatments displayed represent the combination of natural fuels reduction, fuel continuity reduction, and forage enhancement/juniper reduction as described in Chapter 2. Table 4-15 illustrates the amount of acreage by alternative that is prescribed for each objective.

Table 4- 15 Prescribed Burning by Treatment Objective

	Alt A	Alt. B	Alt. C	Alt. D
Fuel Reduction	0	11,661	4,192	3,293
Forage Enhancement Juniper Encroachment	0	8,339	4,549	5,183
Fuel Continuity (Jackpot Burning)	0	692	0	0
Total Acres Prescribed Burning	**0**	**20,692**	**8,741**	**8,476**

Alternative B proposes approximately 20,692 acres for burning activities. It reduces natural fuel concentrations on more than twice the acres of either Alternative C or D. It contains fuel continuity burning (also called jackpot burning) to reduce the potential for wildfire spread in the north end of the planning area where fuels are currently at high levels. The intensity and spread of wildfire will be reduced because the horizontal continuity and concentrations of fuels are reduced. Neither Alternative C nor D proposes this type of burning. Alternative B proposes more acres of forage enhancement and juniper reduction than Alternatives C and D. Overall, Alternative D does the least to address current fuel conditions and overall risk of wildfires. Alternative B is the most effective at the re-introduction of fire on the landscape.

Units proposed for prescribed fire are grouped based on similarity in species composition, tree density, and fuel loading. The units are grouped for analysis of effects as follows:

Table 4-16 Prescribed Fire Unit Grouping

Group Number*	Plant Community Composition	Alternative B Units	Alternative C Units	Alternative D Units
1	70% ponderosa pine/elk sedge or ponderosa pine/pinegrass 30% stuff sagebrush/Sandburg's bluegrass	8, 9, 11, 12, 13, 18, 19, 21, 26, 27, 28	9, 11, 12, 19, 21, 28	9, 11, 12, 19, 21, 28
2	70% Douglas-fir/pinegrass 10% grand fir/pinegrass 20% stuff sagebrush/Sandburg's bluegrass	3, 20, 25	3, 15, 20, 29	3, 15, 16, 17, 29
3	60% grand fir/pinegrass 30% Douglas-fir/pinegrass 10% stiff sagebrush/Sandburg's bluegrass	2, 4, 5, 6, 7, 10	7, 26, 27	26, 27
4	80% ponderosa pine/elk sedge 20% Douglas-fir/pinegrass	17, 22	17, 22	17, 22
5	20% grand fir/pinegrass 50% Douglas-fir/pinegrass 10% ponderosa pine/elk sedge 20% stiff sagebrush/Sandburg's bluegrass	14, 15, 16, 23	14	14

*See Appendix E for a description of these sites.

Appendix E contains numerous tables for the five groups of units displaying the existing tree composition, the existing and post-burn fuel loading, existing and post-burn snag conditions, and effects on duff and litter. Please refer to this appendix for more detailed information on the prescribed fire activities. The fire and fuels extension to the Forest Vegetation Simulator was used to estimate the effects of treatment.

Activities proposed for Group 1 units may be either underburning or juniper reduction, followed by underburning. Some units may have both treatments applied. Refer to table 4-16 for which units are proposed for treatment by alternative. Though underburning is prescribed, for Group 1 type of units, the effects are anticipated to be more similar to a jackpot burn, where concentrations of fuels are burned and other portions of the units are lightly burned or unburned. The non-forested areas have insufficient fuel continuity to carry a fire. The resultant trees per acre by size class, standing dead trees, and post-burn fuel loading, are displayed in tables in Appendix E, pages E-9 to E-10. The effects of the prescribed fire proposed in Alternatives B, C, and D would reduce trees per acre less than 5 inches dbh by about 64%, with western juniper being the most affected. About 97% of trees larger than 5 inches dbh would be retained. Fuel treatments in Alternatives B, C, and D would reduce the < 3" diameter fuel category from an average of 4 tons per acre to 3 tons per acre. This would reduce potential fire spread rates and intensity. Standing dead trees are estimated to increase from an average total of 1.4 to 1.82 snags per acre. Existing snags may be consumed by the prescribed fire while new snags would be crated through the combined effects of the prescribed fire and insects or diseases. After the prescribed fire, snag levels would be within desired ranges.

Activities for Group 2 units may be either underburning or juniper reduction, followed by underburning. Some units may have both treatments applied. As with Group 1 units, the underburning in Group 2 units will be similar to a jackpot burn, where concentrations of fuels are burned and other portions of the units are lightly burned or unburned.

For Group 2 units the effects of the prescribed fire proposed in Alternatives B, C, and D would reduce trees per acre less than 5 inches dbh by about 64%, with western juniper being the most affected. About 77% of trees larger than 5 inches dbh would be retained. For trees larger than 5 inches dbh, most of the loss occurs in western junipers 5 to 8.9 inches dbh. Fuel treatments proposed in Alternatives B, C, and D would reduce the < 3" diameter fuel category from an average of 7 tons per acre to 3 tons per acre. This would reduce potential fire spread rates and intensity. Estimated mineral exposure is 36 percent. Standing dead trees are estimated to decrease from an average total of 4.7 to 2.58 per acre. The prescribed fire may consume existing snags while new snags would be created through the combined effects of the prescribed fire and insects or diseases. Based on the plant association composition of units within Group 2, the snag levels will still be within the desired ranges.

As with the other groups, activities proposed for Group 3 units may either underburning or Juniper reduction followed by underburning, or a combination of both. See table 4-16 for which units are treated by each alternative. Under Alternative B, Unit 18 is proposed for a fuelbreak. A fuelbreak would involve removal of an increased amount of surface fuels, and thinning to remove ladder fuels to reduce the potential for crown fire.

The effects of the prescribed fire proposed in Alternatives B, C, and D for group 3 units would reduce trees per acre less than 5 inches dbh by about 64%, with grand fir, Douglas-fir and western juniper being most affected. About 83% of trees larger than 5 inches dbh would be retained. Fuel treatments proposed in Alternatives B, C, and D would reduce the <3 inches diameter fuel category from an average of 7 tons per acre to 4 tons per acre. This would reduce potential fire spread rates and intensity. Estimated mineral soil exposure is 36 percent. After prescribed fire, snag levels would not meet desired ranges, but would be within desired ranges about 15 years after treatment. Retention of existing snags may be increased through adjustment of lighting pattern, or clearing fuels around the base of snags.

For Group 4 units, the effects of prescribed fire proposed in Alternatives B, C, and D would reduce trees per acre less than 5 inches dbh by about 65%, with grand fir, ponderosa pine, and western juniper being the most affected species. About 95% of trees larger than 5 inches dbh would be retained. Fuel treatments proposed in all action alternatives would reduce the <3 inches diameter fuel category from an average of 6 tons per acre to 4 tons per acre. This would reduce potential fire spread rates and intensity. Estimated mineral soil exposure is 36%. Standing dead trees are estimated to decrease slightly from an average total of 2.8 to 2.7 snags per acre. Existing snags may be consumed by the prescribed fire while new snags would be created through the combined effects of the prescribed fire and insects and diseases. See table 4-16 for which units are treated by each alternative.

Activities proposed for Group 5 units may either be underburning or Juniper reduction, followed by underburning, or a combination of both. The effects of the prescribed fire proposed in Alternatives B, C, and D would reduce trees per acre less than 5 inches dbh by about 64%, with grand fir, Douglas-fir, and western juniper being the most affected. About 81% of trees larger than 5 inches dbh would be retained, most of the loss would be grand fir and western juniper 5 – 8.9 inches dbh. Fuel treatments proposed would reduce the <3 inches diameter fuel category from an average of 6 tons per acre to 3 tons per acre. This would reduce the potential fire spread rates and intensity. Estimated mineral soil exposure is 36%. Standing dead trees are estimated to decrease from an average total of 4.2 to 2.63 snags per acre.

Acres where Fire Hazard has been Reduced: Each of the action alternatives proposes treatments that would reduce the overall fire hazard within the watershed to some extent. Treatments that have the potential to reduce these hazards are listed in Table 4-17. A discussion of how each treatment reduces fire hazard follows the table.

Table 4- 17 Activities that Reduce Overall Fire Hazard

Activity	Alt A	Alt B	Alt C	Alt D
Commercial Harvest*	0	5,525	5,696	5,021
Precommercial Thinning	0	3,550	3,757	2,007
Aspen Treatment	0	77	81	77
Meadow Treatment	0	825	825	825
Natural Fuels Burning**	0	20,692	8,741	8,476

* Only includes commercial activities acres outside of natural fuels units.
** Activity units within natural fuels units are included in these acres.

Commercial harvest, precommercial thinning, and aspen and meadow enhancement prescriptions all entail thinning prescriptions that are predominately thinning from below. These treatments would remove a portion of the understory resulting in a reduction of the ladder fuels within these stands. This would help reduce the vertical continuity of fuels, thereby reducing the overall hazards of fire. These treatments would, however, initially increase the amount of ground fuels within units. Treatments of these activity fuels would be delayed until they are sufficiently dry for prescribed burning. Therefore, increased horizontal continuity of fuels would last for approximately two to five years. Once these fuels are treated, these areas would have a reduced level of ladder and ground fuels. Alternative B proposes the highest level of commercial and precommercial treatments. It would generate more activity fuels in the short term but would have the greatest potential to reduce overall fire hazard in the long term. Alternative D would generate less activity fuels in the short term, but overall would do the least to reduce overall fire hazard within these treatment areas in the long term.

Prescribed fires would be implemented at low intensities and have natural fuel reduction and juniper reduction/wildlife forage enhancement objectives. This project would be the first entry for many stands, which have high fuel loading and stand structure changes from past activities and fire suppression. Multiple entries at varying intensities would have to be implemented over a period of years to complete the re-introduction of fire, emulating natural disturbance processes. This entry with fire is not intended to have a great effect on trees above the seedling/sapling size class. Because this area was predominately a short return interval, non-lethal fire system, large landscape level burning was common. All of the prescribed burning prescriptions would be low severity and burn in a mosaic pattern. Effects of fuels treatments are described in more detail in Appendix E. They would reduce a range of existing fuel loading across the landscape. Natural fuels underburning and forage enhancement/juniper reduction would help reduce the buildup of duff layers and small diameter trees that are contributing to ladder fuel accumulations. Jackpot burning would reduce larger concentrations of fuel by controlling the spread of wildfire and reducing the overall hazard associated with heavy fuel loading on the ground. Overall, Alternative B has the greatest potential to reduce fire hazard across the landscape, followed by Alternative C and D, respectively.

Acres Susceptible to Elevated Fire Severity Compared to HRV: The vast majority of the treatments proposed under all alternatives are within the areas that have historically carried a non-lethal historic fire regime. Alternative B prescribes more treatment than Alternatives C and D. The level of treatment proposed has a direct effect on the alternative's ability to move the overall landscape closer to historical occurrences.

Table 4- 18 Comparison of the Alternatives on the Potential Fire Effects

Potential Fire Effects	Historical Range of Variability	Alt. A	Alt. B	Alt. C	Alt. D
Non-Lethal Effects	23,300 – 34,000 (59-86%)	10,677 (27%)	15,152 (38%)	13,395 (34%)	13,235 (33%)
Mixed Effects	1,700 – 10,700 (4-27%)	17,946 (45%)	15,251 (39%)	15,799 (40%)	15,928 (40%)
Stand Replacement Effects	3,300 – 14,200 (8-36%)	10,984 (28%)	9,207 (23%)	10,413 (26%)	10,446 (26%)
Acre Reduction in Stand-Replacement Conditions:		*0*	*1,777*	*571*	*538*

In summary, Table 4-18 shows that after treatment, Alternative B has the most dramatic effect at moving the area closer toward the historic range of variability. Fire effects from high severity fire would be anticipated more under Alternative A, followed by D, C, and B respectively.

Cumulative Effects on Fire Severity and Fuels: The acres presented under Alternative A in the above table reflect the potential of fire effects based on the existing condition that has been updated to reflect past activities. Summit Timber Sale has recently been completed using mechanized equipment that removed the majority of activity fuels from the stand, contributing little to short term increases in horizontal fuel continuity. A total of 1085 acres of precommercial thinning are planned for the Summit project, some of which has already been implemented. Thinning would contribute to a short-term increase in horizontal fuel continuity as described above. The Summit Environmental Analysis proposed 8,744 acres of prescribed natural fires. Burning would be low intensity as described above and would further reduce natural fuel loads within the Deep Planning Area.

Over time, allowing for stand development and growth and continued management aimed at meeting the forest stand and fuel objectives, additional area would move from the mixed and stand replacement categories to non-lethal. Eventually the area would reach HRV levels. Without future management, the area would return to having more potential for stand replacement fires. As stands with reduced access due to road closures or decommissioning are left to move toward higher density, late seral species conditions, the potential for stand replacement fires also increases.

OTHER ISSUES

<u>Air Quality</u>

Prescribed fire and wildfire have the potential to affect air quality. Due to local conditions, smoke will normally be transported by west/southwest winds in the early to late afternoon. Inversions in the area usually dissipate by mid morning. Local communities that may be affected by smoke would be Dayville, John Day, Paulina, Mitchell, Prineville, and Bend, Oregon. The Black Canyon Wilderness, which is a Class II airshed, is located approximately 6 air miles east of the planning area.

With prevailing winds from the west/southwest, areas to the south, southwest, west and northwest have very little potential for smoke intrusions. Due to distances to the Class I airsheds to the northeast, smoke transportation will disperse concentrations and alleviate most impacts.

ALTERNATIVE A (NO ACTION)

Direct, Indirect and Cumulative Effects: No prescribed fire would be introduced into the Deep Planning Area from this alternative. Therefore, this alternative would have no direct effect on air quality from management prescribed ignitions. This alternative would, however, carry a higher potential for more intense wildfires than would have occurred historically. This would leave the area susceptible to smoke emission from lightening and human-caused fires. Prescribed natural burning proposed under the Summit Environmental Analysis would occur on 8,744 acres as planned. Emissions from this burning are presented in Table 4-17.

ALTERNATIVES B (PROPOSED ACTION), C, AND D

Direct and Indirect Effects: Prescribed fire would produce the majority of emissions in the planning area. See Appendix E for further descriptions on smoke management and how prescribed burning would be conducted consistently with the *Interim Air Quality Policy on Wildland and Prescribed Fires.*

Table 4- 19 Tons of Total Suspended Particulates (TSP) Expected from Action Alternatives

	Alt. B	Alt. C	Alt. D
Tons Per Year of Suspended Particulate from all Treatment Acres	252	166	148
Tons Per year	944	520	486

Alternative B would produce the highest amount of emissions from the treatment of all the commercial and natural fuels acres. Alternative D would produce the least. This would be accomplished over a period of no less than five years for the action alternatives. Due to local conditions, smoke would normally be transported by west/southwest winds in the early to late afternoon. Inversions in the area usually dissipate by mid morning. Local communities that may be affected by smoke would be Dayville, John Day, Paulina, Mitchell, Prineville, and Bend, Oregon. The Black Canyon Wilderness, a Class II airshed, is located approximately six air miles (at the closest point) east of the planning area. Burning activities may affect the air quality within the Wilderness. Because of the prevailing winds, intrusion into the Wilderness should be kept to a minimum, and burning operations would be conducted to minimize the effects of smoke within it. With prevailing winds from the west/southwest, areas to the south, southwest, west, and northwest have very little potential for smoke intrusions. Due to distances to the Class I airsheds to the northeast, smoke transportation would disperse concentration, thus minimizing impacts.

Cumulative Effects: For the purpose of assessing the potential for cumulative effects, the burning proposed within the Summit Environmental Analysis is included as part of this analysis. Summit proposed a total of 8,744 acres of prescribed natural burning in the southern portion of the Deep Watershed. Although these treatments are likely to affect the smoke emissions through time rather than magnitude in a given year, they are considered here to reflect the potential for cumulative effects if done over the same five-year period assumed for Deep. Emissions for the planning area would be 2.7 percent, 1.8 percent and 1.7 percent of the yearly emissions identified in the Forest Plan for Alternative B, C, and D, respectively. Emissions are displayed in Table 4-20.

Prescribed burning activities from this proposal would be incorporated into the overall Paulina Ranger District annual burning program. The district has been averaging approximately 3,000 to 5,000 acres of burning treatments per year. The amount of burning accomplished per year is not anticipated to increase dramatically due to the relatively short burning seasons.

Table 4- 20 Smoke Emissions Projected from Additional Projects within Deep Planning Area

	Summit Acres	Summit Emissions	Deep Acres	Deep Emissions	Emissions Per Year Over 5 Years	Percent of Yearly Forest Emissions
Alt. A	8,744	310	0	0	62	0.6%
Alt. B	8,744	310	26,217	944	250	2.7%
Alt. C	8,744	310	14,437	520	166	1.8%
Alt. D	8,744	310	13,497	486	160	1.7%

All alternatives would comply with Forest-wide Standards and Guidelines. Emissions produced from prescribed burning activities would be well within those projected under the Forest Plan. After implementation, the area would have reduced susceptibility from emissions generated from wildfire.

Cultural Resources

A planning area cultural resource inventory has been completed for the Deep Creek Watershed.

ALTERNATIVE A (NO ACTION)

Direct, Indirect and Cumulative Effects: There would be no direct change in conditions to known prehistoric and historic sites or cultural plants within the planning area under the No Action Alternative. However, existing stands of suppressed vegetation would remain and current levels of natural fuels would be allowed to accumulate, increasing the risk of fire severity if wildfire were to occur. Stand replacement fire would substantially affect physical materials, cultural plants, wooden historic structures, and prehistoric artifacts as compared to that expected effects under non-lethal fire. Suppression activities could also directly affect prehistoric site artifacts. There would be no effects from road closures, meadow enhancement, or riparian improvements. Cultural sites would continue in their existing condition.

Increases in recreation use and continued livestock grazing would continue to occur and could lead to a decline in the surface integrity of sites. Livestock grazing can have detrimental impacts to cultural plants in both scabland and riparian habitats. The grazing of allotments in the Deep area begins in mid-June. Generally, scablands have dried out and many plants have already flowered. This helps reduce the potential for effects to scabland habitat in the spring. Full time riders have been established on allotments to help reduce the grazing pressure on riparian areas and protect cultural plants growing within wet areas.

ALTERNATIVES B (PROPOSED ACTION), C, AND D

Direct, Indirect and Cumulative Effects:

Prehistoric and Historic Sites: For all action alternatives, projects are designed to reach a determination of No Effect or No Adverse Effect to cultural resource sites. Consultation and compliance with Oregon SHPO will be completed for the preferred alternative. Action alternatives are designed to avoid or protect both prehistoric and historic sites. Cultural resource management is planned during implementation for all project activities to avoid and protect known sites (See Chapter 2, Design Elements Common to All Action Alternatives, page 2-42). Alternative B requires the greatest need for cultural resource management during implementation and Alternative D, the least.

Disturbance of unknown sites could occur through construction of roads, harvest, or any ground disturbing activity. If such a site is discovered, the activity in the area may be relocated to avoid disturbance. If the activity cannot be relocated, then the District Archeologist would field review the site and together with the resource specialist and determine the necessary design steps to avoid further impacts to the site.

In 1986, the Historic Summit Trail was deemed eligible for inclusion within the National Register of Historic Places, and in 1988 a management plan was written for the Trail. In addition, the Ochoco National Forest Plan addresses the management of this linear historic site. Using the Summit Trail Survey and Evaluation (USFS 1986), there are no pristine segments of the Trail within the Deep Planning Area. There is one high value segment of the Trail within the northwest corner of the Planning Area from the Keeton Trailhead west to Porter Spring (T.13S., R.22E., sections 13 and 14). High cultural value segments are defined as those exhibiting integrity so as to confirm the location of the Trail, the integrity is intact for a measurable distance, the physical evidence is prominent, and/or the interpretive potential is high. This high value segment is an improved motorway (Forest Road 2630) in current use today for vehicles but which exhibits physical evidence of the Summit Trail such as blazed trees and telephone lines. Within the action alternatives, no activities are proposed adjacent to this high value segment. Along all other segments, no value, low value, or moderate value (integrity is destroyed or absent, altered, or intact with minimal alteration) of the Summit Trail, pre-commercial thinning, tractor harvesting, underburning, temporary road building, meadow enhancement, and riparian area enhancement are the activities proposed. Design elements to protect these segments include retaining any cultural features contributing to its NRHP eligibility status by modifying harvest prescriptions within 300 feet of the Trail, and to retain any cultural features with a low intensity burn during underburning, and also during tractor harvesting, temporary road building, and riparian and meadow enhancement activities. These design elements are above and beyond the Ochoco National Forest (ONF) Management Plan emphasis for the Summit Trail, which states that only pristine segments will be managed to protect, interpret, and preserve their historic qualities. In addition, proposed vegetative treatments associated with the Summit Trail would have a short-term effect on visuals during harvest, post-harvest, and fuels treatment activities under all the action alternatives. Design elements have been developed to protect the visual integrity and meet Visual Quality Objectives (See Chapter 2, Design Elements Common to All Action Alternatives, page 2-37).

In 1988, the Camp Watson Military Road was deemed eligible for inclusion within the National Register of Historic Places. The Ochoco National Forest Plan does not define this linear site as needing particular management, nor has there been a separate management plan written for this site. This early day travel route traverses north to south almost mid-center of the Deep Planning Area. In 1988, visible segments of this road were rated for their historical value, and only one segment within the Deep Planning Area was rated as high. Ratings were based on the presence of tracks or ruts, a visible tree-free grade, and/or blazed trees along a suspected route. The section of this linear site that was rated as high follows a seasonal channel through a meadow, and will be protected from project activities. Along all other segments, (no value, low value, or moderate value (integrity is destroyed or absent, altered, or intact with minimal alteration)) of the Camp Watson Military Road, tractor harvesting, winter logging, underburning, large woody debris placement, meadow enhancement, and riparian area enhancement are the activities proposed. Any physical features of these segments will be protected during layout and design of the units (tractor harvesting, winter logging, underburning) or by avoidance from the project activity (large woody debris placement, meadow enhancement, and riparian area enhancement).

There are 28 aspen stands within the Deep Planning Area with carved trees. Twenty-six of these carved aspen sites are either eligible for inclusion or potentially eligible (insufficient information) within the National Register of Historic Places. One large stand contains 265 carved trees, and is considered significant for its size and complexity. This particular stand is in need of treatment due to the severe encroachment of true firs causing disease and loss of habitat to the aspens. A harvesting of the true firs is planned as part of Deep project activities. In August of 2001, Paulina Ranger District staff and other specialists identified and marked the true firs in the aspen stand for removal; each fir was judged whether removal would impact an adjacent live aspen. Once on the ground, these firs would be helicopter yarded from the stand. In addition, during August of 2002, a Passport In Time (PIT) project was held in this stand. All 494 aspen in this stand were mapped including the 265 carved aspen, which were also recorded, sketched, and given a permanent tracking number. Riparian enhancement of the stream flowing through this particular aspen stand, and meadow enhancement of the surrounding meadow are also planned for this site; both projects will have design elements in place for the protection and preservation of the carved aspens. Once all activities are completed, an exclosure fence will be constructed around the entire stand to protect the young aspen clones from cattle and big game.

All other aspen stands with carved trees, in the Deep Planning Area, that are proposed for treatment will also have design elements in place for protection and preservation of the carved trees. Each site would be located and carved trees would be flagged for avoidance during project activities.

Several other historic sites within the Deep Planning Area include the Paulina Drift Fence and Deadline, sheep corrals, remnants of the Derr Guard Station, campsites, log troughs, rock cairns, a tree lookout, and telephone lines. All proposed projects adjacent to these areas have design elements in place to preserve and protect the features that make these sites significant; sites would be located and a buffer zone would be placed around them excluding them from project activities.

Numerous lithic sites (stone tool manufacturing) exist within the Deep Planning Area. Proposed projects in the vicinity of these sites include meadow and riparian enhancement, pre-commercial thinning, large woody debris placement, and tractor harvesting. Each site would be located and its boundaries would be protected by avoidance during project activities. Low ground impacting Spyders would be used during riparian enhancement activities providing protection to areas adjacent to streams, which are high probability areas for archaeological sites. In addition, design criteria require the survey of any new temporary road segments across scablands to prevent the disturbance of unknown sites during ground disturbing activities.

Natural fuels treatments would be coordinated to avoid impacts to heritage sites. Historic sites with physical features would be avoided and projected by a buffer zone from burning activities. Blazed trees associated with historic sites and trails are normally large diameter, and would not be affected by prescribed burning, however, their location would be made known to the fire personnel. Surface lithic sites would be located, their GPS coordinates noted and mapped, and would be assessed on a case-by-case basis for possible impacts due to burning and possible associated ground-disturbing activities.

Depending on the alternative chosen, potential fire spread rates, intensity, and estimated mineral soil exposure will vary due to existing vegetation and litter and duff amounts. Non-forested areas, such as scablands, have insufficient fuel continuity to carry a fire in all but the most extreme conditions; therefore, lithic sites located on these rocky flats would be avoided due to their location. In forested areas, there would be some risk and potential for loss of cultural features in all the action alternatives during burning activities due to the weather and the ability to control the fire. Although most surface lithic sites have been subjected to fire in the time since they were originally deposited, little is known or understood regarding the affects of either wildfire or prescribed burning on these sites.

Cultural Plants: No direct impacts to cultural plants on scablands are expected from road building or landing locations. Scabland habitats have shallow, rocky soils with high clay content and do not recover well from disturbance. Design elements identify that scablands would be avoided as road or landing locations. Coordination with the Archaeologist and Botanist would occur to survey new proposed locations. There may be some loss of black lichen through timber harvest within the ponderosa pine and dry Douglas-fir plant associations. Alternative B would have the most potential for direct and indirect effects to scabland cultural plants and black lichen, and Alternative D, the least. Natural fuels burning may provide an opportunity to enhance some species, such as grouse huckleberry, rose, and strawberry, which respond favorably to fire.

Riparian improvements including planting, large wood placement, and road closures would benefit riparian areas thus increasing the material available for basketry. The removal of encroaching conifers through meadow enhancement may benefit certain species of cultural plants by providing more light and growing room. Cumulative effects would be similar to those discussed under Alternative A. The proposed road decommissioning plans would terminate short segments of several roads but would not prevent access to potential gathering areas in the Deep Planning Area.

Noxious Weeds

A Noxious Weed Risk Assessment was completed for the project area. It is included as Appendix 2 to the Botany Specialist Report.

ALTERNATIVE A (NO ACTION)

Direct, Indirect and Cumulative Effects: This alternative has the least potential to spread or introduce noxious weeds. There would be no new disturbance from logging, road building, prescribed fire, or other activities under Alternative A.

The 12.6 acres of existing weed infestations included in the Weed EA would be treated each year, and would continue to decrease in size (see table 13-6, page 3-40). Of the remaining 8 acres, the Russian knapweed, St. John's-wort, dalmatian toadflax, and teasel populations would remain stable in the short term. Long term, these infestations would increase. The remaining untreated infestations would continue to spread through reproduction and disturbance, competing with native plants and reducing biodiversity. New weed sites would develop through vectors such as cattle, wildlife, vehicle travel, and forest recreationists.

ALTERNATIVES B (PROPOSED ACTION), C, AND D

Direct and Indirect Effects: Vehicles and equipment have the largest potential to introduce new weed infestations and spread existing ones. This potential exists for activities including: timber harvest, log hauling, culvert replacement, road closures, woody debris placement and grapple piling. All of the alternatives rate as high risk for the spread of noxious weeds, see Appendix 2 of the Botany Specialist Report for the risk rating. 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 and Best Management Practices and design elements are followed. Prevention measures are listed in detail in Appendix 2 of the Botany Specialist Report. Design elements common to the action alternatives are outlined in Chapter 2 of the Deep Vegetation Management EIS. The risk of bringing in weeds from outside is proportional to the amount of activity and 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 proportional to the increase in disturbed soil. This is especially true along travel corridors.

Most of the risk of weed introduction from equipment is mitigated through design elements that require cleaning before entering Forest Service land. Heavy equipment such as skidders, harvesters and excavators will be free of weed seed, dirt and debris. This substantially reduces the risk of introducing new infestations. However, vehicles, 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.

The majority of Peck's mariposa lily populations (*Calochortus longebarbatus* var. *peckii*, a Sensitive species) follows major drainages and associated meadows, and since most collector roads follow these drainages, spread of noxious weeds through log haul is a risk. Once established along the road shoulder, there is the possibility of spread into *Calochortus* populations. Natural vegetation of riparian areas may be replaced by more aggressive weed species, which competitively exclude natives, especially in overgrazed areas (Fredricks 1989).

Table 4- 21 High Risk Actions for the Introduction and Spread of Noxious Weeds

	Alt. A	Alt. B	Alt. C	Alt. D
Piling burning adjacent to major roads	0 Acres	25 Acres	22 Acres	21 Acres
Culvert replacement adjacent to major roads	0	6	7	6
Road construction	0 Miles	1.9 Miles	1.1 Miles	0 Miles
Log haul along major weed infestations	0 Roundtrips	28 Roundtrips	26 Roundtrips	22 Roundtrips
Number of harvest landings [1]	0	414	354	295

[1] This estimate is based on 15 acres of harvest per landing for conventional logging and 100 acres per helicopter landing. Actual figures depend on terrain and volume in each unit.

Table 4-21 lists high risk activities from the risk analysis in Appendix 2 of the Botany Specialist Report. These activities have potential for introduction and spread of noxious weeds through the creation of bare ground (pile burning, culvert work, road construction) which can be quickly colonized by noxious weeds. There is a risk of weed spread from vehicle traffic, namely log haul, on roads that have concentrated weed infestations. A helicopter landing (#15) adjacent to Crazy Creek is proposed, which is above a large spotted knapweed site. The site runs along the road that would be used for hauling. This knapweed population is treated with herbicide every year; a small number of plants occur from the seedbed. From the table, it is apparent that the number of roundtrips through this site is similar for each alternative, with Alternative D having the least direct effect on the population. Landings are disturbed areas where the potential for weed infestations coming from outside is the greatest. Log trucks travel great distances and go to mill yards which may have noxious weed infestations, and then return to the landing. There is a probability of starting new infestations.

CUMULATIVE EFFECTS FOR NOXIOUS WEEDS

The exact source of past infestations is unknown. The location pattern shows concentrated sites along the 42-470, 4250-100 and 4256-010 developed during heavy disturbance, possibly timber harvest. The other infestations are scattered along roads indicating introduction by forest visitors. The Summit project, which included 2,234 acres of harvest concluded in 2001. In conjunction with harvest, 14.8 miles of road was built and prescribed burning on 8,000 acres is on-going. This amount of disturbance, along with the proposed Deep activities, cumulatively makes the probability of new weed infestations fairly high.

The Roba grazing allotment has a growing houndstongue population. Cattle graze this area first, and then move to the Deep allotment, possibly bringing seed with them. Grazing could easily spread the houndstongue population. Cattle and big game are becoming a cumulative impact in weed dispersal. Manual treatment is on going to hand-treat some of the houndstongue infestation. In conjunction with this effort the west Roba pasture, where one of the heaviest infestations occur, is being rested from grazing in 2002 and 2003.

Prevention techniques through design elements and the current weed treatment program will help reduce increased cumulative effects of the Deep action alternatives. See Appendix 2 of the Botany Specialist Report for prevention measures and control strategies for noxious weeds in this project.

The proposed activities in the Deep project will reduce stand densities, which is critical to reduce the risk of wildfire. Dense multi-storied stands act as “ladder fuels”, bringing ground fire into the crowns of trees, greatly increasing the burn severity. 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 is brought in from different areas, and may be harboring weed seed. Due to the emergency nature of wildfire, prevention measures including 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. Alternative B does the most to reduce this risk by treating the most acres through commercial harvest, precommercial thinning, and prescribed burning. Alternative A does nothing to reduce wildfire risk.

Cumulative impacts of travel on forest roads by visitors and forest workers will be detrimental to native vegetation through the spread of noxious weeds in the long-term. Human use on the forest is expected to increase in the future. Recreation use on Paulina Ranger District is currently increasing, especially from August through November during hunting season, and is expected to increase in the future as populations in nearby towns continue to grow. Late hunting season is a wet time of year, and is particularly conducive to weed spread due to mud clinging to tire tread.

The use of herbicide and biological control on new sites and species is not expected within the near future due to current litigation of vegetation management proposals within the Region. As a result of litigation, the Region 6 Competing and Unwanted Vegetation EIS has been deemed invalid due to the availability of newer herbicides and human risk factors. Therefore, a new EIS will need to be completed before site-specific treatment using herbicides or biological control is proposed at the District level.

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 4-18 are relatively minor, considering a 55,000 acre project area.

Prevention is the best defense against noxious weeds. There are extensive prevention measures in place for the Deep Vegetation Management Project. These in conjunction with current infestation treatment will 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. Alternative D has the least probability and risk of noxious weed spread, and Alternative B has the highest probability.

Range

ALTERNATIVE A (NO ACTION)

Direct, Indirect and Cumulative Effects: Under Alternative A (No Action), there would be no direct effect on the ability to graze livestock within the Deep Watershed. Grazing permittees would be able to continue to graze livestock in accordance with annual operating plans. Range condition, however, would change over time under this alternative. Although no direct or indirect effects from canopy manipulation and forest litter disturbance or reduction would occur, high-density tree canopies would continue to suppress the development of grass and shrub populations. Over time, forage quality would continue to diminish as tree canopies remain high or increase. Forage plant diversity and distribution would continue to decrease.

Cumulative effects from continued livestock grazing are discussed under the other resource areas where applicable. Livestock plays no role in the overstory stand composition, structures, or density aspects of the Purpose and Need. Nor does it have much influence on the risk of moderate and high intensity fires. However livestock grazing would continue to play a role in the future condition of riparian vegetation and affect the ability to meet the objectives of enhancing vegetative conditions of aspen, riparian and upland shrubs, and meadow communities.

ALTERNATIVES B (PROPOSED ACTION), C, AND D

Direct and Indirect Effects: Design elements (Chapter 2, Design Elements Common to All Action Alternatives, Improvements, page 2-48) have been incorporated into all action alternatives that recognize the potential to affect the grazing plans within the existing allotments. Design elements call for the protection of existing range improvements and coordination of activities with permittees as necessary. Road closures and obliteration were reviewed from a range and permittee perspective to avoid conflicts. Fall burning is prescribed under all action alternatives to ensure that adequate forage is available in the year of the burn, and to promote new plant growth and forage availability the following year. Livestock would benefit from increased forage from both the natural fuels and wildlife enhancement burning. Alternative B prescribes more burning than Alternative C or D. Where significant acres are being burned in a given allotment, burning is scheduled over more than one year. Under Alternatives B and D, burning in Deep allotment would not occur in the north and south pastures in a single year. Under Alternative B, burning in Happy Allotment would not occur within the west and east pastures in a single year.

The effects of the alternatives on range condition are primarily related to the amount of canopy manipulation and forest litter disturbance that occurs under each alternative. There would be an increasingly positive effect on forage production, accessibility, diversity, and quality. As a result, livestock distribution would improve. The more canopy opened to allow sunlight in, the more quality forage is produced. More shrubs and woody vegetation can become established. Tree canopy reduction would occur under the alternatives and the amount of duff disturbed or reduced would be linked to the amount of treatment acres under the action alternatives.

Conversely, as the canopy opens up and soil is disturbed, noxious weeds can invade previously uncolonized areas. Increases in noxious weeds are also directly related to source material, the amount of canopy opening, and duff disturbance. The prevention measures discussed in the Noxious Weeds section are designed to avoid the spread and introduction of noxious weeds.

CUMULATIVE EFFECTS ON RANGE

Cumulative effects from continued livestock grazing are discussed under the other resource areas where applicable. Livestock plays no role in the overstory stand composition, structures, or density aspects of the Purpose and Need. Nor does it have much influence on the risk of moderate and high intensity fires. However, livestock grazing would continue to play a role in the future condition of riparian vegetation and water quality. It could limit the ability to meet the Purpose and Need to enhancing vegetative conditions (and subsequent shading) of aspen, riparian and upland shrubs, and meadow communities.

An increase in forage production and reduction of tree density within riparian areas has the potential to increase use of cattle. This potential effect is mitigated because of the limited quantity of thinning within the riparian areas and the use of “no treatment” buffers along streams. In addition, the development of improved forage in the associated upland areas from burning would help draw cattle out of the untreated riparian areas into the uplands. The requirement to not ignite fire directly within the riparian areas, and to only allow fire to back into these areas would help insure that “no treatment” buffers are retained along all streams. See the Water Quality and Fish Habitat and Vegetative Diversity sections for more specific information on the potential for grazing to affect these resources.

All other watershed improvement projects proposed under the action alternatives would include protection measures to help improve the potential for success and prevent trampling and/or browsing. Aspen stands are prescribed for protection as applicable, with the vast majority of stands being fenced. See Appendix H. Protective tubing, cages, fencing, and/or high density planting would help insure that riparian planting and upland shrub enhancement projects are successful. Culvert replacements may have a short-term effect on access to certain parts of the allotments.

Recreation Experience and Scenic Quality

ALTERNATIVE A (NO ACTION)

Direct, Indirect and Cumulative Effects: The effects on scenic quality and the recreational setting are measured by the degree of change from the existing condition of an area. Due to the exclusion of fire in the Deep Creek Watershed, changes in the major species composition have taken place (See Vegetative Diversity, page 4-12). One of the key objectives outlined in this EIS is to move the structure and diversity of vegetation closer to historical levels. However, under this No Action Alternative, no prescribed fire or vegetation treatments would take place. Many individuals consider these historic vegetative conditions, characterized by open stands dominated with large trees, more scenic than current stand conditions. Current levels of natural fuels would be allowed to accumulate, substantially increasing the possibility of stand-replacing fires, insects, and diseases. This would result in a long-term risk for the loss of timber production, wildlife cover and forage, fishing and water quality, and visual quality.

ALTERNATIVES B (PROPOSED ACTION), C, AND D

Direct and Indirect Effects to Scenic Quality: Maintaining scenic viewsheds affects the quality of recreation opportunities and experiences. All action alternatives propose commercial timber harvest to sustain or improve long-term productivity for all resources (water, wildlife habitat, soils, etc.). Approximately 169 acres, either within or adjacent to the Deep Creek Recreation Area, are proposed for some type of vegetation treatment. Depending on the alternative chosen, approximately 35 acres would be harvested using an improvement prescription (HIM) and helicopter logging system (see Chapter 2 for descriptions of harvesting methods and chapter 4 for descriptions of logging systems). Seventy-one acres are proposed for a commercial thinning (HTH) using a combination tractor/winter harvesting method. Approximately 10 acres would be harvested using a commercial thinning prescription and tractor logging system, and 53 acres would be a commercial thinning (HTH) using a skyline logging system. Vegetation treatments would be apparent but would not dominate the landscape as the evidence of management declines. More open, large diameter tree dominated stands would become apparent and improve the scenic quality.

Visual quality along Forest Service Roads 4200 and 1200, adjacent to dispersed sites, and the Summit Trail (Forest Road 2630) would continue to be managed to provide high quality scenic values with conditions that are more representative of historic vegetation. Design elements would help alleviate any short and long-term impacts to these visual corridors. For example, landings will be located at least 100 feet from these roads where feasible, and stump heights will be 8 inches or less within sight of these roads, to reduce the visual impact to travelers.

In addition to vegetation treatments described above, commercial timber harvest and precommercial thinning within the watershed would be evident in areas that are outside of management areas with visual emphasis. Vegetation treatments are discussed in the Vegetative Diversity Section beginning on page 4-13. Vegetation treatments would be evident to forest visitors, however, reducing stand densities would reduce the potential for stand mortality and produce more open stand conditions with large trees and greater visual quality in the long term.

Fire would be reintroduced into the landscape. Prescribed fire activities proposed for within the Deep Creek Watershed are: Alternative B, 20,692 acres; Alternative C, 8,741acres; and Alternative D, 8,476 acres. These acreages include a mix of fuels reduction (underburning, see Chapter 2) for a description of burning methods), forage enhancement and juniper encroachment (underburning/juniper thinning), and fuel continuity reduction (jackpot burning). See Table 4-14 for a breakdown of treatments and acres for Alternatives B, C, and D. In addition to the vegetation treatments, approximately 169 acres of fuels reduction (underburning) are proposed within or adjacent to the Deep Creek Recreation Area. Short-term effects of fire are evident to forest visitors passing near recent fires of any kind, however, the visual impacts of frequent prescribed fires of a low intensity would contribute to a high scenic resource value through an open, park-like landscape interspersed with a mosaic of other vegetation conditions.

Although the initial appearance of a burn may not be a quality scenic experience, the long-term effects of maintaining open stand conditions and providing for the improvement of wildlife habitat will provide a better quality scenic experience in the long run. The gradual reduction in fuels would allow lower impact disposal methods (less mechanical and lower intensity prescribed fire) in the future. The cumulative effect of a reintroduction of fire would be the continued existence of suitable habitat for wildlife and the reduction of the chances of a catastrophic wildfire with higher than normal intensities and extent. The negative effects to scenery from such a wildfire would be worse and longer lasting than the immediate effects from fuels reduction.

Effects to Recreation: People prefer a natural appearing scenic environment for recreation activities and management emphasis for dispersed recreation sites is to provide and maintain a near-natural setting. The desired condition for the Deep Creek Watershed is that forested areas contain large size class trees of larch and ponderosa pine and known dispersed recreational places are protected from timber harvesting activities. Management activities would be visible from dispersed sites, but would remain subordinate to the surrounding landscape. In addition, opportunities for camping in developed sites at the Deep Creek Campground would be provided. Road construction, tied to timber harvesting, increases access for motorized travel (sight-seeing, hunting, firewood gathering) but at the same time affects the “naturalness” of an area. Alternative C proposes the most road closures and decommissioning, thus reducing the open roads within the planning area more than the other action alternatives. Closures have the potential to limit dispersed recreation access. Short duration (1-2 months) impacts are anticipated to this access while culverts are being replaced.

In addition, rehabilitation is planned for six dispersed recreation sites. Rehabilitation includes a combination of fencing to deter vehicle use in and around wet meadows, boulder placement restricting vehicle access in the riparian zone, or hydrologic road closures. It is expected that vehicle access would no longer be available to two of the six sites and would be restricted on the other four sites. Walk-in use to these sites would not be discouraged. It is not expected that the rehabilitation planned for these sites would prevent forest visitors from finding dispersed recreation opportunities elsewhere within the Deep Planning Area.

A short-term, direct effect of the reintroduction of fire to bring the watershed to a more natural historic condition is the production of smoke from that burning. This EIS includes a smoke management plan (see Appendix E) that addresses the possibility of the intrusion of smoke into the Deep Creek Watershed and adjacent areas. Smoke emissions are projected to be greatest from Alternative B followed by C, and then D. Other short-term effects include the noise associated with the implementation of activities. Long-term effects for the Deep Creek Recreation Area will be a more naturally-appearing environment with little immediate evidence of management activities.

With the reintroduction of fire, there would be a reduction of fuel levels. This would lessen the potential of catastrophic wildfire and the corresponding loss of the naturally appearing character.

CUMULATIVE EFFECTS TO SCENIC QUALITY AND RECREATION EXPERIENCE

There has been a history of timber sale activity within the watershed. Past harvest activities modified the scenic character of the area (e.g. by removal of large diameter pine) and were more intensive than those that have occurred since the implementation of the Regional Forester’s Plan Amendment #2 in 1993. Recreational visitors to the forest can expect to encounter sights of recently logged areas such as Summit Timber Sale. These effects are common to all action alternatives. The loss of some individual trees and some scattered clumps through timber harvesting is to be expected and should not diminish scenic quality, but add to it in the long term by the addition of snags and small openings in the forest. Forested areas would continue to have large ponderosa pines and riparian areas would contain alder and other hardwood species.

Social/Economics

Direct and Indirect Effects: Timber harvest would occur under all the action alternatives. There would be some minor economic recovery from the dead and dying timber removed as hazard trees.

Revenue from the timber sale would have the potential to return money to the Federal Treasury. The economy could expect timber related jobs to be generated or maintained from the timber sales that are proposed.

Stands put back into productivity with a higher percentage of pine and larch would have greater future economic value than the fir dominated stands existing today. Managed stands would have less potential for economic loss compared to the mortality that would occur under Alternative A and the possibility of subsequent western spruce budworm epidemics. The service contracts are likely to generate additional opportunity for employment for individuals and companies that bid on such contracts.

Specifically, riparian and upland planting, precommercial thinning, large woody material placement, and culvert replacements are historically accomplished through service contracts. Historically, the respective costs of these service contracts are approximately $300/acre, $100/acre, $160/hour, and $30,000/culvert, respectively. In summary, Alternative B, which proposes higher board foot volumes for harvest, would recover and utilize more value from overstocked stands, would restore more acres to healthy conditions, and would provide more service contract work and greater opportunities for employment and benefits for the local economy.

The effects from each alternative on employment and income that is attributed to the volume of timber that it proposes to harvest are rough estimates based in part on the Ochoco National Forest Plan. Additional information is available on social/economic effects of timber production in the analysis files and is available upon request. Return to the Treasury is also related to the volume harvested, but the cost effectiveness of delivering the timber from the stump to the mill can affect the amount. Service contracts are not included in the following table, but depending on contract rates, all action alternatives are likely to generate over one million dollars of service contract work.

Table 4- 22 Timber Related Economic Effects

Economic Effects	Alt. A	Alt. B	Alt. C	Alt. D
Harvest Volume (mbf)				
Saw Timber	0	14,095	11,647	9,708
Non-Saw Timber	0	2,605	2,153	1,792
Jobs	0	362.1	299.3	249.4
Total Income ($1000)	0	10,436	8,628	7,188
Estimated Net Sale Value ($)	0	450,000	350,000	400,000

The values presented in Table 4-22 are based on the following economic assumptions from the 1997 Ochoco National Forest Timber Sale Program Information System (TSPIRS Report):

- One million BF of sawtimber material produces 25.4 jobs and a payroll of $732,000
- Non-sawtimber material generates 1.6 jobs and $45,470 of income per 1 million BF
- Net sale values reflect the specific costs related to the commercial harvest. It does not include the cost associated with the other proposed treatments such as planting, precommercial thinning, and burning. This is provided here to give an idea of the economic feasibility of implementing the vegetation management activities that would influence the ability to provide jobs and income as well as meet Purpose and Need objectives. Net sale values are sensitive to species harvested, total volume, logging and road costs. Logging systems mix tend to have the most influence on

overall sale value.

CUMULATIVE EFFECTS SOCIAL/ECONOMICS

No known cumulative effects are expected to the local and regional economies from this proposal. The local economies, as characterized by Crook County's, have lost much of the infrastructure necessary to process logs. Therefore, it must be recognized that this estimate of jobs supported and income generated is more likely recognizable at the sug-regional scale.

Soils

The effects of the actions on the soils resource focuses on the following components:

- Compaction, displacement, and charring;
- Surface soil erosion;
- Soil nutrient availability;
- Microbiotic soil crusts;
- Forest mycorrhizal associations.

ALTERNATIVE A (NO ACTION)

Direct, Indirect and Cumulative Effects: This alternative would not result in direct changes to the existing soil conditions within the Deep Planning Area. Compacted soils would recover naturally over time but may take from several to many decades. Freeze/thaw cycles and biological activity would result in more rapid recovery in the surface horizon. Compaction is more of a problem in the ashy surface soils than the self-cracking smectitic subsoils (see ash depth range by landtype in Table 3-19). Compaction can decrease productivity on a heavily trafficked unit by as much as 16 percent or more (Froelich1979). This is roughly equivalent to a loss of one site class on the compacted soils. Much of this (up to 20 percent) is largely unavoidable and is considered part of the cost of maintaining a ground based harvest network. See compaction hazard rating for individual landtype in Table 3-19.

Wildfire risk would remain higher than historically. The potential for increased volatilization, mineralization, and leaching of nutrients that occur as a result of wildfire would leave the area more susceptible to effects on long-term site productivity. The hazard for high intensity fires exists more strongly in stands with a current seral –structural state that will cause stand replacement fires. When ladder fuels and horizontal continuity due to overstocked stands exist, there is an increased hazard of high severity fire and subsequent impacts such as listed above.

ALTERNATIVES B (PROPOSED ACTION), C, AND D

Direct and Indirect Effects:

Compaction, Displacement, and Charring: Soil compaction may be defined as the packing together of soil particles by forces exerted at the soil surface, resulting in increased soil density. Roads, log landings, skid trails, and machine fuel treatments are the actions associated with timber harvest that cause soil compaction. Soil displacement is movement or rearrangement of the soil profile so that normal processes are adversely affected.

The potential for displacement and compaction to soils is related to the types and amounts of treatments that are prescribed, slope, and soil type. Of the treatments proposed under the action alternatives, commercial harvest (harvest intensity and logging method) and road construction have the most potential to affect soil compaction and displacement in the Deep Planning Area. The risk of impacts goes up with the magnitude of treatment. Over 85% of the planning area is less than 15% slope. Roads, log landings, and skid trails are typically areas that are detrimentally displaced during commercial timber harvest activities.

Soil charring can occur when concentrations of fuels are burned and the soil becomes superheated. This causes loss of organic matter and hydrophobic soil conditions can result from the cooked waxes and resins in the surface ash layer. Typically, charring occurs on landings where large piles (concentrations) of slash are burned. Burning of hand and grapple piles does not typically result in detrimental charring because of the small pile size.

As shown on Table 4-17 Comparison of the Alternatives on the Potential Fire Effects, and discussed in the Fire/Fuels section, Alternative B reduces the stand replacement conditions by the most acres.

Road closures and obliteration help reduce levels of compaction where they are scarified, subsoiled or ripped (see road decommissioning on Figures 2-3, 27, and 2-11). Percolation and infiltration are increased allowing improved water and air transport. Penetration resistance is also reduced for roots. Conifers, brush, grass and forbs can more easily establish on these decompacted substrates.

Soil Erosion: Soil erosion may be defined as the detachment and movement of soil from the land surface by wind, water, or gravity. Associated with erosion of soil from a particular site is the potential for subsequent deposition into streams called sedimentation. Soil erosion is a natural process. Increases in soil erosion rates can have impacts on soil productivity and water quality. Since 85 percent of this area is below 15 percent slope there is not as much potential surface and rill erosion as some watersheds in different terrain such as in the western Ochoco mountains where slopes are much steeper and much more prevalent. What is different here in the Deep Watershed is the juxtaposition of scablands and timbered stringers. The scablands, having mostly shallow impermeable soils, function as large tin roofs or rapid runoff areas, which feed additional overland runoff volume into the ashy soils of the stringers. This increases the potential for detrimental erosion into the stringers and into the drainways flowing through the stringers. The effect of even the moderate slopes becomes more potentially impacting under disturbed conditions that may concentrate overland flows. The standard generic slope erosion models may not adequately describe this relationship on relatively moderate slopes.

A series of dormant landslide scarps and debris lobes are spread along the south rim of Little Summit Prairie, a stretch of Happy Camp Creek and along a segment of Jackson Creek (650 acres total). The dormant landslide forms originate on Picture Gorge Basalts. The toes of the dormant landslides along Little Summit Prairie are in the alluvium. When the dormant landslides were more active, they contributed a portion of the existing sediment currently occupying the flood plains of the stream courses.

Effective ground cover is defined as the basal area of perennial vegetation, plus litter and coarse fragments (greater than 2mm sizes), including tree crowns and shrubs that are in direct contact with the ground (Forest Plan, p. 4-196). This reduces surface soil erosion potential by protecting the soil surface from forces of wind and rain thereby keeping the soil in place. Alternatives B, C, and D reduce the potential for increased soil erosion rates with the requirement of 60 percent effective ground cover in the first year following proposed activities. Estimates of the effects of the prescribed fire treatment indicate that 60 percent of the duff and litter layer would be retained. The Ochoco Forest Plan identifies a minimum of 60% cover for soils that have very severe erosion potential. Erosion potential has been incorporated into the development of the Relative Erosion Rate Model. This model identifies timber harvest, road construction, and fuels treatment (prescribed fire) as activities that can affect surface soil erosion rates. The potential for increases in sedimentation are discussed in detail under the Water Quality and Fish Habitat. In brief, Alternative B has the highest potential to generate surface soil erosion, while Alternative D has the least potential.

Road Closures: closing a road can help reduce surface and ditch erosion if properly mitigated with water bars and/or culvert removal.

Road Decommissioning: may entail a variety of erosion control measures including but not limited to water bars, rolling dips, culvert removal.

Culverts: Proper sizing of culverts can help prevent bank erosion by helping to prevent blowouts.

Large Woody Material: If properly placed, large woody debris can help prevent and reduce bank erosion. In addition, LWM can help provide additional surface roughness on flood plains that helps trap sediment and prevent erosion.

Riparian Planting: This helps reduce erosion by providing additional bank stability, surface roughness and large woody debris. Establishment rates and growth can be accelerated by planting older stock from stool beds at a deep enough depth to access sufficient water for survival.

Dispersed Recreation: these sites have been used for many decades across the forest. They are often detrimentally compacted and do contribute sediment from sheet and rill erosion. Some of these have been rehabilitated and closed to vehicle access across the forest.

Soil Restoration Tillage: Can help prevent erosion by increasing infiltration, percolation, and increasing surface roughness; all of which help reduce potential for overland flow. This is contingent on the standard operating procedures for tillage that specify contour tillage of units and discontinuous tillage of skid trails (see tillage guidelines in soil specialist report). Tillage also has the potential to increase erosion if not conducted on the contour or conducted too close to streams. RHCA guidelines apply to this activity.

Soil Productivity and Soil Nutrient Availability: Soil nutrients tend to accumulate and cycle at or near the soil surface in organic horizons and feeder roots. At this location, nutrients are particularly vulnerable to disturbance and dislocation processes that can result in outright loss or reduced capacity for replacement (Harvey 1989). The nature, amount, and distribution of disturbance to the soil surface are primary factors affecting nutrient cycling.

The harvest methods, type of silvicultural treatment, and fuel treatments proposed in Alternatives B, C, and D would not have substantial effects on long-term maintenance of organic material and nutrient cycling. Properly applied treatments using either fire or machines can be compatible with long-term nitrogen conservation (Harvey 1989).

Direct effects of Alternatives B, C, and D on nutrient cycling are negligible. Of the action alternatives, Alternative D has a higher potential for crown or high intensity fire, as well as having a higher risk of reducing nutrient availability, reducing organic material, increasing erosion, and altering chemical properties. Alternative B has the least potential since it treats the most acres that have the highest potential for stand replacement fires.

Road Closures: Depending on the type and reason for a particular closure, there can be short term re-establishment of grasses, shrubs, and trees which may provide short term production.

Road Decommissioning: if coupled with deep tillage and/or ripping this can help restore un-needed roads to a more productive condition by allowing for better tree and plant growth.

Culverts: help reduce bank erosion and/ or un-natural aggradation and subsequent blowouts. This will help maintain the productivity of riparian areas.

Large Woody Material: Placement of LWM will help lessen the amount of bank and floodplain erosion thereby maintaining site productivity.

Riparian Planting: this can help maintain site productivity through bank and floodplain protection from erosion. The roots, standing trunks and large woody debris from woody riparian plants help maintain productivity.

Dispersed Recreation: can increase compaction and displacement, especially along riparian areas. This can be worsened by un-authorized stream crossings by four-wheel drive vehicles and all terrain vehicles.

Soil Restoration Tillage: For irregular tillage operations, such as in forest settings, the impacts to soil productivity and soil nutrient availability are positive. Soil compaction is reduced and there is more water infiltration, percolation, and aeration. Surface carbon reserves are incorporated into the soil which reduces the susceptibility to volatization and mineralization by severe fires. There is some indication that 90 years of fire suppression has increased organic matter levels more than under a more regular fire regime. Incorporation of some of this extra organic matter will help maintain and improve productivity (Cochran and Hopkins et al).

Microbiotic Soil Crusts: Living organisms and their byproducts, creating a crust of soil particles bound together by organic materials, form macrobiotic crusts. Chemical and physical crusts are inorganic features, such as a salt crust or platy (vesicular) surface crusts. These crusts are more prevalent on the scabland soils and on interspaces between rocks along the edges of timbered stringers. These crusts can be disturbed by vehicle and animal hoof action. Fire can have detrimental effects on this crust but is usually not severe enough in scab areas to be of much concern. There will be no direct lighting of scablands. Given the normal prescribed burn prescriptions these areas are not expected to carry fire (low volume, discontinuous horizontal fuels, spotty fuels). There are extensive scablands in this watershed, however, this proposal is largely confined to the timbered stringers and is not likely to adversely effect scablands with either timber operations or burning due to the design elements identified under the action alternatives. Design elements call for new road locations to avoid scablands as feasible.

Road Closures: depending on the length and/or type of closure there may be more development of crusts in road centers and shoulders. Effect will be minimal.

Road Decommissioning: if the roadbed is decompacted, water-barred and properly drained then microbiotic crusts can develop over time once surface conditions become suitable.

Culverts: Proper sizing and placement of culverts can help reduce bank erosion. Effects on crusts will be minimal.

Large Woody Material: by providing microsites, large wood can provide more suitable sites for moss and other common components of surface crusting such as blue green algae and cyanobacteria.

Riparian Planting: provides large woody debris and shade for surface moss, algae, fungus and bacteria.

Soil Restoration Tillage: Tillage operations will not be conducted on the shallow rocky soils of scablands where the majority of the microbiotic crusts occur. Therefore, little or no effect.

Forest Mycorrhizal Associations: Ectomycorrhizae are an important fungal component of temperate forests. These mostly symbiotic fungi species infect host species of pines and firs. The trees provide nutrients to the fungus and the fungus provides nutrients and minerals to the tree. The fine mycelial strands increase the surface area of nutrient collection and provide an important soil link for forest trees. Harvest treatments such as commercial thinning (the majority of the treatment proposed) have very little effect on these fungal associations as long as there are live host tree species throughout the stand. Other treatments such as clearcut harvest or sanitation salvage can have greater impacts especially if all host trees are removed, there is a high amount of ground disturbance, and introduced grass species are allowed to dominate the site. There is very little of this type of treatment proposed. For HSG, HCR and HSH treatments, the different alternatives propose the following: Alternative B = 482 acres, Alternative C = 132 acres and Alternative D = 287 acres. Broadcast grass seeding is not being recommended in these units that will help prevent changes in mycorrhizal associations.

Road Closures: can allow recolonization of roadbeds by mycorrhizal fungus if roadbed is decompacted. Otherwise a simple closure would not have a significant effect.

Road Decommissioning: can allow recolonization of roadbeds by mycorrhizal fungus if road bed is decompacted.

Culverts: if properly sized and placed, can help maintain productivity of riparian soils and associated mycorrhizae.

Large Woody Material: important reservoir for soil fungus, including mycorrhizal fungus. Helps maintain soil microsites and nutrient reserves.

Riparian Planting: can help maintain active mycorrhizal fungus by providing live root interactions such as nutrient transfer between trees and fungus.

Therefore the alternative with the highest potential to affect mycorrhizal associations is Alternatives B, followed by D and C. Alternative C has the lowest potential to affect mycorrhizal associations. The more ground disturbing activities have the higher potential for impacts.

Soil Restoration Tillage: Forest mycorrhizal associations are disturbed by tillage. However, these associations are aided by the additional moisture infiltration and percolation, as well as greater rooting depth by plants and trees. Also, there are additions of soil organic matter and nutrients upon which these fungi feed.

HARVEST TREATMENTS AND METHODS EFFECTS TO SOILS

Table 4- 23 Acres of Harvest Treatments Proposed by Alternative

Harvest Treatment	Alternative B	Alternative C	Alternative D
HIM	5906	5688	4120
HTH	713	562	779
HSN	11	11	11
HSG	327	58	184
HCR	86	60	59
HSH	69	14	14

Table 4-23 displays the amount of each commercial harvest treatment by alternative. The various harvest methods have varying degrees of soil impacts, as discussed below.

HIM, HTH, HSN: See Chapter 2 (page 2-52) for a description of these treatments. These intermediate treatments comprise 93% (6,630 acres) of the commercial harvest for Alternative B, 98% Alternative C (6,128 acres) and 95% of Alternative D (4,910 acres). Soil impacts can increase as skid trail spacing is decreased. Recent monitoring data has confirmed that Regional standards can be met with incorporation of design criteria in the project plan. The individual unit design criteria identified below would mitigate adverse impacts to soils from these types of treatments.

HSG, HCR, HSH: These treatments affect a much smaller number of acres than the HIM, HTH, and HSN treatments listed above. Proposed treatments include: 482 acres for Alternative B, 132 acres under Alternative C, and 287 acres under Alternative D (Table 4-23). These treatments are more intensive than thinning from below, and the potential for additional ground disturbance from tractor harvest is higher. Silvicultural prescriptions call for soil amelioration for these treatments under certain circumstances (i.e. soil standards are exceeded for an individual unit). Amelioration is based on the ability of the soil to be scarified or tilled. Reference Appendix G to see where soil amelioration is identified.

Table 4- 24 Acres of Harvest by Harvest Method

Harvest Method	Alternative B	Alternative C	Alternative D
Ground-Based Harvest (Tractor)	4,206	3,754	3,244
Winter Logging	1,601	1,329	1,031
Helicopter	1,050	1,310	892
Skyline	255	0	0

Harvest methods for the project are displayed in Table 4-24. The following discussions of harvest methods relates to Appendix G, which includes unit-by-unit soil information for each action alternative.

Ground Based Harvest (Tractor): This harvest method has the highest amount of impacts to the soil. Rubber tired skidders and crawler tractors are used to skid logs to the landings. The main skid trails comprise the majority of the detrimental disturbance, which is largely compaction and displacement. With a 10-foot skid trail width, spaced 100 feet apart, this results in approximately 9 percent of the area in a compacted state. In comparison, a 60-foot spacing would result in approximately 14 percent of the area in skid trails. Depending on unit design, landings and roads can roughly contribute an additional 5 and 2 percent, respectively. Design criteria identified in Chapter 2 have been prescribed on a unit-specific basis to keep the overall percentage of net detrimental impacts to a minimum and to meet Forest Plan Standards and Guidelines. Tracked feller bunchers with a 25-foot boom are commonly used on the Ochoco and are one of the least impacting ground-based systems for intermediate treatments. Wider tracks on these machines would be even more beneficial. Additional detrimental conditions would be less likely to result from this entry if movement off the main skid trails were kept to a minimum. See Appendix G for specific unit recommendations.

Winter Logging: Winter logging specifications help reduce impacts to soils, cultural resources, and sensitive plant populations. Effectiveness can vary with snow conditions. Design elements describe conditions where winter logging is prescribed. Winter logging was incorporated into alternative design when the soil resource inventory indicated there was a moderate potential for compaction and a moderate potential for soil to be tilled. However, the potential to mitigate effects was generally limited due to soil type. Two areas, with numerous units, were identified and incorporated as winter logging under all action alternatives (See Chapter 2, Figures 2-1, 2-5, and 2-9). Rehabilitation is planned for landing areas. These units are expected to meet standards and guidelines.

Helicopter Harvest: This harvest method is used largely on steeper slopes with poor road access or where road construction is expensive or difficult. The economic costs are higher for this type of logging but the impacts to the soil resource are much lower. Ground disturbance results largely from roads and associated landings. The unit design for all alternatives in the Deep project include helicopter on flatter ground to help address soil and watershed concerns. No roads would be developed for these units and landings are proposed to coincide with previously disturbed areas, resulting in the conclusion that helicopter harvest units would meet Forest Plan Standards and Guidelines after harvest.

Skyline Harvest: This harvest method is used largely on steeper slopes where there is sufficient deflection for the use of cable operations. They are usually set up with an uphill access road at the top of the unit or drainage with landings along the road. Potential for detrimental disturbance is much lower than ground-based harvest. Ground disturbance results from landings, roads, and cable corridor disturbance from partial suspension. Steeper slope units have been identified for skyline harvest under Alternative B. Units that currently meet soil standards are expected to meet Forest Plan

Standards and Guidelines after harvest.

Discussion: A unit-by-unit assessment was conducted to assess the existing conditions (compaction/displacement) from past actions. These assessments were a combination of measured transects with shovel probing, walking traverses, and aerial photo interpretation. Each proposed timber sale treatment area was evaluated and placed in the nearest ten percent disturbance bracket. Eleven miles of measured transects were completed in the units proposed for harvest. Measured transects indicated less than 16 percent of the area within these units was in a detrimentally compacted condition.

Helicopter, skyline, and winter logging units are expected to meet Regional soil standards without post harvest soil amelioration. The relative impacts of helicopter logging (3 to 5 percent of a unit disturbed), skyline harvest (ave. of 6 to 12 percent of a unit detrimentally disturbed) and winter logging (0 to 20 percent of a unit detrimentally disturbed) are lower than standard tractor logging operations. For tractor harvest, it is important to know the existing condition of harvest units to design individual units to meet soil standards (See Appendix G). Soils standards state that when initiating new activities:

1. Design new activities that do not exceed detrimental soil conditions on more than 20 percent of an activity area (this includes the permanent transportation system).
2. In areas where less than 20 percent detrimental soil conditions exist from prior activities, the cumulative detrimental effect of the current activity following project implementation and restoration must not exceed 20 percent.
3. In areas where more than 20 percent detrimental soil conditions exist from prior activities, the cumulative detrimental effects from project implementation and restoration must, at a minimum, not exceed the conditions prior to the planned activity and should move toward a net improvement in soil quality.

Design elements will keep the overall disturbance to a minimum by staying on existing roads, landings, and trails and by tilling, where possible. Design elements have been incorporated into all action alternatives. Incorporation of these recommendations would ensure alternatives meet overall soil objectives, and that Regional and Forest Plan Standards and Guides will be met. They collectively help reduce erosion and limit the extent of mechanical disturbance.

Design elements are listed in Chapter 2 (page 2-46) and include, but are not limited to:

- Burn prescriptions will leave a minimum effective ground cover.
- Winter logging specifications would be incorporated. See Chapter 2 design elements for more detail. Units will be designed to stay within standards where they already meet the soil standards.
- The re-use of areas that are already disturbed.
- Scarification or tillage on units to ensure no net increase of detrimental soil conditions.
- Confinement of skidding, loading, and hauling operations to existing disturbance where tilling or scarification is not feasible.
- Minimizing impacts along scab stringer interfaces to maintain infiltration rates and reduce overland flow potential.

All action alternatives are similar with the relative percent of tractor ground where scarification or tillage would be feasible to reduce existing levels of compaction, or to rehabilitate additional ground disturbance from these alternatives. The majority of the area within harvest units is estimated to be at least 50 percent tillable based on the soil resource inventory. Rock content could vary, however, with harvest systems designed to limit additional disturbance, a high percentage of all action alternatives are expected to have enough tillable area within the individual units to mitigate adverse effects to soils.

Where units already exceed 20% detrimental conditions from prior activities, additional disturbance will be limited to 5 percent of the area of a commercial harvest unit. To bring conditions back to pre-harvest conditions, this 5% additional disturbance would be mitigated through scarification and/or tilling on units with moderate to high tillage potential ($\geq$ 50 percent). This activitiy would be accomplished after harvest and would be incorporated into the timber sale contracts and/or the sale area improvement plan. In addition, landings of winter logging units are scheduled for similar rehabilitation.

The 5 percent estimate is a conservative figure. Under all alternatives, it is likely that after rehabilitation there would be a slight reduction in compaction levels from the current condition. Units scheduled for rehabilitation are displayed in Appendix G. Alternative B includes approximately 194 acres of rehabilitation. Alternative C includes approximately 180 acres. Alternative D includes approximately 144 acres. Where standards are currently exceeded and soil rehabilitation is not feasible, operations would be restricted to existing areas of disturbance to avoid additional cumulative impacts.

Decompaction tillage may be scarification which is generally 8 to 12 inches deep or deeper ripping or subsoiling which may be up to three feet deep on heavily compacted landings, roads or main skid trails. More detailed information and definitions of tillage are included in the Soils Specialist's Report. Tillage decompacts the soil thereby providing improved infiltration, percolation, and aeration. Root penetration resistance is lessened also. With the above-mentioned results, subsequent soil productivity potential is improved over the same soil in compacted state.

Tractor operations in smaller diameter material typically use feller bunches that result in limbs and tops being removed to landings. This treatment results in lower fuel amounts inside the harvest unit by concentrating slash at the log landings. More intense heat results when the landing piles are burned, producing more charred soil. Since the landings are situated most often on top of old landings and disturbed areas from prior activities, this usually does not result in a net increase in detrimental soil conditions. Similar results can be expected at large helicopter or skyline landings where yarding with tops attached occurs.

Several other types of treatments are also proposed which generally do not result in detrimental soil impacts. These treatments include: precommercial thinning, planting/hardwood enhancement, natural fuels underburning, and activity fuels treatments such as hand piling or burning. Soil disturbance that may result from these activities is limited in scale, and of such a light intensity, that no detrimental compaction, displacement, or charring is expected. These activities do not involve the use of heavy equipment such as bulldozers. No measurable detrimental effects to the soil resource are expected from these activities under any alternative.

SLASH TREATMENT AND FIRE EFFECTS TO SOILS:

Compaction, Displacement and Charring: Compaction and displacement levels are a concern in grapple piled units only. This potential impact will be mitigated by requiring that grapple-piling operations be confined to existing disturbance only. Detrimental charring (same as burned soil) is defined as follows: Soils are considered to be detrimentally burned (same as charred) when the mineral soil surface has been significantly changed in color, oxidized to a reddish color, and the next one-half inch blackened from organic matter charring by heat conducted through the top layer. The detrimentally burned soil standard applies to an area greater than 100 square feet, which is at least 5 feet in width. (from R-6 Supplement 2500-98-1, August 24, 1998.)

Grapple piling operations will produce some level of detrimental charring depending on fuel loadings. Those units proposed to be grapple piled will have an estimated 3 to 5% detrimental charring level immediately under pile locations.

Soil Erosion: Soil erosion may be defined as the detachment and movement of soil from the land surface by wind, water, or gravity. Associated with erosion of soil from a particular site is the potential for subsequent deposition into streams called sedimentation. Soil erosion is a natural process; increases in soil erosion rates can have impacts on soil productivity and water quality.

Timber harvest, road construction and fuels treatment (prescribed fire) are activities that can affect surface soil erosion rates. Effective ground cover reduces surface soil erosion potential by protecting the soil surface from forces of wind and rain thereby keeping the soil in place. Alternatives B, C, and D reduce the potential for increased soil erosion rates with the requirement of 60 percent effective ground cover in the first year following proposed activities. Estimates of the effects of the prescribed fire treatment indicate that 60 percent of the duff and litter layer would be retained.

The Forest Plan directs that activities will be planned to achieve effective ground cover. Effective ground cover is defined as the basal area of perennial vegetation, plus litter and coarse fragments (greater than 2mm sizes), including tree crowns and shrubs that are in direct contact with the ground (Forest Plan, p. 4-196).

Soil Productivity and Soil Nutrient Availability: Soil nutrients tend to accumulate and cycle at or near the soil surface in organic horizons and feeder roots, and thus located, nutrients are particularly vulnerable to disturbance and dislocation processes that can result in outright loss or reduced capacity for replacement (Harvey et al 1989). The nature, amount, and distribution of disturbance to the soil surface are primary factors affecting nutrient cycling.

The logging methods, type of silvicultural treatment, and fuel treatments proposed in Alternatives B, C, and D would not have substantial effects on long-term maintenance of organic material and nutrient cycling. Properly applied treatments using either fire or machines can be compatible with long-term nitrogen conservation (Harvey et al, 1989).

Direct effects of Alternatives B, C, and D on nutrient cycling are negligible, however alternatives which result in higher potential for crown or high intensity fire have a higher risk of: reduced nutrient availability, reduced organic material, increased erosion, and altered chemical properties.

Alternative A (No Action) would maintain the conditions within the Deep area.

The action alternatives would maintain long-term site productivity. The primary impacts to soils would occur where soil is compacted, anticipated to occur only on designated skid trails, temporary roads and landings. Maintenance of the soil organic layer would be achieved in of the all action alternatives through the use of helicopter and skyline logging systems and, for tractor harvest designating skid trails for machine use, or by tractor logging under winter conditions. Soil organics, including coarse woody material, would be at levels that maintain site productivity through all activities including, harvest, precommercial thinning and prescribed fire. Levels of coarse woody material resulting from the proposed activities are displayed below. The groups refer to those listed in Appendix E and in Table 4-16 under Fire/Fuels section. Coarse woody material is defined as woody residue larger than 3 inches in diameter.

Table 4-25 Stratification of CVS plots into various groups (Owens 2001)

Group Number	Amount of Coarse Woody Material Existing (tons per acre)	Amount of Coarse Woody Material After Fuel Treatment (tons per acre)
1	9	6
2	7	5
3	9	7
4	12	8
5	8	6

Prescribed fire is an excellent method for managing coarse woody material (CWD), charring does not interfere substantially with the decomposition or function of CWD (Graham et al. 1994).

Microbiotic Soil Crusts: These crusts are more prevalent on the scabland soils and on interspaces between rocks along the edges of timbered stringers. These crusts can be disturbed by vehicle and animal hoof action. Fire can have detrimental effects on this crust but is usually not severe enough in scab areas to be of much concern. There will be no direct lighting of scablands. Given the normal prescribed burn prescriptions these areas are not expected to carry fire (low volume, discontinuous horizontal fuels, spotty fuels). There are extensive scablands in this watershed, however, this proposal is largely confined to the timbered stringers and is not likely to adversely effect scablands with either timber operations or burning due to the design elements identified under the action alternatives. Design elements call for new road locations to avoid scablands as feasible. The potential for impacts relates directly to the relative amounts of proposed fuels treatments. Alternative B treats fuels on the most acres, Alternative C treats fuels on slightly more acres than Alternative D.

Forest Mycorrhizal Associations: Fire can have a significant, although indirect, effect on soil mycorrhizae. Mycorrhizal fungi form a symbiotic relationship with roots of higher plant species of both forests and rangelands. The fungal strands absorb water and nutrients (particularly phosphorus) from the soil and translocate them to the roots of the host plant. The host plant provides photosynthetic products to the fungi. The presence of mycorrhizae can lengthen root life and protect them against pathogens (Harley and Smith 1983 in Perry et al. 1987), and can be critical for the establishment of some species of trees. Most mycorrhizal roots occur in surface soil horizons, particularly the organic soil layer, and decaying wood, especially large diameter decomposing logs. If fire removes most of the organic matter on a forested site, productivity may be significantly reduced for many years (Harvey et al. 1986). If fire kills all species of plants that sustain mycorrhizal associations, spores of these fungi may die after several years. It may then be difficult for desired species of plants to reestablish, either by natural regeneration, planting, or direct seeding.

An important mechanism for reintroduction of mycorrhizal fungi on burned forested areas is dispersal by chipmunks *(Tamias spp.)*. These animals eat fruiting bodies of mycorrhizal fungi in adjacent unburned areas, and spread spores in burned areas when they defecate (Maser 1978b and McIntyre 1980 in Bartels et al. 1985). Downed logs provide important travel lanes and home sites for chipmunks. Therefore, the presence of residual logs after a wildland fire enhances the reestablishment of mycorrhizal fungi, both by enhancing habitat for chipmunks, and providing suitable microsites for mycorrhizal infection and growth. (Dr. Bob Clark, Fire Effects Guide, Chapter V, National Wildfire Coordinating Group, 1991).

This impact is significant largely under slash piles and/or heavier concentrations of natural fuels. These types of impacts are spotty and are well surrounded by soils capable of recolonizing these spots quite readily, especially in thin from below treatments.

Alternative C is the most potentially impacting with fuels treatments proposed on 1,777 acres, Alternative B has the second largest acreage with 571 acres and Alternative D has the least amount of fuels treatment with 538 acres.

COMPARISON OF FUEL TREATMENT METHODS ON THE SOIL RESOURCE

Fuels treatment is a mixture of harvest fuels treatments and pre-commercial thinning fuels treatment (Both treatments will occur on most harvests units) along with some wildlife burns. See Chapter 2 for a description of the following fuels treatment methods:

1. **Underburning (UB**) is the least impactive to the soils resource. Burn severities are minimized due to the largely dispersed impacts of the burn itself. These types of burns most closely emulate natural processes as to nutrient volatilization and nutrient dispersal.

2. **Jackpot burning (JP) and Leave Tops Jackpot burning (LTJP)** may or may not be any different than broadcast burning depending on fuel loadings and distribution. Through jackpotting the

heavier concentrations are burned as the primary focus and if burned under wetter conditions can be less impacting than broadcast burning.

3. **Broadcast Burning (BC)** can produce high intensity fires depending on fuel loading and distribution. If burned under drier prescriptions, especially with lots of logging and PCT slash, these types of fires can kill the leave trees (if present) throughout the stand. These types of fires may be similar to stand replacement types of fire intensities. Hydrophobic soil conditions can result from the cooked waxes and resins in the surface ash layer.

4. **Grapple Piling (GP)** from existing trails and landings allows the net ground disturbance to be kept to a minimum. Pile locations can be adjusted to avoid leave trees. Horizontal fuel continuity can be interrupted so that potential rate of fire spread is reduced. Fire intensities will be higher under the piles but this effect will be concentrated near or on the already disturbed areas resulting in less net fire effects.

OTHER TREATMENT EFFECTS TO SOILS: Common to Alternatives B (Proposed Action), C, and D

Meadow Enhancement: Meadow systems (825 acres are proposed for treatment) have or are in the process of losing water storage efficiency. The factor contributing to this condition is channel incision. Accelerated entrenchment has occurred as a result of lack of vegetative stability due mainly to grazing and road crossings. As channel incision has progressed conifer encroachment has further degraded water table levels. Enhancement activities would involve pre-commercial thinning in and around the edges of these meadows where conifer encroachment is evident. This treatment should increase understory riparian/wetland species (rushes, grasses, sedges, etc.). Where headcuts are not occurring or have not occurred there should be a subsequent increase in bank stability by decreasing conifer encroachment and increasing riparian/wetland species.

Dispersed Recreation Sites: Restoration activities at six dispersed recreation sites would involve hydrologic closure as well as confining usage to avoid impacts to steams and floodplains. Hydrologic closure would include scarification as feasible, slope stabilization, installation of closure devices and revegetation. This treatment would help reduce sedimentation and runoff from these areas.

Road Decommissioning and Closures-these activities can help place some acres back into production depending on the purpose and method of closure. If a road is being obliterated for instance and has been decompacted then there is an opportunity for tree, brush and other plant growth. Road reconstruction, hydrologic road closure, and road decommissioning (treatments within the action alternatives range from approximately 38-40 miles) have the potential to increase sedimentation over the short term (1-3 years). In the long term, sedimentation from these roads is expected to decrease and have an overall beneficial effect (see Transportation Specialist’s Report).

Culvert Management/Upgrading: Culvert Replacement can have short-term negative impacts regarding sedimentation but will have long-term positive impacts on soils by reducing bank and channel erosion. Culvert replacement (7 total) will have a short-term effect of increasing sedimentation levels for the first year. Longer term increased hydrologic function would enhance the ability of streams to pass bedload and peak flows.

Large Woody Material Placement: overall, large woody material placement will have some short-term increases in sediment production, but will reduce bank and floodplain erosion in the long term. This will help maintain the productivity of riparian soils.

Riparian Planting: Hardwoods such as mountain alder, willow, cottonwood and aspen provide bank stability and stream shade. Stream segments throughout various parts of the watershed were identified (28 miles) as areas that would benefit from hardwood planting (i.e. increases in shade, root strength and surface roughness to hold banks and dissipate energy). There is an active program to gather local genetic stock for outplanting at Stone Nursery in Medford and at our BLM/USFS facility at Clarno on the John Day River. This program ensures that locally evolved genetic stock is used and perpetuated for restoration activities.

Aspen Treatments: Watershed conditions related to channel stability, water table interaction and water quality would benefit from management in aspen stands. Aspen treatments would be intended to increase both vigor and size of selected stands by thinning various conifer species. There are two aspen treatments within Class II streams and five stands in Class III (23 acres). All other aspen stand treatments lie in Class IV drainages. Aspen stand treatment within perennial flowing systems would enhance stream shading during critical summer months, provide a source of LWM recruitment, and deliver cleaner and cooler water to downstream populations of redband trout. Aspen stand objectives for intermittent flowing systems would enhance water table interaction and improve channel stability.

Forest Vegetation Treatments/Prescribed Fire Activities: Due to increased conifer stocking from past management activities (e.g. fire suppression), many conifer stands would benefit from thinning (commercial and pre-commercial) and under burning. RMOs for thinning were developed and projects are designed to increase individual tree growth for stream shading, promote the development of larger trees to increase future LWM recruitment to the stream channels, and to raise the density of desirable understory species that are important for channel stability to occur. Prescribed fire activities (fuel reduction and activity fuel treatment) would not retard infiltration and would decrease the potential for adverse wildfire effects to RHCAs.

Post-treatment soil tillage can reduce the bulk density of soil and improves soil porosity. This improves water and air movement to roots and soil flora and fauna. Tillage increases the numbers and distribution of mainly coarse pores thereby improving water and air movement for soil flora and improves mobility for soil fauna. The root growth conditions are also improved. Tillage may invert topsoil and subsoil, which can have both positive and negative effects. In substrates relatively poor of organic matter, as with many of the volcanic ash soils, this can add to the overall long-term nutrient reserves. Tillage also has the potential to provide a seedbed where noxious weeds can be established or existing populations expand because soil would be disturbed and exposed. Refer to the Soil Specialist Report for a lengthier discussion of the effects of tillage. Cumulatively, sites that are tilled will have a higher potential for site productivity with increased effective moisture, aeration, and less root resistance.

CUMULATIVE EFFECTS TO SOILS

Human uses are dispersed throughout the watershed. Detrimental effects from these actions are most evident where use is concentrated (e.g. livestock grazing and recreation). These types of activities would persist into the future under all the alternatives. The action alternatives are expected to maintain long-term site productivity and reduce the risk to detrimental soil effects from high intensity wildfire. Soil organics, including coarse woody material, would be at levels that maintain site productivity through all activities that include commercial harvest, precommercial thinning, and prescribed fire. The primary impact to soils is expected to occur on skid trails, roads, and landings due to compaction and displacement. Maintenance of the soil organic layer would be achieved in all the action alternatives using helicopter and skyline logging systems. On tractor harvest, designated trails and winter logging methods have been incorporated along with the design elements listed above. Soil rehabilitation is planned for several of the tractor-logging units to mitigate effects. Actions are not expected to exacerbate existing conditions. Post-treatment, there is the potential to have a slight incremental improvement in tractor harvest units where rehabilitation is planned. Road decommissioning is also expected to improve existing detrimental soil conditions through the decommissioning of 11.7 miles (21.3 acres) under Alternatives B and D, and the 15.2 miles (27.7 acres) under Alternative C. Future actions, such as the Deep Creek Restoration EA, have been identified on the Schedule of Proposed Actions. Although a site specific proposed action has not been finalized, it is reasonable to assume this watershed restoration EA would incorporate additional hydrologic road closures and decommissioning projects. Where these activities can till and revegetate road surfaces, current compaction levels at the watershed scale would be improved.

Roading has historically been concentrated along the gentle grades of drainways. Road surfaces are impervious to water and function as water conduits and runoff aprons. See the Water Quality section for a discussion of the effects on sedimentation. Drainways, including down to class IV streams, average approximately 4 percent of any particular watershed in this area. This is largely the most productive acreage of any particular pasture. These areas often become the most heavily used by grazing cattle due to their inherent productivity and adjacency to water. Compaction on heavily used dry stream terraces and benches can range as deep as 10 inches. This reduces water infiltration rates and reduces site productivity. This is especially true on highly entrenched streams where the water table has dropped significantly and soils are wet for shorter periods. There has been rehabilitation progress in certain areas such as Timothy Meadows in which a large headcut was repaired with a rock step pool sequence and riparian fencing installed around the meadow. Also there has been headcut rehabilitation in Derr Meadows. Also see the Water Quality section and the Hydrology Report for more discussion of grazing impacts.

Restoration activities have been outlined in the Deep Restoration Environmental Analysis which is currently in the planning stages. A number of activities designed to help rehabilitate and restore riparian habitat and improve riparian soil conditions are included in that project. Actions that will improve riparian soil conditions include: headcut repair which will protect alluvial soils and maintain site productivity; Channel reconstruction which will restore a more sustainable dimension, pattern and profile to selected areas to reduce bank erosion and provide a functional floodplain to reduce flood energies and stabilize stream banks; cutbank treatment which will protect eroding cutbanks and reduce subsequent bank erosion; exclosures along Buck Hollow Creek and West Thorton Creek to reduce the effects of cattle grazing on streambanks and riparian areas; large woody material placement will protect cutbanks and be accomplished with a low-impact spyder type of backhoe; spring developments that will lessen impacts to riparian areas and culvert replacements that will help reduce bank erosion. This package of projects will take up to 10 years or more to complete depending on funding levels. These types of projects will help ameliorate the cumulative impacts of past management actions throughout this watershed. Additionally, road closures and decommissioning are proposed over time. Depending on the techniques used this can reduce sedimentation and help restore productivity.

Threatened, Endangered, and Sensitive Species

The Ochoco National Forest has recently consulted with the U.S. Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS) regarding project effects to listed, proposed, and candidate species. Within the Programmatic Biological Assessment, Project Design Criteria (PDCs) have been established which projects must meet in order to be consistent with the Biological Assessment (BA), thus eliminating further consultation on those projects. Project design criteria were divided into two types. Criteria I must be used by the action agency. They include Endangered Species Act (ESA) requirements, current management direction, and standards and guidelines from the Ochoco National Forest Plan, as amended. Criteria II may, in some instances, be discretionary by the action agency. Criteria I aid in the conservation and recovery of listed, proposed, and candidate species, while Criteria II further reduce and/or negate the adverse effects of any project that “May Affect” listed and candidate species. All projects are screened against the PDCs for consistency. For a project to be within the programmatic nature of the BA, all Criteria I and II PDCs must be met and the effect determination a “No Effect” or “Not Likely to Adversely Affect”. If all Criteria I PDCs are met, but not all Criteria II, the project may still be “Not Likely to Adversely Affect”. However, the project must be forwarded to the Level I team (comprised of Forest Service, U.S. Fish and Wildlife Service, and National Marine Fisheries Service personnel) for concurrence on any effects determination. If the project fails to meet all Criteria I PDCs, the project is “Likely to Adversely Affect” and a separate project BA must be completed and consultation must occur outside of the programmatic BA. Effect determinations were made consistent with the PDCs contained in the BA. The following discussions of effects to TES Species are summaries of the specialist’s reports. Please refer to specific specialist’s report (available upon request at the Paulina Ranger District Office) for full discussions.

Table 4-26 Summary of Effects to Threatened, Endangered, and Sensitive Fish and Animal Species Considered in this EIS

Species	Alt. A	Alt. B	Alt. C	Alt. D
Northern Bald Eagle (T)	NLAA	NLAA	NLAA	NLAA
Canada Lynx (T)	NE	NE	NE	NE
Malheur Mottled Sculpin (S)	NI	WIFV	MIIH	MIIH
Blue Mountain Cryptochian Caddisfly (S)	NI	WIFV	MIIH	MIIH
Redband Trout (S)	NI	WIFV	MIIH	MIIH
Bufflehead (S)	NI	NI	NI	NI
Tricolored Blackbird (S)	NI	NI	NI	NI
Upland Sandpiper (S)	NI	NI	NI	NI
Western Sage Grouse (S)	NI	NI	NI	NI
American Peregrine Falcon (S)	NI	NI	NI	NI
Pygmy Rabbit (S)	NI	NI	NI	NI
Columbia Spotted Frog (S)	NI	NI	NI	NI
Gray Flycatcher (S)	NI	MIIH	MIIH	MIIH
California Wolverine (S)	NI	MIIH	MIIH	MIIH

NE = No Effect (listed species)
NLAA = Not Likely to Adversely Affect (listed species)
NI = No Impact (sensitive species)
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 (sensitive 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 (sensitive species)

The following are summaries of discussions found in the specialist's reports of those listed or candidate species or Region 6 Sensitive Species that this project may affect.

TES FISH

Water Quality and Fish Habitat is a key issue in this EIS. The effects to fish species are closely related to water quality which has been discussed in detail in Chapter 3 (page 3-1) and at the beginning of this Chapter. As discussed previously, stream temperature and shade, sedimentation, streambank stability, width to depth ratios, large woody material, and number of pools per mile, would be affected by proposed actions. This section will only summarize these effects as they relate to sensitive fish species. Refer to the Fisheries Specialist report for a full discussion of habitat, species presence and potential effects.

Bull trout (*Salvelinus confluentus*) is a federally listed threatened species that historically occurred in various drainages throughout the Crooked River Basin. Bull trout no longer use tributaries within the Crooked River Basin due to fish passage barriers, therefore they are not considered further in this analysis. Due to the natural migration barriers at lower and upper falls on the North Fork Crooked River and the downstream dam blockage, summer steelhead (federally threatened) and spring Chinook salmon (essential fish habitat) are not considered further in this analysis. Westslope cutthroat trout (*Oncorhynchus clarki lewisi)* is a Regional Forester's sensitive species. It does not occupy habitats within the Deep Planning Area and is not considered further in this analysis. The closest population is present on the Malheur National Forest.

Populations that are considered in this analysis include:

- Redband trout (Sensitive and Management Indicator Species)
- Malheur mottled sculpin (Sensitive)
- Blue Mountain cryptochian caddisfly (Sensitive).

ALTERNATIVE A (NO ACTION)

Direct and Indirect Effects: This alternative would have no direct impact to Redband trout (Sensitive Species and Management Indicator Species), or habitat for Malheur mottled sculpin, and Blue Mountain Cryptochian caddisfly under this alternative (See Appendix A, Biological Evaluation, Summary of Conclusion of Effects). Reference the Water Quality section of this chapter for effects to fish habitat under this Alternative. Under this alternative, only on-going land management practices would continue (e.g. fire protection, livestock grazing, and road maintenance). It proposes no commercial timber harvest, road construction or reconstruction, precommercial thinning, prescribed fire or other watershed related projects.

Cumulative Effects: Existing causal factors such as the number of roads within sediment delivery zones, number of road crossings, headcut evolution and advancement, past timber harvest practices, and livestock utilization would continue to degrade stream systems. The present condition of the drainages within the planning area would likely remain unstable through implementation of this alternative (see also Chapter 3, Existing condition description for Water Quality and Fish Habitat).

Hydrologic recovery from past and ongoing timber harvest activities would decrease the likelihood of undesirable adjustments in channel form as a result of higher intensity peak flows. However, current range utilization, road location, road crossing density, and potential wildfire effects would offset recovering channel form. Subsequently, stream turbidity, embeddedness, and the percentage of fine sediment within spawning gravels and pool habitats would be expected to remain at current levels (See the Affected Environment section for Water Quality and Fish Habitat in Chapter 3).

ALTERNATIVE B (PROPOSED ACTION), C, AND D

Direct and Indirect Effects: For redband trout, Malheur mottled sculpin, and Blue Mountain cryptochian caddisfly, the determination “May affect individuals or habitat, but would not likely contribute to a trend toward federal listing or loss of viability to the population or species” was reached for Alternatives C and D. The determination “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” was reached for Alternative B. See the Fisheries specialist report for the full text of direct, indirect and cumulative effects to TE Species, pages 41-43.

Actions proposed under the alternatives are designed to be consistent with INFISH standards. RHCA treatments are designed to increase shade, reduce the risk of catastrophic fire, and improve large woody material recruitment. Short-term (two water years) increase in sediment from harvest, log haul, and stream restoration efforts are expected from Alternative B. The sediment resulting from these activities may produce localized effects to Redband trout immediately below project sites. Under this alternative, the timing and magnitude of these localized effects are expected to result in a negative response to the overall viability of the Redband trout population.

Cumulative effects: Alternative B cumulative effects would have the greatest potential to negatively affect the Deep Creek watershed’s aquatic environment. Alternative B has the highest amount (acres and miles) of commercial harvest, precommercial thinning, prescribed fire, as well as temporary and new system road development. In addition, this alternative does not incorporate designs for these activities (i.e. timing and magnitude of commercial harvest) that are intended to temper watershed effects. EHA analysis displays high probability for undesired adjustments within the aquatic habitat.

Headcut advancement and lateral scour from stream bank erosion, as a result of the expected intensity and duration of peak flows would increase fine sediment, decrease pool quality and quantity, and increase stream temperatures. These effects would have the highest probability of occurring if a 10-year or greater flood event was to occur between 2004-2009. Should they occur, the high spawning and rearing value to Redband trout could be limited. The potential to increase fine sediments within Happy Camp, Jackson, and Deep Creeks poses the greatest detriment to mottled sculpin populations. Channel adjustments and fine sediments pose the greatest risk to Cryptochian caddisfly populations. Watershed restoration work and design elements under this Alternative would be limited in their effectiveness of improving aquatic habitat due to the potential for increases in peak flows (EHA > 20%).

Short-term (two water years) increases in sediment from harvest, log haul and stream restoration efforts are expected from Alternative C. The sediment resulting from these activities may produce localized effects to Redband trout immediately below project sites. However, due to built-in designs concerning timing and magnitude of the vegetative manipulation projects, these localized effects are not expected to result in a negative response to the overall viability of the Redband trout population under this alternative. Restoration measures under this alternative have the greatest potential to temper sediment production; therefore, persistence over the long-term is not expected. Stream temperatures are not expected to increase as a result of the proposed management activities.

Alternative C of the EHA analysis displays watershed values below 18 percent. EHA analysis shows some risk of increasing flows in headwater habitat (i.e. 2007 in Little Summit subwatershed), but at lower probability than in alternatives B and D. This risk is not expected to inhibit the viability or status of the Deep Creek fish populations (as well as the overall aquatic environment). On a watershed scale, EHA indicates that the past, proposed and future actions exhibit low potential for habitat altering effects. This would not change the life history needs that Deep Creek currently has to both resident and migrating Redband trout from the North Fork Crooked River.

Redband trout (as well as the overall aquatic environment) would benefit the most from proposed culvert replacements, road decommissioning/closures, riparian planting, large woody debris placement, and dispersed campsite rehabilitation. Of the three alternatives, Alternative C proposes the highest amount of treatment miles concerning these watershed related restoration activities. These activities are expected to more effectively increase stream shade, improve upon the quality and quantity of pool habitat, provide cleaner spawning gravels, decrease the amount of fine sediment, and provide passage to upstream aquatic habitats.

Like Alternative C, short-term (two water years) increases in sediment from harvest, log haul, and stream restoration efforts are expected from Alternative D. The sediment resulting from these activities may produce localized effects to Redband trout immediately below project sites. However, the timing and magnitude of these localized effects are not expected to result in a negative response to the overall viability of the Redband trout population under this alternative. Therefore, Alternative D has potential to negatively impact the aquatic environment within the Deep Creek watershed.

Cumulative effects for Alternative D of the EHA analysis reflects that Happy Camp and Little Summit subwatersheds are at highest risk for undesired adjustments in aquatic habitat for the years between 2003 and 2007 should 10 year or greater flood events occur. Habitats in Crazy Creek and two tributaries to Little Summit Creek are at highest risk for undesired effects from prescribed natural fire (increases in sediment and decreases in stream shade) activities. Utilizing design elements for commercial harvest, precommercial thinning, and prescribed fire activities within RHCAs would temper undesired effects to aquatic habitats (e.g. sedimentation). Culvert replacements would allow migration passage for fish and other benthic invertebrates to upstream habitats. Large wood placement activities would potentially increase pool habitat and decrease stream bank erosion. Riparian planning activities would increase shade and increase bank stability, thereby benefiting the aquatic community. When compared to alternative C, Alternative D has a less likelihood of meeting RMOs that are intended to benefit native aquatic species.

TES WILDLIFE

ALTERNATIVE A (NO ACTION)

Direct and Indirect Effects: The No Action Alternative proposes no vegetation management activities that would alter habitat for threatened, endangered, or sensitive species. Human activity would likely decrease within the planning area under this alternative. Habitat would increase through time by 10,950 acres. Unless otherwise indicated below, a "No Impact" or "No Effect" determination is expected for all species under this alternative.

Cumulative Effects: In the absence of new projects, the current levels of human activities are expected to decrease over the next 20 years. New grazing monitoring modules have recently been implemented and are expected to improve the condition for riparian vegetation. In addition, Allotment Management Plans for the Deep Allotments are scheduled for updates beginning in 2003. These updates would provide the opportunity to further address riparian vegetation. Prescribed fire for Summit would be expected to increase snag levels in the Little Summit sub-watershed where current snag levels are deficit. Additional watershed restoration activities currently listed in the Schedule of Proposed Actions but not yet identified through an Environmental Assessment have the potential for additional improvements of riparian habitat conditions. Current vegetation trends and ongoing activities considered together with Alternative A would be expected to improve habitat for northern bald eagle, Canada lynx, and California wolverine over the next 50 years in the absence of stand replacement events which are expected future foreseeable events. Habitat, individuals, or the population for many of the sensitive species would not be affected as either the population is stable; the area lacks habitat, or use is unlikely, rare, or considered incidental within the analysis area. (Sensitive species considered include: Bufflehead, tricolored blackbird, upland sandpiper, western sage grouse, gray flycatcher, American peregrine falcon, pygmy rabbit and Columbia spotted frog.)

ALTERNATIVES B (PROPOSED ACTION), C, AND D

Threatened Species

Direct and Indirect Effects: Northern Bald Eagle: Alternative A would maintain the existing acres of suitable reproductive habitat for the northern bald eagle. A model (WILDHAB) was used to project the effects on habitat for this and other species discussed in this document. Alternatives B, C, and D would not reduce reproductive habitat post-treatment. This is because none of the alternatives propose to harvest trees larger than 20” and these large trees are the platform for nests. Therefore modifications to habitat from treatments would not reduce the amount of large tree structure present. All alternatives would result in habitat being below historic ranges in the short term because of the current lack of large tree structure, however population levels are expected to remain stable. Even though habitat quantity will remain below what was historically present, no currently suitable habitat would be removed and over time additional large trees would be recruited into the planning area, bringing the planning area into its historic quantity of habitat in approximately 50 years.

Since eagles are not currently known to use the planning area as a nesting territory or for winter roosts, the potential for effects are limited to individuals using the area incidentally. Alternatives B, C, and D would not result in an increase in human and management activity over what has been occurring in the recent past. New and temporary road construction would open additional areas to motor vehicle access and future management activities. However, a total of 20.9 miles of roads would be closed or decommissioned in alternatives B and D. Alternative C proposes 31.2 miles. These closures would result in reducing the total area accessible to motor vehicle travel within the planning area. Upon implementation, the level of human activities and disturbance would remain within current parameters (specially and temporally) found within the watershed over the last 20 years. Incidental use by eagles would not be negatively affected under the alternatives because there is sufficient suitable habitat within the area. Also, the species is capable of traveling great distances and could avoid areas being disturbed.

Since live trees greater than 21” dbh would not be harvested, large diameter green tree replacements would be retained. Snags in harvest units would be retained at the high end of the historic range in Happy Camp, Lower Deep, and Jackson subwatersheds. In Little Summit Prairie, no snags would be harvested, except those needed to be felled to meet OSHA safety requirements. In all subwatersheds, snags may be felled to meet OSHA safety requirements. The types of hazardous snags that may be felled are generally associated with haul routes, landings, and skid trails. Eagles prefer large diameter (> 21” dbh) snags with large, widely spaced limbs for roosting or perching. Where feasible, they would be maintained. Prescribed fire does have the potential to remove existing snags, however, hard snags would also be created post burning in these areas to help retain snag habitat.

While current actions are not likely to reduce habitat for eagles due to the retention of large trees, estimated habitat changes over the next 50 years show an increase in suitable bald eagle reproductive habitat within the planning area. Alternative A would increase habitat by 10,950 acres, Alternative B by 10,530 acres, Alternative C by 10,886 acres and Alternative D by 10,687 acres. In 50 years, assuming no other treatments occur (no future vegetation proposals have been identified at this time), suitable reproductive habitat for bald eagles would be within the historic range of variability.

Proposed activities under the action alternatives would restore hydrologic processes through activities such as large woody material placement, road closures, culvert replacements, fencing of aspen stands, and riparian planting. All of these activities including prescribed burning, commercial thinning, and precommercial thinning, would help improve habitat for bald eagles.

Cumulative Effects: Past timber harvest removed large diameter trees and snags and necessitated the development of an extensive road system, thus opening most of the area to motor vehicle traffic and recreation. Currently, all Deep subwatersheds have between 28 and 43 percent of their area below Forest Plan standards for snags (Paulina Ranger District, 1998). These subwatersheds are dominated by plant association groups of ponderosa pine, a primary nesting and roosting tree species for the bald eagle.

Altered hydrologic flows from past grazing, timber harvest, the extirpation of beavers, and road development have negatively affected the amount of riparian habitat and the associated prey species that eagles depend on. The Little Summit Prairie subwatershed also contains a large stream system and prairie complex, thus offers the most potentially suitable unoccupied habitat present within the watershed. The Deep Creek Restoration Environmental Assessment, currently listed in the Schedule of Proposed Actions, proposes to restore hydrologic processes through activities such as road closures, culvert replacements, stream channel reconstruction, fencing, and riparian planting. Projects proposed and being implemented (such as prescribed burning in Summit, precommercial thinning, fencing, planting, range monitoring, and other restoration work) are designed to improve vegetative conditions that would cumulatively improve habitat for bald eagles. Because of this work, not only will the recruitment of large trees as nest structures occur, but also increases in the prey base for eagles should be realized through increased vegetative diversity, particularly in riparian areas.

For the bald eagle and its habitat, a "May Affect, Not Likely To Adversely Affect" determination for alternatives A, B, C, and D was reached through the following rationale:

- The planning area is not currently being used for breeding or winter roosting. Eagle use within the planning area is incidental, sufficient suitable habitat exists throughout the planning area, and eagles could avoid disturbed areas during implementation of Alternatives B, C, and D.
- Eagles within Central Oregon seem to be tolerant of fairly high levels of human presence because there are a number of eagle nests occurring in close proximity to developed recreation sites on the Deschutes and Ochoco National Forests. These nests were constructed after the recreational facility was built and in operation.
- Sufficient suitable foraging and reproductive habitat exists outside of the planning area.

The number of bald eagle occupied territories within the High Cascades recovery zone exceeds the recovery plan goal, and the 5 year average for young produced/occupied territory is extremely close to meeting the recovery area goal.

- Past management activities have created the existing condition, which is below the historic range of variability. The alternatives would increase the amount of suitable bald eagle habitat over the next 50 years.
- Loss of large diameter snags is likely to be minimal in all land allocations, and no loss would occur in Bald Eagle Management Areas or Bald Eagle Consideration Areas.
- Alternatives A, B, C, and D meet all Criteria I and II Project Design Criteria of the Programmatic Biological Assessment consistent with the Endangered Species Act and therefore, no further consultation with USFWS is needed.

Direct, Indirect and Cumulative Effects: Canada Lynx: Based on the most current science, neither the Canada lynx nor its habitat is present in the Deep project area. Surveys have been conducted throughout the northwest, including the Ochoco National Forest (in 1999, 2000, and 2001). No lynx were detected on the Ochoco National Forest by either Forest Service or US Fish and Wildlife Service surveys. Also, McKelvey and Aubry (2001) have concluded that there is no evidence of a resident population of lynx ever having occurred in Oregon or Western Washington, and the Final Rule on the listing of the Canada Lynx, published in the Federal Register on March 24, 2000 states "…we cannot substantiate the historic or current presence of a resident lynx population in Oregon." Habitat for Canada Lynx is considered sufficient to support survival and reproduction when there is at least 10 square miles of primary vegetation, which is defined as subalpine fir plant associations capable of supporting a minimum density of snowshoe hare (Claar et al. 2001, Ruediger et al. 2000). There are no subalpine fir plant associations located in the Deep project area. Because there is no occurrence of Canada lynx in the project area and because of the lack of habitat, there would be "No Effect" to Canada lynx or its habitat as a result of land management activities in the project area. Refer to the Wildlife Specialist Report in the project record for more information on lynx surveys and the habitat mapping process.

Sensitive Species

No impact is expected from the alternatives on the following species:

Bufflehead (*Bucephala albeola*)
Tricolored Blackbird (*Agelaius tricolor*)
Upland Sandpiper (*Bartramia longicauda*)
Western Sage Grouse (*Centrocercus urophasianus phaios*)
American Peregrine Falcon (*Falco peregrinus anatum*)
Pygmy Rabbit (*Brachylagus idahoensis*)
Columbia Spotted Frog (*Rana luteiventris*)

None of the alternatives would have an adverse effect on habitat, individuals, or the population of the above-named species because activities are not proposed in or near known populations. The area lacks suitable breeding habitat and suitable nest sites within or around the planning area, and use is unlikely, rare, or considered incidental (see Chapter 3).

Direct and Indirect Effects to Gray Flycatcher: The sagebrush, juniper, and ponderosa pine habitats within the planning area are marginal to poor habitat for the flycatcher. Alternative A would have no effect. The action alternatives propose varying amounts of prescribed burning and juniper thinning in its habitat. Treatments are designed to enhance these habitats, by moving them toward historical ranges. But, post-treatment habitat would remain marginal. These sites are not highly preferred, as compared to low elevation habitats outside of the area. Burning would negatively affect habitat within the area by reducing understory shrubs used for perching and nesting, therefore, Alternative B is likely to have the most potential to affect habitat. Burning is proposed for the fall and would avoid the nesting and breeding season.

Cumulative Effects: Past activities (such as timber harvest, fire suppression, and grazing) have contributed to the existing conditions described in Chapter 3 (page 3-45). Fire suppression has resulted in juniper encroachment into ponderosa pine and sagebrush habitats thereby reducing the total biomass of herbaceous cover, shrubs, and overall plant density. Grazing has contributed to changes in species composition and density as well. New and ongoing projects would not negatively or beneficially affect flycatcher distribution or habitat. Burning under the Summit natural burn would have similar effects as described above.

Direct and Indirect Effects to California Wolverine: Alternative B proposes to commercially harvest 7,112 acres. Alternative C proposes to commercially harvest 6,385 acres and Alternative D proposes to harvest 5,167 acres. This affects 13 percent, 12 percent and 9 percent, respectively, of the planning area. Treatment would occur in foraging habitat for wolverines while reproductive habitat would be avoided. All action alternatives would reduce existing habitat by 4 acres post-treatment. Following implementation, the following road densities would result: Alternative A - 2.19 mi/mi², Alternative B - 2.03 mi/mi², Alternative C - 1.99 mi/mi², and Alternative D - 2.03 mi/mi².

Allen (1987) and Butts (1992) recommend providing a variety of successional stages, maintaining or encouraging a cover type mosaic (through cutting or burning), and maintaining travel corridors between extensively managed areas and wilderness. Actions proposed are consistent with these recommendations. Harvest and burning provide a variety of vegetative conditions on the landscape. Alternative B moves the area closest to historic conditions, followed by Alternatives C and D. Harvest and burning are designed to help manage the snag and down wood levels toward HRV ranges thereby providing habitat for prey species.

A reduction of road density would benefit wolverines. Road decommissioning and road closures are likely to help improve the cover and hunting opportunities for wolverines. Connectivity is provided under each of the action alternatives to connect designated old growth areas and LOS. Leaving 10% of the harvest and precommercial thinning units, along with burning mosaics, in an untreated condition would help provide cover for prey species. These types of management changes provide a landscape or ecosystem approach that provides for the needs of many species (Butts 1992).

Cumulative Effects: Assuming no future treatments occur, habitat would increase over the next 50 years as follows: Alternative B by 18 acres, and Alternative C and D by 19 acres. Treatments proposed are designed to move habitat toward HRV.

The model does not measure road density or human presence as it relates to population viability. Over time, timber harvest and road development have modified habitat, increased road densities, and increased the amount of human presence. The planning area is highly roaded with an open road density of 2.19 miles per square mile. The planning area is also highly dissected and fragmented by scablands. Road locations are generally along forested stringers usually associated with riparian areas. An analysis of the planning area, including a 3-mile radius outside of the area, indicated that over the past 20 years there has been a relatively consistent level of harvest activity and human presence within this area. The action alternatives would maintain this level of activity.

Wolverines appear to be intolerant to land-use activities that fragment by permanently altering habitats, such as agriculture and urban and industrial development (Ruggiero et al. 1994). The proposed actions do not include these activities and would not fragment wolverine habitat. Refugia exists on the Paulina Ranger District north of the 2630 road, in the Rock and Cottonwood Roadless areas, and within Black Canyon Wilderness, where little human use occurs except during hunting season.

Another habitat component required by wolverines is an abundance of big game carrion as a primary food source (Copeland, 1996). Beginning in 1980, ODFW population estimates for Rocky Mountain elk within the Ochoco Unit were 400 animals. Mule deer were estimated at 13,500. In 1990, the estimate for elk was 1,800 and 13,300 for deer. In 2001, elk were estimated at 5,200 and deer at 18,300 animals. Since the 1980s, the populations of big game have increased within the Ochoco Unit.

During big game hunting seasons (August through November), there is a significant increase of human presence within the unit. Generally, this increase includes overland pedestrian travel and motor vehicle use of roads. Since 1980, road closures during hunting season reduce the open road density to 1 mile per square mile. This closure has likely been beneficial to wolverines.

The determination: A "May Impact Individuals or Habitat, But Will Not Likely Contribute To A Trend Toward Federal Listing or Loss of Viability to The Population Or Species" for the California Wolverine and its habitat for Alternatives B, C, and D was reached through the following rationale:

- Wolverines have been documented within the planning area.
- Reproductive habitat is a limiting factor within the planning area, but alternatives do not propose to reduce this habitat.
- Big game populations, which are a habitat component of the wolverine, are increasing within the Ochoco Wildlife Management Unit.
- Harvest activity levels have been sustained over the past 20 years, and the alternatives would not significantly increase this level above the present.
- Human presence and road densities have increased steadily over the last 20 years; however, permanent road closures and the Rager area road closures have mitigated some of these effects.

The wolverine is a widely distributed species and localized effects from this project are not significant enough to the entire population to contribute to a trend toward federal listing or cause a loss of viability to the population or species.

TES PLANTS

Surveys for sensitive plants have been conducted in the Deep Planning Area. A summary table of the plant species analyzed and effects determination is included in Appendix A. A determination of “May Impact Individuals or Habitat, But will Not Likely Contribute to a Trend Toward Federal Listing or Loss of Viability to the Population or Species” was made for all species under the action alternatives, except *Cypripedium parviflorum*, which was a determination of “No Impact.”

ALTERNATIVE A (NO ACTION)

Direct and Indirect Effects: This alternative would have no adverse direct or indirect effects on Peck's mariposa lily, moonworts, or porcupine sedge. Vegetation within the watershed would continue to move towards a late seral condition. No beneficial indirect effects would be made through habitat improvements such as stream rehabilitation projects, prescribed natural fire, culvert replacement and road closures, stand density reduction through timber harvest, or other projects. There would be no direct effects on Deschutes milk-vetch. Also, though, no beneficial indirect effects to Deschutes milk-vetch would be made through habitat improvements such as prescribed natural fire, road closures, stand density reduction through timber harvest, or other projects. This alternative would also have no direct or indirect effects on yellow lady’s-slipper.

There are approximately 10,915 acres of high probability habitat for *Achnatherum hendersonii* and *Achnatherum wallowensis* (ricegrass) within the Deep Planning Area. This alternative would have no direct effects on *Achnatherum hendersonii* or *Achnatherum wallowensis*. However, no beneficial indirect effects would be realized through habitat improvements such as road closures. A “No Impact” determination is expected on all species under the no action alternative for this project.

Cumulative Effects: The long-term cumulative impacts of Alternative A would likely be detrimental to most sensitive species within the Deep Planning Area. No benefits from stand density reduction, culvert replacement, road closures, meadow enhancement, or natural fuels burning would be realized. Many of the conditions affecting stream hydrology, including sediment from roads and cattle grazing, would continue. Factors that affect stream hydrology have been discussed in detail under the Water Quality and Fish Habitat affected environment and environmental effects. The risk of severe wildfire would increase through time, increasing the potential for direct effects from fire and fire suppression. The potential for increased competition from rhizomatous grasses after wildfire may result in reduced vigor of many *Calochortus* species, which are poor competitors.

ALTERNATIVES B (PROPOSED ACTION), C, AND D

Riparian Habitats

Peck's Mariposa Lily *(Calochortus)*: The Draft Species Management Guide for Peck's mariposa lily provides management strategies to protect the viability of the species. These management recommendations are more restrictive than requirements for protecting sensitive plants in the Ochoco National Forest Plan. The Deep EIS project proposes to adopt these management strategies from the Guide for all action alternatives. There are design elements (see Chapter 2) based on recommendations in the Guide, to avoid direct effects to selected populations. There would be no-harvest buffers protecting all populations and habitat from direct impacts, except when there is treatment within the riparian habitat conservation area (RHCA). By following the management recommendations outlined in the Guide (through design elements in Chapter 2), viability of the species would not be compromised.

Direct and Indirect Effects: Short-term indirect impacts are possible under Alternative B within all the populations adjacent to harvest units. A short term, localized increase in sedimentation is expected. This may affect Peck's mariposa lily by changing micro-site conditions as stream pools expand or contract. Alternative C is expected to have a somewhat reduced indirect effect due to the reduction in units adjacent to plant populations. Alternative D is expected to have the least potential to affect plants.

Under Alternatives B and C, there would be 4.8 miles of temporary roads re-opened for timber harvest. Approximately 0.4 miles are within Peck's mariposa lily habitat. The effects to habitat should not increase beyond what has already occurred because a design element confines activities to the existing roadbed. Nine miles of newly constructed temporary roads are proposed, none of which directly affect *Calochortus* populations. However, they do have the potential to indirectly affect sensitive plants and habitat as road construction can change drainage patterns and moisture regimes. Approximately 0.6 miles of new temporary road construction is proposed within Peck's mariposa lily habitat, which would directly be affected under Alternative B.

Alternative B proposes 334 acres, Alternative C proposes 188 acres, and Alternative D proposes 186 acres of burning within Peck's mariposa lily populations. Natural fuels treatments have the potential to directly affect these populations in several ways. It is assumed the riparian habitats in which this species occurs were historically subject to low severity, low frequency, and late summer fires. It is likely the accumulated fuels from decades of fire suppression may sustain fires of greater severity than historically, possibly damaging bulbs. Spring burning can have an effect on plants by damaging the newly emerging vegetative material. Construction of fire line, equipment transport, and emergency fire fighting efforts in the event of an escaped burn could have the same effects listed above. There are design elements specified to address these concerns. No lighting would take place within the RHCA, thereby reducing burn intensities. The fire would be allowed to back down into the riparian area, however, no activity slash would be piled within sensitive plant populations, thus reducing unnatural fuel loading. *Calochortus* individuals are adversely affected by the removal of leaves, depleting carbohydrate reserves (Fredricks 1989). Prescribed fire would take place in the fall after the plants are dormant, to avoid leaf removal. There should be no adverse direct effects to *Calochortus* populations.

In a study of the effects of fire and grazing on Peck's mariposa lily on the Ochoco National Forest, it was observed that cool burns in the meadows appeared to reduce competition to the lily and did not affect the moisture regimes (Kagen 1996). This burn was conducted in a year of high moisture, and the burn did not carry well through the majority of the plots. Thus, no evidence on the effect of hot burns was found. On the Winema National Forest, a wildfire burned a population of long-bearded mariposa lily (*Calochortus longebarbatus* var. *longebarbatus*), a close relative of Peck's mariposa lily. Flowering individuals were greatly increased in the year following the fire (Kagen 1996). Long-term indirect effects should be beneficial for the species by returning toward a historical fire regime.

There are no direct effects to *Calochortus* from precommercial thinning within RHCAs or meadow enhancement anticipated since design elements incorporate a standard of no slash accumulation within sensitive plant sites. A possible indirect effect to habitat would be caused from a possible sediment load increase, which would be short-term in nature. Long-term impacts of both precommercial thinning and meadow enhancement would be beneficial to Peck's mariposa lily by reducing competition and shade reduction.

Some of the proposed riparian planting and LWM is within known Peck's mariposa lily populations. Both activities could directly affect undetected Peck's mariposa lily plants by uprooting, crushing, or the cutting of bulbs when planting holes and logs are excavated. Indirectly, installation of stream structure placements are likely to have a long term beneficial impact on Peck's mariposa lily through raising of the water table and stabilization of the stream bank, thus improving and expanding habitat. It is determined that this activity may impact populations or habitat but would not likely contribute to a trend toward Federal Listing or cause a loss of viability to the population or species.

There are 35 acres of harvest within *Calochortus* populations under the aspen treatment proposal. 25 of these are within selected populations. Helicopter or winter logging would harvest all but eleven acres. Four acres of precommercial thinning within *Calochortus* populations are also proposed, one acre of which is within a selected population. The treatment objective is to remove competing conifers from within the aspen sites to give the aspen sprouts and saplings room to grow. Direct effects to *Calochortus* plants are possible during helicopter logging by falling timber on top of plants during the dry season. Tractor logging on four acres is the biggest threat to the plants. However, since these sites are selected populations, the District Botanist would design the treatments to benefit *Calochortus*, which may mean directional falling and retaining certain trees that would cause a direct effect to plants. Indirect effects may come from increased aspen growth creating too much shade for Peck's mariposa lily to thrive. While the lily may not remain on these sites if they are more densely vegetated, it is likely that populations would shift to the new transition zone and remain stable. Though there is a possibility some plants may be destroyed, it is thought that beneficial effects would offset this loss. It is determined that this activity may impact populations or habitat but would not likely contribute to a trend toward Federal Listing or cause a loss of viability to the population or species.

Rehabilitation of dispersed recreation sites that are close to streams would have a beneficial impact on Peck's mariposa lily. Indirectly, culvert replacement could alter stream flow patterns near the culvert, flooding or drying plant populations. However, the effects should be isolated to the area near the culverts, and many direct impacts can be avoided if the sites are checked for plants before implementation and the majority of plants avoided. There are many beneficial effects to the stream from having the proper size culvert.

Road obliteration and closures would benefit Peck's mariposa lily plants. A design element in the transportation management section requires activities be confined to the existing road prism, alleviating direct effects. Another design element was formulated to prohibit seeding of non-native species, especially within RHCAs and sensitive plant habitat.

Cumulative Effects: On-going grazing activities can affect Peck's mariposa lily through changes in microclimate and sometimes trampling, however, vegetative loss appears to be incidental.

Peck's mariposa lily can be affected by changes in microclimate as well, and plants can be directly affected by consumption of the basal leaf and trampling. *Calochortus* does appear to handle moderate grazing pressure and there is some indication that grazing helps keep habitat in a mid-seral successional stage that benefits the plant. Past activities, such as the exclosure on Little Summit Creek and the incorporation of riders in range administration, should help reduce the grazing pressure in riparian areas and subsequent effects to sensitive riparian plants.

In summary, Alternative B has the greatest potential for direct and indirect impacts to Peck's mariposa lily habitat. Indirectly, Peck's mariposa lily is influenced by changes in hydrology, stream bank condition, and vegetation changes (Kagen 1996). This alternative would affect more riparian acres than Alternative C or D, which may lead to changes in Peck's mariposa lily habitat. In spite of these impacts, it is thought that populations in the planning area are large enough to withstand some loss of habitat with the incorporation of design elements and recommendations from the District Botanist. Of the action alternatives, Alternative D has the least potential for indirect impacts due to a smaller amount of management activities that could potentially affect Peck's mariposa habitat (e.g., timber harvest, road building and prescribed burning.)

Direct, Indirect and Cumulative Effects to Moonworts (*Botrychium)* and Porcupine Sedge (*Carex*): No direct impacts to *Botrychium* and *Carex* populations are anticipated under the action alternatives because areas would be protected by a 50-foot (minimum) no disturbance buffer.

Timber harvest, road construction, and natural fuels prescribed burning all have the potential for indirect effects. Harvest and road construction have the potential to increase runoff where soils are compacted affecting *Botrychium* plants that are very sensitive to changes in soil moisture. Natural fuels prescribed burn units are adjacent to or surrounding *Botrychium* and *Carex* populations (nine, two, and two *Botrychium* sites for Alternatives B, C, and D, respectively). No fire ignition within RHCAs would occur, reducing fire severity. However, it is assumed the fire would back down into the riparian area, possibly increasing residence time. However, due to the moistness of the habitat, it is likely the fire behavior would be subdued, diminishing potential for adverse direct effects. Long-term effects may be beneficial. Careful monitoring during burning operations is necessary to avoid harmful indirect effects of hot fire, including complete duff consumption, which would increase sediment loading. Trees burning through and falling into the populations, affecting micro sites and possibly crushing of plants, is another hazard.

A major threat to the viability of *Carex* species is the change in fire regimes in the recent past (Newhouse 1995). Therefore, while short-term effects may be detrimental, a benefit in the long-term should be realized through prescribed burning.

Two *Botrychium* populations of 13 acres are within proposed meadow enhancement activities. Thus, light shading is common, and may be beneficial to the species (Zika 1995). Removal of encroaching lodgepole pine within the moonwort populations would have a direct effect on the species. A design element prohibits activities that are harmful to sensitive species, alleviating a direct effect. With individuals protected, long-term effects would be beneficial to the species and habitat by raising the water table and increasing meadow connectivity and habitat.

Alternative B has the highest potential for indirect impacts on Botrychium and Carex populations and habitat and Alternative D has the least.

Upland Forest Habitats

Direct, Indirect and Cumulative Effects to Deschutes Milk-vetch: No harvest or road building is proposed within known Deschutes milk-vetch populations or high probability habitat. Therefore, no direct or indirect effects from these activities would occur. Approximately, 5,927 acres, 1,932 acres, and 2,668 acres of prescribed burning occur in moderate to high probability habitat for Alternatives B, C, and D, respectively. Despite the assumption that Deschutes milk-vetch is an early successional, fire tolerant species, the effects of prescribed burning on this plant's biology and habitat are unknown. Due to fire suppression, current fuel loading is greater than levels with which these species may have evolved. Therefore, habitat could be negatively impacted in the short term. The long-term effects of burning may be beneficial by reducing dense stands of brush and understory ponderosa pine, creating more milk-vetch habitat. Alternative C has the least probability of short-term impacts to habitat and the least opportunity for long-term benefit.

Direct and Indirect Effects to Yellow Lady's Slipper *(Cypripedium*): There is no harvest proposed in the high probability unoccupied yellow lady's-slipper habitat. Alternative B proposes two timber harvest units and Alternatives C and D each propose one harvest unit in the grand fir/Columbia brome plant association type. This is a lower potential, drier habitat type within the moist grand fir plant association group. There is a design element for all moist grand fir sites restricting activity fuel treatments. No road construction, reconstruction or re-use would affect *Cypripedium* habitat. Natural fuels burning is proposed on 16 acres within the grand fir plant association group under Alternative B. This also is in the lower potential habitat grand fir/Columbia brome. Burning could reduce the large woody debris that orchids may depend upon. However, this amount of possible loss to less desirable habitat is not expected to affect the viability of yellow lady's-slipper. None of the action alternatives impact typical habitat of *Cypripedium*; therefore, there would not be an impact to the species' viability.

Cumulative Effects: Past effects on Deschutes milk-vetch habitat and yellow lady's slipper habitat are minimal. There is some evidence that suggests the milk-vetch responds positively to disturbance such as low intensity prescribed fire and timber harvest. The low growing nature of the plant prevents consumption by cattle from being an issue.

Non-Forested Habitats

Direct and Indirect Effects to Henderson's and Wallowa Ricegrass: No harvest activities would take place on non-forested scablands in any alternative. No direct effects from logging would occur to plants or ricegrass habitat. Indirect effects to habitat may occur from increased runoff, incidental tree falling, and slash accumulation outside harvest unit boundaries.

No new system road construction is proposed within ricegrass habitat for any alternative. Proposed roads for re-use within scablands were surveyed in the spring of 2000 and no sensitive species were found. Road construction and helicopter landing can impact ricegrass habitat. There are approximately 0.95 miles of temporary roads on 14 sites proposed on scablands within high probability ricegrass habitat. Implementation of action alternatives would adversely affect habitat for *Achnatherum hendersonii* or *Achnatherum wallowensis.* Four landings are proposed within high probability ricegrass habitat. Another five landings are proposed in Alternative B (three in C, two in D) that are directly adjacent to high probability ricegrass habitat. Proposed locations are reviewed and exact locations are approved under the timber sale contract before operations proceed. The District Botanist would review areas with sale administrators before temporary road and landing approval to avoid adverse impacts to habitat for *Achnatherum hendersonii* or *Achnatherum wallowensis.* Design elements were developed to address these concerns. For example, scablands would be avoided for road building, if possible. If avoidance of scablands were not possible, roads would be rocked and designed with erosion control features. Roads planned for inactivation in scablands would not have ripping or scarification attempted.

Alternative B proposes 4,144 acres of natural fuels burning within high probability ricegrass habitat. Alternative C proposes 2,132 acres, and Alternative D proposes 2,004 acres. Natural fuels burning is not designed to burn across scabs, however, no control lines would be constructed to keep fire out of these habitats, therefore, they are included in the total acreage figures. No lighting would occur within scablands. 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* and *Achnatherum wallowensis* probably evolved in an infrequent, light intensity fire regime, however, effects of prescribed fire on these species are unknown. Natural fuels activities are not expected to have an impact on ricegrass habitat.

Cumulative Effects: Past road building and timber landing areas have adversely affected

Henderson's ricegrass habitat.

TES Plant Summary*:* Under the action alternatives, the effects of timber harvest, prescribed fire, precommercial thinning, and meadow and aspen enhancement would reduce stand densities, contributing to returning the area to a more historic fire regime. In the long-term, these activities would be beneficial to many of these sensitive species. Alternative B has the highest acreage proposals of these activities, while Alternative D has the least. Cumulative effects resulting in risk of increased peak flows and adjustments in channel form can also result in indirect effects to plants. Therefore, with Alternative B, the risk of possible direct and indirect effects to sensitive plants is the highest. The risk of increased peak flows is lowest under Alternative C.

Culvert replacement, large wood placement, and riparian planting have a high likelihood of affecting sensitive plants and habitat, especially those in riparian habitats. At the same time, in the long-term they would be beneficial in reducing cumulative effects of past and present actions within the watershed. As discussed under Water Quality and Fish Habitat, the potential for this long term benefit is linked to the risk associated with peak flows. In consideration of this, along with the potential for increases in flows, these actions are most likely to be beneficial under Alternative C. A determination of: "May Impact Individuals or Habitat, But Will Not Likely Contribute To A Trend Toward Federal Listing Or Loss Of Viability To The Population Or Species" (see Appendix A) was made for all species under the action alternatives, except *Cypripedium parviflorum*, which has a determination of "No Impact".

Transportation

Table 4-27 shows the road miles resulting in the planning area based on proposed actions to decommission or close existing roads.

Table 4-27 Road Miles After Implementation

	Alternative A (Current Amount)	Alternatives B and D	Alternatives C
High clearance vehicles (pickups, all purpose vehicles)	163	148	145
Suitable for use by low clearance vehicles (passenger cars).	27	27	27
Total Open roads within Deep Creek Watershed	190	175	172
Miles of Roads in a storage or closed category primarily for resource protection and safety reasons.	95	98	99
Miles of Roads Decommissioned within the Watershed	47	58	61

ALTERNATIVE A (NO ACTION)

No change would occur in overall road miles within the planning area. The open road densities would remain at 2.19 mile per square mile. Custodial maintenance activities would continue to provide access for the public.

ALTERNATIVE B (PROPOSED ACTION), C, AND D

Direct and Indirect Effects: A total of 11.7 miles of roads would be permanently removed from the overall road system under Alternative B and D. Alternative C would remove 15.2 miles from the system. This includes some roads that are currently in a closed capacity that are not necessary in the long term. Under Alternatives B and D, 9.3 miles of roads are to be closed and 16.2 miles under Alternative C. No effect is anticipated to the miles of road suitable for passenger car travel. A total reduction of 15 miles of open roads would occur under Alternative B and D, while 18 miles would be reduced under Alternative C. This would affect overall access for high clearance vehicles within the watershed. Table 4-29 displays the open road densities within the Deep Planning Area by subwatershed.

Table 4- 28 Open Road Densities within Subwatersheds

Subwatershed	Open Road Density (miles per sq. mile)		
	Alternative A	Alternatives B and D	Alternative C
Deep Creek Watershed	2.19	2.03	1.99
Happy Camp Creek	2.06	1.83	1.83
Jackson Creek	2.59	2.26	2.26
Little Summit Creek	2.47	2.26	2.18
Lower Deep Creek	1.42	1.28	1.28

For the watershed as a whole, and within each subwatershed, the open road density is decreased by all action alternatives.

Cumulative Effects: The cumulative effects identified from the reduction in road densities from a transportation system perspective include a reduction of the overall road system, a reduction in access to the area, and reductions in road maintenance. Additional cumulative effects from roads and roads related issues are discussed under the affected resource. The Deep Creek Restoration EA has been identified on the Schedule of Proposed Actions. Although a site specific proposed action is not yet developed, it is reasonable to assume that this watershed restoration EA would incorporate additional hydrologic road closures and decommissioning projects, further reducing the overall transportation system.

Wildlife and Wildlife Habitat

Direct and Indirect Effects to Northern Goshawk: Alternative A, the no action alternative would perpetuate the loss of large tree structure and the species composition shift from shade intolerant species to shade tolerant species. Large tree structure would be slower to develop and fire risk would continue to increase over time with the accumulation of ladder fuels and the continued absence of fire in this fire dependent ecosystem.

Alternatives B, C, and D, as described below in Table 4-30, propose vegetation management within the Post Fledgling Areas (PFAs). Vegetation treatments development by the silviculturist and district wildlife biologist will be designed to meet the objectives and desired conditions that follow:

Management objectives for the PFAs are to:

- Provide hiding cover for fledglings;
- Provide habitat for prey and foraging opportunities for adults and fledglings.

Desired Conditions for the PFAs are:

- Sixty percent of the stand structure in the VEMG structure size 4 and 5 categories (9-20.9" and > 21" dbh) with the majority in the 5 class (LOS);
- The remaining 40 percent, with 20 percent in VEMG structure size 3 (5-8.9" dbh), 10 percent in VEMG structure size 2 (< 5" dbh), and 10 percent in VEMG structure size 1 (grasses, forbs and shrubs);
- LOS that would include: snags, downed logs, mature and old, live trees in clumps or stringers with interlocking crowns, and a developed herbaceous and shrub understory that would be present with an emphasis on native grasses.

Table 4- 29 Proposed Activities by Alternative within PFAs (Percent of PFA)

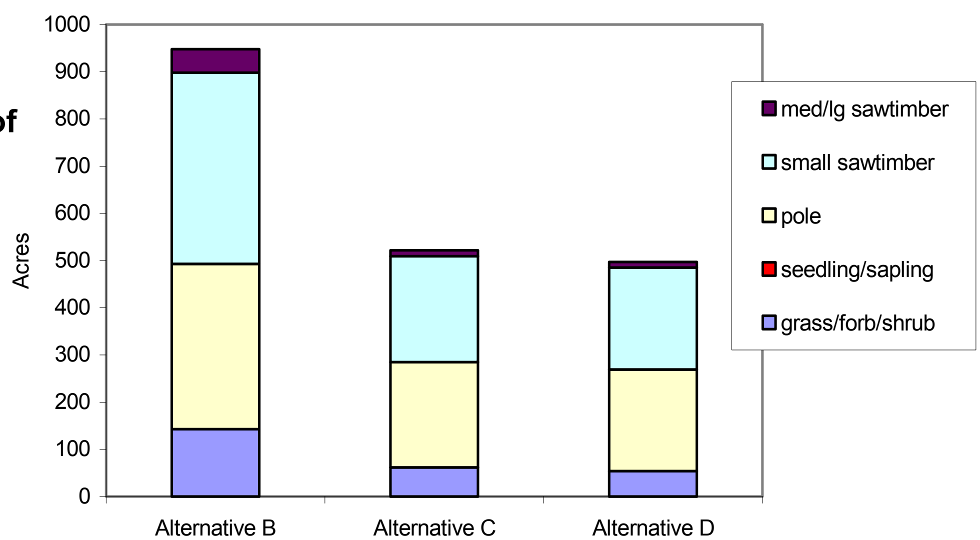
Alternative B	**Post Fledgling Areas**					
	Toggle	**Haypress**	**Little Summit**	**Summit Camp**	**Happy**	**Happy Jack**
Commercial Harvest	24%	35%	4%	29%	22%	48%
PCT	2%	3%	22%	0%	0%	0%
Natural Fuels Underburning	7%	45%	69%	26%	0%	16%
Alternative C	**Post Fledgling Areas**					
	Toggle	**Haypress**	**Little Summit**	**Summit Camp**	**Happy**	**Happy Jack**
Commercial Harvest	1%	16%	4%	19%	8%	33%
PCT	16%	3%	22%	0%	0%	0%
Natural Fuels Underburning	0%	0%	40%	0%	0%	0%
Alternative D	**Post Fledgling Areas**					
	Toggle	**Haypress**	**Little Summit**	**Summit Camp**	**Happy**	**Happy Jack**
Commercial Harvest	10%	18%	4%	19%	18%	33%
PCT	0%	0%	22%	0%	0%	0%
Natural Fuels Underburning	0%	0%	40%	0%	0%	16%

Review of Table 3-23 (Chapter 3, page 3-54) indicates the majority of the PFAs are composed of the small saw timber size class and no PFAs are currently meeting desired conditions. All of the PFAs are deficit in the relative abundance of large structure, and treatments are designed to increase stem growth to improve this condition. PFAs are also below desired ranges in seedling/saplings. All PFAs are above desired levels for pole and small saw timber and the emphasis of treatments within these structures is to improve the overall distribution of structures. The majority of the precommercial thinning is prescribed within Little Summit PFA to increase growth of the pole size material in this PFA. Table 4-31 shows the seral/structural acres proposed for treatment by alternative. Figure 4-3 summarizes this information.

Table 4- 30 Structural Stage Treated by Alternative for PFAs

Structure	Toggle Acres	Haypress Acres	Little Summit Acres	Summit Acres	Happy Acres	Happy Jack	Totals
Alternative B							
Grass/forb/shrub	9	63	31	24	2	14	143
Seedling/sapling	0	0	0	0	0	0	0
Pole	40	49	115	63	20	63	350
Small Sawtimber	48	71	76	69	31	110	405
Medium/Large Sawtimber	0	12	1	5	7	25	50
Alternative C							
Grass/forb/shrub	7	5	27	12	1	10	62
Seedling/sapling	0	0	0	0	0	0	0
Pole	28	24	102	29	4	36	223
Small Sawtimber	32	29	67	33	7	56	224
Medium/Large Sawtimber	0	3	1	3	1	5	13
Alternative D							
Grass/forb/shrub	3	4	29	4	2	12	54
Seedling/sapling	0	0	0	0	0	0	0
Pole	16	15	103	26	18	37	215
Small Sawtimber	21	21	68	29	24	53	216
Medium/Large Sawtimber	0	2	1	3	2	4	12

Figure 4-3 Amount of Vegetation Management within Structural Stage



Alternatives B, C, and D propose vegetation management in each PFA. Treatment in the size classes displayed would move vegetation toward the desired conditions. In areas where large diameter tree structure is present, the treatment would favor these trees and be designed to maintain and enhance their longevity, by thinning smaller diameter competing trees. No large diameter trees over 21" dbh within PFAs would be harvested. Design elements common to all action alternatives for goshawks describe that treatment within PFAs would be designed to meet goshawk objectives for maintenance of suitable nesting cover and for vegetation diversity to produce prey species. Specific treatment objectives would follow management recommendations found in Reynolds and Woodbridge (1992). In addition, all activities associated with the alternatives occurring within PFAs would take place outside of the seasonal restriction of March 1 through September 30, with the exception of road construction and reconstruction. These would be evaluated on a case-by-case basis by the wildlife biologist (See Design Elements in Chapter 2, page 2-40).

Alternatives B, C, and D propose to improve the vegetation condition within PFAs as well as the larger goshawk territory. Treatments within the PFAs would have an emphasis on managing the vegetation for prey species and fledgling cover.

There may be short-term effects to individual goshawks due to the disturbance within the units and the potential for loss of nesting, roosting, or foraging trees if hazard trees are necessary to cut. Design elements mitigate these effects through snag retention and retaining 10% of the treatment units in an untreated state. Design elements for treatments, coupled with the habitat moving closer to HRV conditions, increase the suitable habitat.

Analysis indicated there are currently 16,775 acres of suitable goshawk reproductive habitat within the planning area. No action alternatives would reduce high quality (LOS) goshawk reproductive habitat. This is because treatments would not reduce existing large tree structure, which is an important component of its habitat.

It is estimated that habitat will increase under all alternatives through time. Habitat would increase as follows: Alternative A by 12,556 acres, Alternative B by 11,935 acres, Alternative C by 12,450 acres, and Alternative D by 12,179 acres. Habitat would move to within HRV, and population viability is expected to improve. No large tree structure would be removed in any action alternatives. Treatments are designed to reduce competition to large trees, which results in the acceleration of large tree structure development necessary for goshawk nesting, fledgling cover and structure for their prey species. Because of this, Alternative C will best achieve the desired conditions.

Cumulative Effects: Vegetation management has occurred in each of the PFAs since 1979 which has created the existing condition of tree sizes and stand structure. Harvests completed before 1993 (Chamberlin, Bottoms, Connolly, and Haypress Timber Sales) were much more intensive treatments (regeneration harvest and overstory removals) than the thinning (HTH/HIM) treatments that have been designed to increase tree size and stand structure in the Deep vegetation project while maintaining current stand structure and complexity. Toggle, Haypress, Little Summit, Summit, Happy Camp, and Happy Jack have had vegetation treatments covering 16, 25, 38, 0, 82, and 12 percent, respectively. Each of the action alternatives proposes additional treatments within PFAs (See Table 4-27, page 4-70) to meet objectives for goshawks as described above and displayed in Table 3-22, page 3-52.

Toggle and Haypress seem to have the highest site fidelity with known multiple nests. The nest in Summit was discovered in 2000, and no alternate nests or history of the territory are known. The Happy Camp nest has been known since 1996 with varying monitoring and known reproductive success. The Little Summit nest is the least monitored site within the planning area, with three known nests that have not been used in the last 4 years. The Happy Jack Camp nest was found in 2001 and an alternative nest was also found.

Past management activity and natural disturbance processes can influence vegetation conditions and thus site fidelity with the PFA, either positively or negatively. Vegetation changes can make a PFA undesirable to a nesting pair of goshawks, causing them to shift their core area within their territory or potentially abandon the territory. Historic district data on goshawks shows that goshawk sightings and suspected nests have been documented in these areas through the last two decades. Therefore, these territories have remained stable in the last two decades with varying amounts of past activities. The Deep vegetation treatments will promote desirable stand characteristics and in the long term balance some of the past harvest activities as these stands respond to treatment and develop desired size structures.

Direct and Indirect Effects on Designated Old Growth & LOS Connectivity: Connections were identified between designated old growth (1,267 acres) and all late and old-structured (LOS) stands (11,002 acres) that are greater than five acres in size. There are 3,966 acres of connections identified. Connectivity corridors have been mapped and are included in the wildlife specialist report.

In the absence of wildfire, Alternative A, the No Action Alternative, would not affect corridor connections. Alternatives B, C, and D propose vegetation management within these connections. Alternative B proposes to treat 75 units and 322 acres of connection habitat. Alternative C proposes to treat 65 units and 281 acres and Alternative D proposes 57 units and 221 acres. Connectivity corridors may be left untreated where they coincide with RHCAs or as leave areas to meet 10 percent untreated retention objectives. Where commercial timber sales are planned, prescriptions for these units are designed to manage the canopy closure in the top one-third of site potential, consistent with the Regional Forester's Forest Plan Amendment #2. Connections are designed to maintain a relatively closed canopy to provide for the secure travel and dispersal of old growth-related species, such as the pileated woodpecker. Alternatives A, B, C, and D meet the Forest Plan Standards and Guidelines for connectivity of LOS and old growth.

Cumulative Effects: Past timber harvest has resulted in large structure being reduced well below historic conditions. Of the 3,966 acres identified in connectivity corridors, 23% currently are in the upper one-third of site potential. No change in this figure is expected to result from the proposed action alternatives. Current management objectives result in treatments focusing on maintaining these areas in higher canopy closures and would provide for green tree replacements and snags for these species. As stated in the Vegetative Diversity section, these stands are at high risk for competition related stress and are more susceptible to stand replacement fire effects.

Direct, Indirect and Cumulative Effects on Fragmentation: The action alternatives propose a variety of treatments including commercial, precommercial, and prescribed fire. All these activities would somewhat modify vegetation from its current condition. However, treatments have been designed to return the area to a more sustainable condition as described by HRV. These activities are consistent with historic disturbance regimes. Most commercial harvest treatments would thin from below to reduce overall stocking. Group selections would not be greater than five acres in size. These openings are of a size consistent with historic fire, insect, and disease disturbances. Large structure (trees >21" dbh) would be retained within the planning area. The action alternatives would not increase the edge effects or fragment habitat in a way that is inconsistent with historic disturbance processes.

Before the Regional Forester's Plan Amendment #2, timber harvest included more intensive harvest treatments than are commonly used today. Openings created through harvest did not exceed 40 acres in size. Forty acres is relatively small and is consistent with past disturbances. Currently 57% of the forested vegetation is outside of HRV. Both species composition and structure have been altered through time from management activities and stand development in the absence of fire. This shift in seral/structural stage composition has resulted in vegetation conditions outside of HRV; however, it has not resulted in fragmentation to habitats or on the landscape. As stand conditions continue to tend toward multi-strata conditions, the potential for stand replacement fire under Alternative A would increase. This could lead to larger stand replacement fires than what would be expected under historic fire regimes.

Direct, Indirect and Cumulative Effects on Meadows: All of the action alternatives incorporate 825 acres of treatment to help maintain meadow habitats, maintain the natural extent of edge habitat against forested habitats, and increase available water for meadow vegetation. This would be accomplished through the thinning of encroaching conifers. Conifer increase has occurred from a variety of past actions that have affected the floodplain interaction. With Alternatives B, C, and D, removing conifers from these sites is expected to make them more suitable to a host of wildlife species. For example, deer and elk use these habitats for fawning and calving due to the availability of water and succulent vegetation for lactating females, and bats and a variety of insect-eating birds such as mountain bluebirds use meadows for foraging. The high amount of edge within these areas provides habitat for a greater number of species, reflecting the diversity of plant species and community structures. Alternative A would result in the continuation of conifer encroachment and lead to a reduction in the value of these habitats.

Direct and Indirect Effects on Snags and Down Logs: Alternative A would maintain the existing numbers of snags within the watershed. Design elements common to all action alternatives address the concern that portions of all subwatersheds are below the 100 percent maximum potential for snags as indicated in Chapter 3 Affected Environment (2.25 snags/acre). Other than for safety hazards, no snags would be designated for removal in Little Summit Prairie subwatershed. Snag levels would be maintained at the upper end of the VEMG ranges in proposed treatment units within the Happy Camp, Lower Deep, and Jackson Creek subwatersheds by using the snag levels outlined in Table 3-24 (page 3-56). Snags that are safety hazards along haul routes, landings, and skid trails may be felled and removed to meet OSHA safety requirements. In addition, snag patches would be laid out in helicopter units. This would help to ensure crew safety and protect snags from needing to be felled due to safety requirements. Under all action alternatives, 10% of each treatment unit will be retained in an untreated condition. This will assist in maintaining within-stand diversity. Depending on stand conditions, these untreated areas would coincide with down log concentrations, snags, or multi-strata stand conditions. In addition, green tree replacements would be provided in all harvest units to provide future snag recruitment.

Of special note are hollow grand fir, a unique habitat structure important to numerous wildlife species that are extremely rare. These trees occur in the dry and moist grand fir PAGs found in the Deep Planning Area. Large (>20" dbh) hollow trees are found in late-seral, multi-layer stands, (a seral condition comprising less than 3 percent of the forested landscape in the Interior Columbia River Basin (Bull 1997)). These trees have significant wildlife value. Hollow grand fir can exist as a snag or a live tree. No live green trees >21" dbh are proposed for harvest in any alternative. Marking guidelines would include a description of the distinguishing characteristics of these trees, and they will be favored during marking in combination with the snag management guidelines described in Table 3-27.

The action alternatives contain specific burn prescriptions, based on existing conditions (Appendix E) that are designed to create the appropriate fire intensity for attaining desired conditions for natural fuels reduction or wildlife objectives. Burning will take place in the fall. Burning would have the potential to bring existing snags to the ground, while creating new snags. Burn units have been combined into groups of similar plant potential mixes. Appendix E displays average existing conditions and projects post-treatment conditions for each group. All groups are currently above the 2.25 snags/acre, except Group 1, which has only 1.4 snags/acre. Post treatment, snags are expected to increase within this area to1.8 snags/acre with the increase occurring in larger trees. Other groups are projected to stay above the 2.25 snags/acre and remain within historic ranges (2.58 – 3.39 snags/acre). Based on this analysis and design elements incorporated into the action alternatives for the protection of snags, Alternatives A, B, C, and D are consistent with the Forest Plan Standards and Guidelines for snag management.

Analysis of the project area with the new DecAID (Marcot et al. 2002) advisor shows that habitat for various species of dead wood habitat users is present below the 50 percent tolerance level. There is one exception and that is for the white-headed woodpecker. The snag levels found in the Deep Analysis Area would provide habitat for the white-headed woodpecker at the 50% tolerance level. Insufficient data exists to analyze the project area at the 30 percent tolernace level for all species but the white-headed woodpecker with the DecAID habitat types contained in the Deep Analysis Area. Because harvest of existing snags is not proposed in either the no action or action alternatives, there will be no difference in effect to dead wood habitat users in the Deep Analysis Area.

Down log levels would be maintained within historic ranges in all units proposed in Alternatives B, C, and D, by using the down wood levels described in Table 3-29. Alternative A, the No Action Alternative, would not affect down wood levels. Down wood is influenced by the number, size, and distribution of snags. Currently, the overall amount of wood has been influenced by years of fire suppression. Without natural fire on the landscape, levels have increased and competition related mortality from higher stand densities has resulted in increases in the overall down wood. The existing fuel loading in proposed burning units demonstrate this point (Appendix E).

Alternatives B, C, and D propose the following activities that would have the greatest effect on down wood levels: 1) prescribed fire treatments after timber harvest, 2) natural fuels treatments, and 3) salvaging of down wood. However, the design elements common to all action alternatives provide for the management of down wood within the VEMG range for all treatment acres. Prescribed burning is expected to leave down wood within historic ranges and design elements have been incorporated into action alternatives to maintain wood levels within ranges during timber harvest. Existing down wood, generally does not have commercial value and is left on site, however, recent blowdown or hazard trees may be harvested if wood levels remain within the historic range. All alternatives would meet the Forest Plan Standards and Guidelines for down logs.

Cumulative Effects: The effects of past harvest (prior to 1993) have left areas at or below minimum snag levels based on today's standards and guidelines. Fuel levels have increased over time and have led to existing fuel loading that exceeds historic levels. Currently, silviculture prescriptions provide for green tree replacements for future snags. Snags are managed at higher levels, which results in no snags being harvested other than those posing a safety hazard. Those cut along the main haul routes would help improve public safety. Standing dead ponderosa pine, larch, Douglas-fir, and grand fir are not to be harvested under the personal use firewood program. Most gathering of down wood occurs within 100 feet of open roads. The overall size of down wood reflects the fact that large structure is lower than historic conditions. Current management direction would help accelerate large tree structure and move stands toward this condition resulting in larger size classes being reflected in snags and down wood. The foreseeable action that will likely contribute to cumulative effects to snags would be the 1,417 acres of natural fuels burning planned within the Summit Timber Sale area. An analysis of the effects of this action is presented in Appendix E which basically concludes that dead wood habitat would be consumed by the prescribed fire activities and it would also be created. Actual density of snags would probably not change in the short term after prescribed fires. The type of snag would probably change from soft, advanced decay snags to harder, newer snags.

Management Indicator Species

Direct and Indirect Effects on Pileated Woodpecker: There are currently 13,312 acres of currently suitable foraging habitat that represents pileated feeding areas within ½ mile radius of the four designated old growth areas. Plan standards require that foraging habitat would provide at least 2 snags/acre greater than 10" DBH. Feeding habitat is basically multi-strata LOS stands that are similar to those required for reproductive activities. Under all action alternatives, the post-harvest amount of foraging habitat within ½ mile of the designated old growth areas would exceed Forest Plan standards by a significant amount. Alternative D would provide the most foraging habitat with 12,607 acres followed by C (12,550 acres) and B (12,412 acres). Precommercial thinning and prescribed burning activities would not alter overstory structure; however, stand density reduction would reduce the amount of pileated foraging habitat because overall stand density will be reduced causing the woodpeckers to avoid these open stands or increasing predation of birds that continue using the stands.

Fuels treatments to commercial units and natural fuels treatments may impact pileateds through the loss and degradation of snags and down logs. Snags may be lost from burning operations and converted to down logs. Lighting techniques will avoid snags and monitoring of operations will minimize this risk. Charring caused from burning can harden snags reducing use from insects that pileateds feed on. Down logs will be impacted from burning operations. Prescriptions are designed to remove small diameter logs and maintain large diameter logs. Reducing down log levels may reduce foraging habitat for pileateds and this is likely to impact prey availability for pileateds. The main prey species utilized by pileateds is the carpenter ant. Ant colonies occur primarily in larch, Douglas-fir and Grand fir logs with advanced decay. However, from the standpoint of ant colonization and woodpecker foraging, log size may be more important than species (Bull 1997). Burn prescriptions are designed to reduce small diameter logs and maintain large diameter logs. However, burning is planned to occur in the fall when logs are more susceptible to consumption if moisture levels are low and they have not been able to fully recover.

The pileated woodpecker prefers large, fir-dominated habitat with a closed, multi-layered canopy with large quantities of both snags and down logs for reproducing. Suitable reproductive habitat is generally defined as mixed conifer stands that meet multi-strata LOS definitions. The WILDHAB excel model analysis showed there are 16,775 acres of currently suitable pileated woodpecker reproductive habitat within the planning area (Appendix A). The historic range of variability for pileated reproductive habitat within the planning area ranges from 20,819 to a high of 40,799 acres. Currently habitat is below HRV by 4,044 acres. This is due to past timber harvest activities and the lack of large tree structure. Each alternative was run using the WILDHAB model to assess the affect of each alternative to pileated reproductive habitat within the planning area. All action alternatives will reduce habitat post treatment as follows: alt. B by 544 acres, alt. C by 24 and alt. D by 316 acres. The modifications to habitat from treatments would not reduce existing large tree structure, which is an important part of the habitat, but would affect other habitat features such as the canopy density, canopy layers, and species composition of the under-story trees.

Reproductive habitat for pileated woodpeckers is estimated to increase over time under all alternatives in the absence of future management activities. Assuming no future treatment, the model shows increased habitat through time due to increases in stand density, mortality, and canopy layers. Alternative A would result in more future habitat over the action alternatives because no post-harvest reduction to habitat would result from this alternative. Alternative C would result in a greater increase of future pileated habitat than Alternative D and B, respectively.

During implementation and up to ten years after, there will be negative effects to individual pileated woodpeckers due to harvest disturbance within units, and the potential loss of nesting, roosting, or foraging trees. Snags may be felled from safety hazards within their home range. However, these impacts are likely to be small in scope and short in duration compared to the thousands of acres currently providing foraging habitat. All alternatives meet Forest Plan Standards and Guidelines for managing pileated woodpeckers.

All other activities proposed in Alternatives B, C and D, not yet specifically discussed have been determined to not contribute in a significant way to the discussion of effects to pileateds and their habitat within the planning area, including: precommercial thinning, road construction/reconstruction, temporary roads, road closures/decommissioning, willow protection, culvert replacement, dispersed recreation site rehabilitation, riparian planting, large woody material placement, and meadow enhancement. These activities have been considered in the overall effects determination, but do not warrant specific discussion as they relate to pileateds and the final determination, because they will not reduce large tree structure, snags or down logs important for pileated woodpeckers. In addition, many of these activities are small in scope and scale, will be limited in spatial and temporal disturbance to woodpeckers, or occur in non-habitat.

Cumulative Effects: Past timber harvest activities selectively removed the over story which was dominated by economically valuable live and dead large diameter ponderosa pine. As stated previously, there is a lack of large tree structure within the planning area. In addition, fire suppression activities for the past century have resulted in overstocked stand conditions, and a shift in species composition to shade-tolerant species such as white fir. This has also resulted in an accumulation of down woody material. Changes in the large tree structure have reduced the amount of suitable habitat for the pileated woodpecker. However, since the early 1990s the Ochoco National Forest has been implementing the Viable Ecosystems Management Guide with an emphasis on managing for the Historic Range of Variability. Historically, there were fewer multi-storied, fir-dominated stands and more single-storied, pine-dominated stands in the pine, Douglas-fir and dry grand fir plant communities. In the moist, cool sites of moist grand fir, high canopy closures and multi-layered canopies were historically common, but the planning area is dominated by drier forest types. Moving these drier forested sites towards their HRV, by managing for pine rather than fir, will likely reduce habitat for species such as the pileated woodpecker, because they prefer fir-dominated sites. The shift in species composition through fire suppression has moved habitat conditions outside of HRV for this landscape, which has benefited the pileated to some degree. However, designated old growth areas will continue to be managed to provide habitat for closed canopy, multi-layered old growth related species such as the pileated.

Past timber harvest has had the most effect on the number, size and distribution of snags on the landscape. Prior to the 1989 Forest Plan, snags were not left in timber sale units. From 1989 to 1995 the unamended Forest Plan standards managed at the 47% potential level for primary cavity excavators (LRMP 4-243). Since 1995, when the Forest Plan was amended by the Regional Forester, snags have been managed at the 100% maximum potential level for primary cavity excavators. Currently, the planning area is not providing for 100% maximum potential for primary cavity excavators when analyzed at the subwatershed scale. Approximately 38% of the planning area does not meet Forest Plan standards for snag levels. With the remaining areas containing snag levels at the low end of the range.

Annual firewood gathering combined with hazard tree reduction along roads has likely reduced snag levels below standards within 100 feet of all roads. This equates to approximately 15% of the planning area. Cumulatively, snag levels are deficient on approximately 50% of the planning area, and do not reflect historic size classes important to wildlife species such as the pileated that utilize snags during their life cycle.

Annual firewood gathering has likely reduced down log levels below standards within 100-200 feet of roads. This affects approximately 30% of the planning area. Cumulatively, down log levels are deficient on approximately 50% of the planning area, and do not reflect historic size classes important to wildlife species such as the pileated that utilize down logs during their life cycle.

Furthermore, there are 1,417 acres of natural fuels burning planned within the Summit Timber Sale area. These acres may be burned in both the Fall and Spring burning seasons. Treatments are designed to reduce fuels; however snags and large diameter down logs may be lost during burning operations. Some additional snags will be created through natural fuels burning, but the net affect will be a reduction in snag density over what is presently occurring. Lighting techniques will be used to avoid snags, and post-firing monitoring will be implemented to minimize the loss of existing snag habitat and down logs.

The main prey species important to pileateds, the carpenter ant, utilizes both snags and down logs. The lack of carpenter ant habitat (down logs) suggests that prey availability for pileateds is also deficient, is not meeting potential, and is not well distributed throughout the planning area.

Direct and Indirect Effects on Primary Cavity Excavators: This section is intended to discuss the remaining primary excavators that are not covered through the pileated discussion. This includes the white-headed woodpecker and the common flicker (Management Indicator Species for juniper woodland). The historic range for white headed woodpeckers is from 19,367 to 38,764 acres. Currently the planning area is below the HRV by 4,684 acres. This existing condition – a lack of large tree structure and overstocked stand conditions – has resulted from past management activities. All alternatives will move white-headed woodpecker habitat back towards HRV. Alternatives B and D will reduce existing habitat post treatment by 103 and 40 acres. Alternative C will increase habitat post treatment by 301. This greater reduction is due to the types of silvicultural prescriptions for commercial units in Alternative C that will reduce stocking levels in stands with large ponderosa pine trees. Alternative C will also move habitat towards HRV faster than the other alternatives. In all action alternatives, proposed burn areas have specific prescriptions developed to attain desired conditions. Estimates show that generally snag densities will be reduced in varying amounts throughout the planning area and will not meet 100% potential population levels for primary cavity excavators.

No effect to the common flicker is expected by any of the action alternatives. Actions have been designed to maintain juniper > 12” diameter. This is a design element common to all action alternatives. Commercial and precommercial activity specifications do not remove juniper of this size. The natural fuels burning operations do not burn at an intensity to kill juniper of this size, and this would be the standard for the juniper thinning activities associated with these areas.

Cumulative Effects: Changes to vegetation and snag management have occurred over time. These changes have reduced the amount of suitable habitat for the white headed woodpecker. Historically, there were fewer multi-storied, fir-dominated stands and more single-storied, pine-dominated stands in the pine, Douglas-fir, and dry grand fir plant communities. Moving these drier forested sites toward their HRV, (by managing for pine rather than fir), would provide more suitable habitat for species such as the white headed woodpecker.

Past timber harvest has had the most effect on the number, size and distribution of snags on the landscape. Prior to the 1989 Forest Plan, snags were not left in timber sale units. From 1989 to 1995 the unamended Forest Plan standards managed at the 47% potential level for primary cavity excavators (LRMP 4-243). Since 1995, when the Forest Plan was amended by the Regional Forester, snags have been managed at the 100% maximum potential level for primary cavity excavators. Currently, the planning area is not providing for 100% maximum potential for primary cavity excavators when analyzed at the subwatershed scale. Approximately 38% of the planning area does not meet Forest Plan standards for snag levels. With the remaining areas containing snag levels at the low end of the range.

Annual firewood gathering combined with hazard tree reduction along roads has likely reduced snag levels below standards within 100 feet of all roads. This equates to approximately 15% of the planning area. Cumulatively, snag levels are deficient on approximately 50% of the planning area, and do not reflect historic size classes important to primary cavity excavators that utilize snags during their life cycle.

Annual firewood gathering has likely reduced down log levels below standards within 100-200 feet of roads. This affects approximately 30% of the planning area. Cumulatively, down log levels are deficient on approximately 50% of the planning area, and do not reflect historic size classes important to primary cavity excavators that utilize down logs during their life cycle.

Furthermore, there are 1,417 acres of natural fuels burning planned within the Summit Timber Sale area. These acres may be burned in both the fall and Spring burning seasons. Treatments are designed to reduce fuels, however snags and large diameter down logs may be lost during burning operations. Some additional snags will be created through natural fuels burning, but the net affect will be a reduction in snag density over what is presently occurring. Lighting techniques will be used to avoid snags, and post-firing monitoring will be implemented to minimize the loss of existing snag habitat and down logs.

Direct and Indirect Effects on Big Game Habitat: Rocky Mountain elk and mule deer use the planning area year round. Quantity and quality of cover, and open road density are the main factors influencing the Habitat Effectiveness Index (HEI) standard contained in the Ochoco National Forest Land and Resource Management Plan. HEI is a tool used to assess the existing condition of big game habitat. The following analysis was conducted in accordance with the Ochoco National Forest Plan HEI process calculation. Tables were created to determine the habitat effectiveness for the management areas located within the Deep Creek watershed, in which the Deep Planning Area resides (USFS, Forest Plan Implementation Note #11, 1990). Table 3-23 describes the expected HEI for the analysis area. Table 4-31 summarizes the HEI analysis for the planning area and all action alternatives.

Table 4- 31 Habitat Effectiveness Index Summary

	HEI	Cover Acres	Open Rd Density
Alternative A (current condition)	43	12,732	1.97
Alternative B	20	11,545	1.83
Alternative C	20	11,849	1.78
Alternative D	20	11,964	1.83

At present, the Forest Plan is beginning its second decade. HEI is at 43, which is higher than the Forest Plan's second decade average HEI of 35. Alternatives B, C, and D would reduce HEI to 20. Alternatives B, C, and D would modify big game habitat and are consistent with Forest Plan Standards and Guidelines for management of big game, although HEI would be reduced to the level described for the third decade. The Forest Plan describes for general forestland allocations the preference to plan for the long-term (fifth decade). Short term HEI may be reduced in order to meet management area emphasis if long-term HEI values are achieved (LRMP 4-258). The 20 percent figure exceeds 3rd, 4th, and 5th decade HEI values as described for Deep Creek Watershed (18, 14, and 18, respectively). Alternative A would not change the existing big game habitat and would meet or exceed HEI values in all decades.

In the Forest Plan, HEI was translated into numbers of animals that could be supported in an area if the habitat was maintained at optimum effectiveness. This resulted in elk and deer population numbers. The management objective for deer was 18,300, and elk ranged from 3,000 in the first decade to 2,600 in the fifth decade of the Ochoco Forest planning horizon (LRMP 4-44). Population trends for elk and deer have increased dramatically since 1980 and are currently (2001) estimated at 5,200 elk and 18,300 deer. Alternatives B, C, and D would reduce habitat capability, or carrying capacity, within the planning area. However, this is not expected to negatively affect big game populations within the planning area, or within the Ochoco Wildlife Management Unit, because habitat quality and quantity are not the limiting factors. Big game populations are limited due to hunting season harvest levels, not carrying capacity. In conclusion, Alternatives B, C, and D would provide adequate habitat capability to support the management objectives for population levels of elk and deer described for both the LRMP and ODFW.

Known calving areas would be protected, and disturbance would be minimized from May 15 through June 30 (LRMP 4-246, and Chapter 2, Design Elements Common to All Action Alternatives, page 2-41). Based on telemetry studies and wildlife records, riparian areas are higher probability calving areas. All project work could avoid known calving sites during this period with the exception of riparian planting. Planting would occur in small areas and this effect would be minor to calving elk, and would not require a seasonal restriction during implementation.

Known elk wallows and those identified during implementation would be protected during the rutting season from September 1 through October 15 (LRMP 4-246). Riparian-related projects have the potential to overlap with elk wallows. Proposed projects that may affect wallows include commercial and precommercial units within RHCAs or those that contain springs or seeps and meadow enhancement. Wallows within harvest units would be specified in the timber sale contract with the seasonal restriction. All other activities that may occur in or adjacent to riparian areas would occur before the rutting season and would not affect potential wallows. This would meet the Forest Plan Standards and Guidelines for all alternatives.

All other activities proposed in alternatives B, C and D, not yet specifically discussed have been determined to not contribute in a significant way to the discussion of effects to big game and their habitats within the planning area. These activities include precommercial thinning, road construction/reconstruction, temporary roads, road closures/decommissioning, fuels treatments, and prescribed fire and have been considered in the overall effects determination, but do not warrant specific discussion as they relate to big game and the final determination, because they will not reduce crown closures. In addition, many of these activities are small in scope and scale, will be limited in spatial and temporal disturbance to big game, or occur in non habitat.

Cumulative Effects: Historically, elk were uncommon to rare in the Ochocos. It has only been in the last two decades that elk populations have significantly increased. Deer populations have remained relatively constant over the past 20 years. Grazing, timber harvest, and road construction have cumulatively affected deer and elk. However, hunting has and will continue to be the primary limiting factor affecting big game populations. Cumulatively, there have been consistent changes in management benefiting big game. These include, but are not limited to, actively reducing open road densities; increased prescribed burning which improves forage quantity and quality, recent changes in the management of livestock to help protect riparian areas, wildlife improvement projects, and the Rager Green Dot road closure during hunting seasons. The Deep Creek Restoration EA has been identified on the Schedule of Proposed Actions. Although a site specific proposed action is not yet developed, it is reasonable to assume this watershed restoration EA would incorporate additional hydrologic road closures and decommissioning projects. These activities would likely further reduce open road densities and, from a big game perspective, are likely to have a positive effect on the overall habitat and HEI projections.

Direct and Indirect Effects on Neotropical Migratory Birds: Effects for neotropical migratory birds for each of the alternatives has been analyzed through the use of the Partners in Flight (PIF) - Northern Rocky Mountains Bird Conservation Plan. The conservation strategy does not directly address all landbird species, but instead uses numerous "focal species" as indicators to describe the conservation objectives and measure project affects in different priority habitats for the avian community found there. Many of the focal species are related to non-forested environments and this project will not affect those species. Only effects to the focal species associated with forested environments were analyzed. The No Action Alternative would have no effect on existing habitat, except that natural successional processes would continue to occur. Alternative A would increase habitat for PIF forested species faster than the action alternatives (B, C, and D). The exception to this would be the chipping sparrow, in which Alternative A shows the second slowest decline in habitat through succession. The chipping sparrow is associated with very open canopies and well developed under stories comprised of dense shrubs and small regenerating trees. Alternative A would provide adequate reproductive habitat for the species listed and provides habitat for viable populations.

The proposed actions under Alternatives B, C, and D would reduce habitat by varying amounts for all species listed except for the white-headed woodpecker under Alternative C. In the long term (about 10 years), and with the absence of future treatments, each alternative would increase habitat above present levels for these forested species by varying amounts. Alternative C would increase habitat for white-headed woodpeckers more than other action alternatives because it increases the amount of single-strata conditions. Habitat for the chipping sparrow is expected to decline as habitat is reduced through natural succession. Alternative B shows the slowest decline in habitat. However, the difference between alternatives is minute, with a degree of change by just a few acres and in reality, there really is no difference between the alternatives and their effects to PIF focal species. This is because the major habitat limitation being measured is tree size and none of the alternatives proposes to reduce the composition of large trees (>21”). Accretion of habitat being measured is the reflection of retention of large trees and the in-growth of additional large trees over time. The action alternatives would provide adequate reproductive habitat for all the neotropical species listed through time, thus providing for viable populations.

The upland sandpiper is discussed under Threatened, Endangered and Sensitive Species. The Vesper sparrow inhabits steppe shrublands found at lower elevations and is not present within the planning area. The Gray-crowned rosy finch inhabits alpine habitats of which the planning area has none. Therefore, the proposed activities would have no effect to these species or their habitats.

The red-eyed vireo, veery and willow flycatcher are associated with riparian woodland and shrub plant communities. These habitats exist within the planning area, but are small and fragmented. These species may be present and using the habitats. The proposed activities within riparian areas would maintain or enhance these types of habitats within the planning area. Therefore, the alternatives would have no negative effect to these species or their habitats.

Cumulative Effects: Cumulative effects within the planning area, which result from the incremental impact of the alternatives added to other past, present and reasonably foreseeable future actions regardless of whom undertakes the action will be described. There has been a long history of timber harvest and fire suppression within the planning area and on the Paulina Ranger District. These activities have resulted in the existing forested conditions for these focal species. Prior to implementing the VEMG, management activities did not always design treatments to move stands toward HRV. Although this past activity has occurred it has not significantly affected these focal species, because their populations are stable or increasing within the state, and through time their habitat increases across all alternatives. Implementing VEMG and targeting stands to move vegetation towards HRV will ultimately provide for the habitat needs of these species within the planning area.

Livestock grazing, road construction and the extirpation of beavers has significantly reduced the site potential of riparian habitats within the planning area. Loss of sediment, modified hydrologic flows, and the absence of a keystone species – the beaver, are reasons why there are fragmented riparian woodland and shrub plant communities available for the red-eyed vireo, veery and willow flycatcher. Historically, habitat for these species was much more abundant within the planning area.

Wild and Scenic Rivers

Direct, Indirect and Cumulative Effects No activities are planned within the North Fork of the Crooked River Wild and Scenic River Corridor. The Outstandingly Remarkable Values for which it was designated include scenic, wildlife, botanical, fish, and recreation. Alternatives C and D are expected to meet State Water Quality Standards for turbidity, whereas, Alternative B may meet water quality standards, but is at a higher risk of exceeding the standard of no more than 10% increase in existing turbidity levels. Based on the peak flow analysis (EHA), Alternative B has high potential for increasing sediment transport into the main stem of Deep Creek, and subsequently downstream into the North Fork Crooked River. Therefore, it has the highest potential of not being consistent with the North Fork Crooked River Management Plan (USFS 1993). Alternative D has a moderate potential. Measurable increases to peak flows are not expected from Alternative C and as a result this Alternative has low potential or risk to affect Wild and Scenic values.

OTHER ENVIRONMENTAL CONSIDERATIONS

Adverse Environmental Effects Which Cannot Be Avoided

The implementation of any of the alternatives would result in some adverse impacts. Many of these impacts will be mitigated to acceptable levels using the design elements listed in Chapter 2. The unavoidable adverse impacts summarized below are those that are expected to occur after the application of design elements, or that cannot be improved to a level approaching existing conditions.

Air quality would be degraded on a localized and short-term basis from prescribed fire activities.

Road construction generally results in adverse effects on scenery, water quality, and soils. Temporary road surfaces can be revegetated but soil productivity is reduced. Many of these effects can be reduced with design elements or Best Management Practices but they cannot completely be eliminated.

Short-Term Uses v. Maintenance and Enhancement of Long-Term Productivity

The existing condition of the Deep project area landscape is currently outside of the historic range of variability and may not be sustainable over the long term. One of the purposes of the Deep project is to move the area closer to the range of historic conditions. This would be accomplished by moving the vegetation toward conditions that are sustainable, including a more natural fire regime, providing long-term habitat diversity, and enhancing and maintaining the integrity of aquatic ecosystems.

Irreversible and Irretrievable Commitments of Resources

Irreversible commitments are decisions affecting nonrenewable resources such as soils, wetlands, roadless areas, and cultural resources. Such commitments are considered irreversible because the resource has deteriorated to the point where renewal can occur only over a long period of time or at great expense, or because the resource has been destroyed or removed.

The construction of roads, to provide access to timber, is an irreversible action because of the time it takes for a constructed road to revert to natural conditions. Alternative B and Alternative C propose some level of new system road construction. All alternatives propose temporary road construction.

Irretrievable commitments of natural resources involve the loss of production or use of resources. This represents opportunities foregone for the period that the resource cannot be used.

Timber stands that are not currently managed present an irretrievable loss of growth potential. Although the lost growth is irretrievable, it is not irreversible because the stands could be managed in the future.

Energy used to grow, manage, and harvest trees is generally considered irretrievable.

Irreversible and irretrievable commitments are expected to be within the context of those discussed in the Forest Plan.

Management of Competing and Unwanted Vegetation

All action alternatives would incorporate the measures contained in the Final Environmental Impact Statement for Managing Competing and Unwanted Vegetation (November 1988), the Record of Decision, signed December 1988, and the requirements of the Mediated Agreement, signed May 24th, 1989. All action alternatives would use prevention as the main strategy to manage unwanted and competing vegetation.

The majority of the weed populations found in the planning area are located along roadsides, landings, in regeneration units, and recreation sites. Noxious weeds in the planning area include: whitetop, diffuse knapweed, spotted knapweed, Russian knapweed, Canada thistle, common hound's-tongue, teasel, St. John's-wort, dalmation toadflax, and sulfur cinquefoil.

Compliance with Existing Forest Plans, Regulations and Policies of Other Jurisdictions, Including Local Comprehensive Plans

The regulations for implementing NEPA require a determination of the possible conflicts between the Proposed Action and the objectives of federal, state and local land-use plans, policies and controls for the area. The alternatives discussed in this EIS are generally compatible with local governmental plans.

Prime Farmland, Rangeland, Forestland

No lands within the project area are classified as prime farm or rangelands. Proposed activities would not change areas classified as prime forestland. There would be no direct, indirect, or cumulative adverse effect to these resources and thus comply with the Farmland Protection Act and Departmental

Regulation 9500-3, “Land Use Policy”.

Floodplains and Wetlands

Executive Orders 11988 and 11990 direct Federal agencies to avoid, to the extend possible, both short-term and long-term adverse impacts associated with the modifications of floodplains and wetlands. The action alternatives would have no impact on floodplains or wetlands as described in these orders.

Effects on Consumers, Civil Rights, Minority Groups and Women, and Environmental Justice

Civil Rights legislations, especially the Civil Rights Act of 1964, Title VI, prohibits discrimination in Forest Service program delivery. The underlying principal behind the Civil Rights Act is that no activity shall negatively affect minorities, women, or persons with disabilities by virtue of their race, color, sec, national origin, religion, age, disability, or material or familial status.

Environmental Justice, Executive Order 12898, demands the fair treatment and meaningful involvement of all people. Fair treatment demands that no group of people, including racial, ethnic, or socioeconomic group should bear a disproportionate share of the negative environmental consequences resulting from the execution of our actions. Environmental justice focuses on minority, low-income groups, and subsistence lifestyles (including Indian Tribes). The purpose of involving these groups and analyzing the effects upon them is to determine whether adverse civil rights impacts are anticipated, or whether disparate or disproportionate impacts associated with the alternatives is anticipated on any of these groups.

With this project, there is no known potential for disparate or disproportionately adverse effects, or to discriminate or negatively impact any individual or subset of the population described above. Scoping did not reveal any issues or concerns associated with the principles of Environmental Justice.

The action alternatives would provide for human health and safety of all members of the public by reducing the risk of wildfire. In addition, the vegetation treatments would provide opportunities for employment, having positive effects on the categories of individuals and populations groups these laws and regulations are intended to protect. Road closures will eliminate vehicle access is some specific locations, but there is still ample access throughout the project area. Traditional uses of cultural plants are covered under the Cultural Resources section. The project is not located in a minority community and any impacts will not affect any specific subset of the American population at a disproportionately higher rate than others.

In addition, the effects of this project on the social and economic context of these groups are within those described in the Forest Plan. The benefits and risks associated with implementation of the proposed action are provided to all members of the public. Therefore, the project alternatives would not pose disproportionately high or adverse effects to minority communities or to low income groups. See also the Socioeconomic Report in the analysis file.

Chapter 5
Consultation and Coordination

Preparers and Contributors

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LORI BLACKBURN has a B.S. in Forest Management from Washington State University. Her 22 years with the Forest Service includes working on the Klamath, Okanogan, Colville, and Malheur National Forests. Her experience includes work in fire suppression, timber sale preparation, silviculture, planning, reforestation and managing the timber stand improvement and tree improvement programs. She has participated in Wild and Scenic River management planning and numerous fire recovery projects and salvage sales. Lori became a certified silviculturist in 1994.

DEBRA MAFERA has a B.S. in Forestry and Range Management from Colorado State University. She became a certified silviculturist in 1995 and has 21 years experience with the Forest Service in Louisiana, Kentucky, and Oregon. Debra has served as the Paulina Ranger District Botanist for two years.

TOM MAFERA has a B.S. in Forest Management from the University of New Hampshire and a Masters of Forestry degree in Forest Engineering from Oregon State University. He has over 22 years of experience in natural resource management and has worked on the Kisatchie, Daniel Boone, and Ochoco National Forests. Tom has been the Resources and Timber Management Assistant on the Paulina Ranger District for the past four years.

CARL MAGILL has an A.A. in Forestry from Mount Hood Community College. He has 27 years of experience with the Forest Service on the Umpqua and Ochoco National Forests. His experience includes timber sale preparation, logging system design, reforestation, timber stand improvement, and fire suppression. He served as the Paulina Ranger District's Range Technician from 1999 – 2001.

JOE REINARZ has 22 years of experience with the Forest Service. He has been involved in several planning efforts as a Fuels Specialist. Planning efforts have included timber sales and burning projects. He served on the Paulina Ranger District for 11 years and was the Fire Management Officer for approximately five years.

RICHARD VACIRCA has a joint B.A. degree in Fisheries and Wildlife Science from New Mexico State University. He has 9 years of experience in fisheries and wildlife biology on the Lincoln and Ochoco National Forests. Richard has been the Paulina Ranger District Fisheries Biologist for two years.

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Federal, State, and Local Agencies Contacted

Federal and State Governmental Agencies

Advisory Council On Historic Preservation

Federal Aviation Administration, Northwest Region
Federal Energy Regulatory Commission, Advisor On Environmental Quality
Federal Highway Administration, Western Resource Center
Federal Railroad Administration, Office Of Transportation And Regulatory Affairs

General Services Administration

National Marine Fisheries Service, Habitat Conservationists Division
Northwest Power Planning Council

Oregon Department Of Environmental Quality
Oregon Department Of Fish And Wildlife, Habitat Conservation Division
Oregon Department of Fish And Wildlife, Prineville Division
Oregon Department Of Forestry
Oregon Water Resources Department

State of Idaho, Division of Environmental Quality
State Of Oregon Governor's Forest Advisor
Surface Transportation Board, Energy And Environment

U.S. Department Of Energy, Office Of Environmental Compliance
U.S. Army Engineers Division, North Pacific, CENPD
U.S. Department Of Housing & Urban Development
U.S. Environmental Protection Agency, Office Of Environmental Review
U.S. Environmental Protection Agency, Region X

USDA, Animal & Plant Health Inspection Service

USDA, National Agricultural Library
USDA, National Resource Conservation Service
USDA, OPA Publication Stockroom
USDA, Policy And Planning Division
USDA, Forest Service, Environmental Coordination

USDI, Fish and Wildlife Service, Oregon State Office
USDI, Office Of Environmental Policy And Compliance
Utah State University, Natural Resources Research Library

Tribal Governments, Organizations and Persons

American Lands Alliance, George Sexton
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References Cited

Adamus, P.R., et. al. 2001." Oregon Breeding Bird Atlas." Oregon Field Ornithologist, P.O. Box 10373, Eugene, OR 97440

Agee, J. 1993. "Fire Ecology of Pacific Northwest Forests." Washington DC: Island Press.

Altman, B. 2000. "Conservation Strategy for Landbirds in the Northern Rocky Mountains of Eastern Oregon and Washington." Oregon-Washington Partners in Fight. Boring, OR.

Anderson, B. 1989. Background information on the EHA Model, unpublished. On file at the Ochoco National Forest Supervisor's Office , Prineville, Oregon.

Bates, L. J., E. O. Garton and M. J. Wisdom. 1999. "Estimating Snag and Large Tree Densities and Distributions on a Landscape for woodpecker management." Gen. Tech. Report. Portland, OR: USDA Forest Service, Pacific Northwest Research Station.

Banci, V. 1994. Wolverine. In L.F. Ruggiero, K.B. Aubry, S.W. Buskirk, L.J. Lyon and W.J. Zielinski, technical editors. "The scientific basis for conserving forest carnivores: American marten, fisher, lynx and wolverine in the western United States." Pages 99-127. USDA Forest Service General Technical Report RM-254.

Boyd, M. and D. Sturdevant. 1997. "The Scientific Basis for Oregon's Stream Temperature Standard: Common Questions and Straight Answers." Oregon Department of Environmental Quality. Technical Report.

Buckley, G. 1992. "Desertification of the Camp Creek Drainage in Central Oregon, 1826-1905."

Bull, E.L. 1995. "Progress report on American marten home range and habitat use." Portland, OR: USDA, Forest Service, Pacific Northwest Research Station. 21 p. Unpublished report. On file with: Pacific Northwest Research Station, Forestry and Range Sciences Laboratory, 1401 Gekeler Lane, La Grande, OR 97850

Bull, E.L. and R.S. Holthausen. 1993. "Habitat use and management of pileated woodpeckers in northwestern Oregon." Journal of Wildlife Management. 57:335-345.

Bull, E.L., Parks, C.G. and T.R. Torgersen. 1997. "Trees and logs important to wildlife in the Interior Columbia River Basin." Gen. Tech. Rep. PNW-GTR-391. Portland, OR: USDA, Forest Service, Pacific Northwest Research Station. 55p.

Burkhardt, J.W. and E.W. Tisdale. 1969. "Causes of Juniper Invasion in Idaho." Ecology: 57:472-484.

Butts, T.W. 1992. " Wolverine (*Gulo gulo*) biology and management: a literature review and annotated bibliography." Pages 31-33. USDA Forest Service, Northern Region.

Claar, J., S. Gniadek, B. Holt, S. Michton, B. Naney, J. Trick, A. Vandehey, F. Wahl, N. Warren, D. Wenger, J. Whitney, and T. Wittinger. 2001. 10/19/01 Response to the USFWS White Paper on Management of Canada Lynx in the Cascades Geographic Areas of Oregon and Washington.

Cochran, P.H. and K.W. Seidel. 1999. "Growth and Yield of Western Larch Under Controlled Levels of Stocking in the Blue Mountains of Oregon." USDA Forest Service publication PNW-RP-517.

Cochran, P.H. and J.W. Barrett. 1999. “Thirty-five-Year Growth of Ponderosa Pine Saplings in Response to Thinning and Understory Removal.” USDA Forest Service publication PNW-RP-512.

Cochran, P.H. and J.W. Barrett. 1998. “Thirty-five-Year Growth of Thinned and Unthinned Ponderosa Pine in the Methow Valley of Northern Washington.” USDA Forest Service publication PNW-RP-502.

Cochran, P.H. and W.G. Dahms. 1998. “Lodgepole Pine Development After Early Spacing in the Blue Mountains of Oregon.” USDA Forest Service publication PNW-RP-503.

Cochran, P.H. 1998. “Examples of Mortality and Reduced Annual Increments of White Fir Induced by Drought, Insects, and Disease at Different Stand Densities.” USDA Forest Service publication PNW-RN-525.

Cochran, P.H., and Hopkins W.E. 1991. “Does Fire Exclusion Increase Productivity of Ponderosa Pine?” Proceedings - The Management and Production of Western Montane Forest Soils. USDA Forest Service Intermountain Region, General Technical Report INT-280. Boise, Idaho.

Copeland, J.P. 1996. “Biology of the Wolverine in Central Idaho.” M.S. thesis. University of Idaho.

Crane, M.F. and W.C. Fischer. 1986. “Fire Ecology of the Forest Habitat Types of Central Idaho.” USDA Forest Service publication GTR-INT-218.

Csuti, B., et. al. 1997. “Atlas of Oregon Wildlife.” Oregon State University Press, Corvallis, OR. 492 p.

Currens, K. 1994. Genetic variation in Crooked River rainbow trout: Oregon Fishery Unit. Oregon State University, Corvallis, Oregon.

Dixon, R.D. 1995. “Ecology of white-headed woodpeckers in the central Oregon Cascades.” Moscow, ID: University of Idaho. 148 p. M.S. thesis.

Federal Register, Volume 63, Number 130. July 8, 1998. “Proposal to List the Contiguous United States Population Segment of the Canada Lynx.”

Federal Register, Volume 64, Number 128. July 6, 1999. “Proposed Rule to Remove Northern Bald Eagle from the ESA list.”

Federal Register, Volume 64, Number 164. August 25, 1999. “Final Rule to Remove American Peregrine Falcon from the ESA list.”

Federal Register, Volume 64, Number 169. September 1, 1999. “Proposed Rule, Notice of Public Hearings to Remove Northern Bald Eagle from the ESA list.”

Federal Register, Volume 65, Number 58. March 24, 2000. “Final Rule Federally Threatened Listing for the Canada Lynx.”

Ferry, B. T. 1998. “South Ochoco Elk Telemetry Project in Central Oregon.” Wildlife Information Report. Oregon Department of Fish and Wildlife. Ochoco Wildlife District, High Desert Region. Prineville, OR.

Fredricks, N. 1989. “Preliminary Status Report for *Calochortus longebarbatus* var. *peckii*.” Unpublished Oregon Department of Agriculture Report submitted to the Ochoco National Forest.

Frenzel, Richard, W. 2001.Nest-Sites, Nesting Success, and Turnover-Rates of White-headed Woodpeckers on the Deschutes and Winema National Forests, Oregon in 2001. A report submitted to: Oregon Natural Heritage Program. The Nature Conservancy of Oregon, 821 SE 14th Ave, Portland, OR 97214.

Graham, R.T., et. al. 1999. “The Effects of Thinning and Similar Stand Treatments on Fire Behavior in Western Forests.” General Technical Report PNW-GTR-463.

Grover, D. and B. Hodson. 1999. “Deep Creek Redband Trout Study – 1999 Progress Report.” Oregon Department of Fish and Wildlife, Prineville District.

Gruell, G., et. al. 1985. “Influence of Fire on Curlleaf Mountain-Mahogany in the Intermountain West.” Symposium on Fire’s Effects on Wildlife Habitat, Missoula, MT.

Gruell, G., et. al. 1982. “Seventy Years of Vegetative Change in a Managed Ponderosa Pine Forest in Western Montana-Implications for Resource Management.” USDA Forest Service publication GTR-INT-130.

Hall, Fred C. 1987. “Growth Basal Area Handbook.” USDA Forest Service publication R6-Ecol-181b-1984.

Hall, Fred C. 1976. “Fire and Vegetation in the Blue Mountains – Implications for Land Managers.” Proceedings, Tall Timbers Fire Ecology Conference: Oct. 16-17, 1974. Portland, OR.

Hall, Fred C. 1980. “Fire History – Blue Mountains, Oregon.” USDA Forest Service publication GTR-RM-81.

Hall, Fred C. 1989. “Plant Association and Management Guide for the Ochoco and Southern Blue Mountain Areas.” USDA Forest Service publication R6-Ecol-TP-000-90.

Harvey, A. 1991. Proceedings - The Management and Production of Western Montane Forest Soils. USDA Forest Service Intermountain Region, General Technical Report INT-280. Boise, Idaho.

Hornocker, M. and H. Hash. 1981. “Ecology of the wolverine in northwestern Montana.” Canadian Journal of Zoology: 59:1286-1301.

Johnson, C.G. and R.R. Clausnitzer. 1991. “Plant Associations of the Blue and Ochoco Mountains.” USDA Forest Service publication R6-ERW-TP-036.

Johnson, C.G. and S.A. Simon. 1987. “Plant Associations of the Wallowa-Snake Province, Wallowa-Whitman Nation Forest.” USDA Forest Service publication R6-Ecol-TP-255a.

Isaacs, Frank. 2001. 2001 Bald Eagle Nest Survey Summary.

Kagen, J. 1996. “Final Draft Species Management Guide for *Calochortus longebarbatus* Wats. var. *peckii* Ownbey.” Unpublished report submitted to the Ochoco National Forest.

Kimmens, J.P. 1987. “Forest Ecology.” New York: Macmillan Publishing Company.

Lloyd, T. 1996. Unpublished report. Washington State Department of Wildlife. Olympia, WA.

Long, J.N. 1985. "A Practical Approach to Density Management." The Forestry Chronicle (February): pp. 23-26.

Marshall, D. B., M. Chilcote and H. Weeks. 1992. "Sensitive Vertebrates of Oregon." Oregon Department of Fish and Wildlife. First Edition, June 1992.

National Environmental Policy Act. 1969. 42 U.S.C. 1600.

Newhouse, B. et. al. 1995. "Ecology of the Genus *Carex* in the Eastside Ecosystem Management Area." An unpublished report submitted to the Eastside Ecosystem Management Project, U.S. Forest Service, Walla Walla, WA.

Oliver, C. and Bruce C. Larson. 1990. "Forest Stand Dynamics." New York: McGraw-Hill, Inc.

Oregon Natural Heritage Program. 2001. "Rare, Threatened and Endangered Plants and Animals of Oregon. Oregon Natural Heritage Program, Portland, OR.

Parks, C.G., Bull, E.L., and T.R. Torgersen. 1997. "Field guide for the identification of snags and logs in the interior Columbia River basin." Gen. Tech. Rep. PNW-GTR-390. Portland, OR: USDA Forest Service, Pacific Northwest Research Station. 40 p.

Paulina Ranger District. 1997. Wildobs Database. Paulina Ranger District, Ochoco National Forest, OR.

Paulina Ranger District. 1998. Deep Creek Watershed Snag Surveys. Paulina Ranger District, Ochoco National Forest, OR.

Paulina Ranger District. 1999. Deep Creek Watershed Analysis, August 1999. Paulina Ranger District, Ochoco National Forest, OR.

Paulina Ranger District. 2002. Wildobs Database. Paullina Ranger District, Ochoco National Forest, OR.

Perry, David A. 1994. Forest Ecosystems. The John Hopkins University Press, 2715 North Chatles St., Baltimore, Maryland 21218-4319.

Personal Communication. December 1999. Dave Zalunardo, Terrestrial Ecology Program Leader, Ochoco National Forest, Prineville, OR.

Personal Communication. February 6, 2001. Dave Zalunardo, Terrestrial Ecology Program Leader, Ochoco National Forest, Prineville, OR.

Personal Communication. January 23, 2001. Frank Isaacs, Senior Faculty Research Assistant, Oregon Cooperative Fish and Wildlife Research Unit, Department of Fisheries and Wildlife, Oregon State University.

Personal Communication. January 29, 2001. Jim David, Forest Soil Scientist, Ochoco National Forest, Prineville, OR.

Petersen, J. 1995. "A Desk Reference for NEPA Air Quality Analysis." Report submitted to the USDA Forest Service by CH2M Hill.

Pyne, S.J. 1984. "Introduction to Wildland Fire. Fire Management in the United States." New York, NY: John Wiley & Sons, Inc.

Reinarz, J. 1999. "Determining Fuels Hazards on the Paulina Ranger District." Unpublished report, Technical Fire Management Final Project, District Files.

Reynolds, R. T. et. al. 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 p.

Rosgen, D. 1994. "A Classification of Natural Rivers." International Society of Soil Science, Catena, Vol. 22, No. 3.

Rosgen, D. 1996. "Applied River Morphology." Wildland Hydrology. Pagosa Springs, Colorado.

Ruediger, B. et. al. 2000. "Canada Lynx Conservation Assessment and Strategy." USDA Forest Service, USDI Fish and Wildlife Service, USDI Bureau of Land Management, and USDI National Park Service. Forest Service Publication #R1-00-53, Missoula, MT. 142 p.

Ruggiero, L. F., et. al. 1994. "The Scientific Basis for Conserving Forest Carnivores" American Marten, Fisher, Lynx and Wolverine in the Western United Stated. Gen. Tech. Rep. RM-254. Ft. Collins, Co: U.S. Department of Agriculture, Forest Service, Rocky Mountain and Range Experiment Station.

Silovsky, G. and B. Woodbridge. 1992. "Survey protocol for northern goshawk on National Forest Lands in the Pacific Northwest Region." USDA Forest Service, Pacific Northwest Region, Portland, OR.

Smith, David M. 1962. "The Practice of Silviculture." New York: John Wiley & Sons, Inc.

Stokes, D. and L. Stokes. 1996. "Field Guide to Birds – Western Region." New York: Little, Brown and Company. 519 p.

Tewksbury, J. 1996. "Cottonwood and Aspen as Wildlife Habitat: A Focus on Birds." Natural Resource News (January) 1996. Blue Mountains Natural Resources Institute.

Thomas, J.W., technical editor. 1979. "Wildlife habitats in managed forests - the Blue Mountains of Oregon and Washington." USDA Forest Service, Agriculture Handbook No. 553. 512

USFS (USDA Forest Service). 1986. "The Summit Trail: A History, Comprehensive Survey, and Evaluation, Part 1 and 2." Ochoco National Forest. Prineville, OR

USFS (USDA Forest Service). 1988. "General Water Quality Best Management Practices." Pacific Northwest Region, Portland OR.

USFS (USDA Forest Service), Pacific Northwest Region. 1989. "Final Environmental Impact Statement, Land and Resource Management Plan, Ochoco National Forest."

USFS (USDA Forest Service). 1990. HEI Table – PIN #11. September 13, 1990. Ochoco National Forest. Prineville, OR.

USFS (USDA Forest Service). 1992. "Forest Service Manual 2670 - threatened, endangered, and sensitive plants and animals."

USFS (USDA Forest Service). 1993. "North Fork Crooked River Management Plan." Ochoco National Forest. Prineville, OR>

USFS (USDA Forest Service). 1993. Ochoco National Forest and Crooked River National Grassland Travel Management Field Guide. A Guide to Assist in the implementation of Travel Management on the Ochoco and Grassland. May,1993. Prineville, OR.

USFS (USDA Forest Service). 1994. "Draft Viable Ecosystems Management Guide." Ochoco National Forest. Prineville, OR.

USFS (USDA Forest Service). 1995a. Decision Notice and FONSI for the Inland Native Fish Strategy and Interim Strategies for Managing Fish-Producing Watersheds in Eastern Oregon and Washington, Idaho, Western Montana, and Portions of Nevada. Region 1, Region 4, and Region 6.

USFS (USDA Forest Service). 1995b. Environmental Assessment for the Integrated Noxious Weed Management Program. Ochoco National Forest. Prineville, OR.

USFS (USDA Forest Service). 1995c. Letter from John Lowe, Regional Forester, R6, Dale Bosworth, Regional Forester, R4 and Hal Salwasser, Regional Forester, R1, Streamlining Biological Evaluations and Conclusions for Determining Effects to Listed, Proposed and Sensitive Species; August 17, 1995.

USFS (USDA Forest Service). 1995d. Letter from John E. Lowe, Regional Forester, Decision Notice for the Revised Continuation of Interim Management Direction Establishing Riparian, Ecosystem and Wildlife Standards for Timber Sales; June, 1995. Portland, OR.

USFS (USDA Forest Service), Ochoco National Forest. 1997. Letter from Tom Schmidt, Forest Supervisor, Review of Forest Plan Amendments of the Regional Forester's Amendment No. 2 for Eastside Forests, August 22, 1997. Prineville, OR.

USFS (USDA Forest Service). 1997. "An Assessment of Ecosystem Components in the Interior Columbia Basin and Portions of the Klamath and Great Basins". Volume I. PNW-GTR-405, June, 1997. Portland, OR.

USFS (USDA Forest Service). 1998. "Environmental Assessment for the Integrated Noxious Weed Management Program." Ochoco National Forest. Prineville, OR.

USFS (USDA Forest Service). 1999a. "Pacific Northwest Region Noxious Weed Strategy." Portland, OR.

USFS (USDA Forest Service). 1999b. "Joint Aquatic and Terrestrial Programmatic Biological Assessment for Federal Lands within the Deschutes Basin Administered by the Bureau of Land Management Prineville Office and For Federal Lands Administered by the Deschutes and Ochoco National Forests." March 12, 1999.

USFS (USDA Forest Service). 1999c. Deep Watershed Analysis. Ochoco National Forest. Prineville, OR.

USFS (USDA Forest Service). 2000. "Joint Aquatic and Terrestrial Programmatic Biological Assessment for Federal Lands within the Deschutes Basin Administered by the Bureau of Land Management Prineville Office and For Federal Lands Administered by the Deschutes and Ochoco National Forests." April 14, 2000.

USFS (USDA Forest Service), Pacific Northwest Region. 2000a. Letter from Harv Forsgren, Regional Forester, Updated Region 6 List of Federally Threatened and Endangered Species, and Proposed and Designated Critical Habitat; September 6, 2000. Portland, OR.

USFS (USDA Forest Service), Pacific Northwest Region. 2000b. Letter from Harv Forsgren, Regional Forester, Updated Regional Forester's Sensitive Animal List; November 28, 2000. Portland, OR.

USFS (USDA Forest Service). 2002a. Letter from Tom Schmidt, Forest Supervisor, Letter to USFWS for Blackbear, Zane and Mill Timber Sales, May 26, 2001. Prineville, OR.

USFS (USDA Forest Service). 2002b. Deep Watershed Road Analysis Report. Ochoco National Forest. Prineville, OR.

USFS (USDA Forest Service). 2002c. Deep Creek Watershed Water Quality Restoration Plan. Ochoco National Forest. Prineville, OR.

USDA Forest Service and USDI Fish and Wildlife Service. 2000. "Canada Lynx Conservation Agreement." USFS Agreement #00-MU-11015600-013. February 7, 2000. 12 p.

USDOT. 1993. Riparian Area Management, Process for Assessing Proper Functioning Condition (Lotic Environments) Tech. Ref. 1737-9.

USDI Fish and Wildlife Service. 1986. "Recovery Plan for the Pacific Bald Eagle." Portland, OR. 176 p.

Verts, B. J. and L. N. Carraway. 1998. " Land Mammals of Oregon." University of California Press. 668 p.

Zielinski, W. J. and T.E. Kucera, technical editors. 1995. "American marten, fisher, lynx and wolverine: survey methods for their detection." Gen. Tech. Rep. PSW-GTR-157. Albany, CA: Pacific Southwest Research Station, USDA Forest Service.

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.

Glossary Of Acronyms And Terms

Air shed – A geographical area that because of topography, meteorology and climate shares the same air.

Alternative - In an EIS, one of a number of possible options for responding to the purpose of and need for action.

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.

BA - Biological Assessment

Best Management Practices (BMP) - Practices designed to prevent or reduce water pollution, including sedimentation.

BF - see Board Feet

BLM - Bureau of Land Management

BMP – see Best Management Practices

Board Foot (bf) - A unit of wood with dimensions of 12" x 12" x 1".

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.

Closed Road - Generally local roads that are physically closed (signs, gates, 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.

Cultural Resources - The remains of sites, structures, or objects used by humans in the past. They may be historic, prehistoric, archaeological, or architectural in nature.

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 significant actions taking place over a period of time.

DBH –Diameter of tree at Breast Height (4.5' from the ground.)

Decommissioned (Road) - A road that is no longer needed and is not planned to be used again. It has been closed and generally has been returned to a vegetated condition. For example, a road that has been ripped (tilled) and planted with vegetation.

Density (stand) - The number of trees growing in a given area usually expressed in terms of trees per acre.

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 significantly 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.

Direct Effects - Impacts on the environment that are caused by an action and occur at the same time and place.

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.

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

Endangered Species - A plant or animal species listed under the Endangered Species Act that is in danger of extinction throughout all or a significant portion of its range.

Endangered Species Act (ESA) - An act, passed by Congress in 1973, which 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.

Endemic – Occurrence of insects or disease contained in population and location to a normal, balance level.

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 that 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.

Environmental Impact Statement (EIS) - A statement of environmental effects of a proposed action and alternatives to it. A Draft EIS is released to the public and other agencies for review and comment. A Final EIS is issued after consideration of public comments. A Record of Decision (ROD) is based on the information and analysis in the Final EIS.

Equivalent Harvest Area (EHA) - That area which when harvested under any of the various silvicultural regimes produces hydrological effects similar to one acre of clearcut.

Evapotranspiration - The process by which water moves from the soil to the atmosphere by evaporation from the soil or transpiration through plants.

Fire Intensity – Can be derived from the energy content of fuel, the mass of fuel consumed, and the rate of spread of the fire (energy release along a linear fire front). The length of flames of a fire can be related to its fire line intensity. Fire line intensity can be directly linked to some ecological effects such as crown or bole scorch.

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 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, aka 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 supercede the Eastside Screens.

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.

Ground Cover - Perennial vegetation plus litter and coarse fragments (greater than 2 mm sizes), 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 the ground covered the first year after management activities.

Group Selection - A silvicultural system in which trees are removed in small groups.

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) - An index of a Rocky Mountain elk habitat model. Habitat Effectiveness Index is a relative value of habitat conditions based on the potential of the habitat type to provide cover, the quality of existing cover, and the miles of road open to vehicular traffic.

HCR – Clearcut harvest with reserve trees, a regeneration harvest system.

HEI - see Habitat Effectiveness Index

HIM – Improvement harvest

HSG – Group selection harvest, an uneven-aged regeneration system.

HSH – Shelterwood harvest, a regeneration harvest system.

HSN – Sanitation harvest, an intermediate treatment.

HTH – Commercial thinning harvest

IDT - Interdisciplinary Team

IIT - Interagency Implementation 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 - see Interim Inland Native Fish Strategy

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 on July 28, 1995.

Instream Structures – Boulders, logs or other artificially placed materials, which 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 "significant" or "key" EIS issue, it must be well defined, relevant to the proposed action, and within the ability of the agency to address through alternative management strategies.

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) – Either single story or multi-story forested stands that meet specific criteria based on large (>21" dbh) trees per acre, stand density and canopy closure. Also see Old Structure.

LAU - Lynx Analysis Unit

Listed Species - A wildlife or plant species listed under the authorization of the Endangered Species Act as threatened or endangered.

Listed (Streams) – Streams listed by Oregon Department of Environmental Quality (ODEQ) as water quality limited due to stream temperatures or habitat modification.

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

LWM - Large Woody Material is material that consists of logs, trees or parts of trees this is on the ground or in streams. It helps create pool habitat for fish and dissipate energy during runoff.

MA - Management Allocation

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 which are important for fishing, hunting, and trapping.

Middlestory – Middle canopy layer of trees.

MIS - Management Indicator Species

Mitigation - Measures designed to counteract environmental impacts or to make impacts less severe.

MMBF - Million Board Feet

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 Environment Policy Act

NLAA - Not Likely to Adversely Affect

NMFS - National Marine Fisheries Service

No Action Alternative - The most likely condition expected to exist in the future if current management direction were to continue unchanged.

Non-forest Land – Lands that never have 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.

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.

PBA - Programmatic Biological Assessment

PCT – Pre-commercial thinning

PDC - Project Design Criteria

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 type.

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.

Preferred Alternative - The alternative identified in a draft environmental impact statement, which has been initially selected by the agency as the most acceptable resolution to the problems, identified in the purpose of and need for action.

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. Proposals for use of natural ignitions for this purpose must be approved by the Regional Forester.

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.

Record of Decision (ROD) - A document, based on information disclosed in a final environmental impact statement, that identifies the alternative chosen, mitigation and monitoring measures to be implemented, and other information relative to the decision.

RER - Relative Erosion Rate

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. RHCAs 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 - Riparian Management Objectives

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.

SDI - Stand Density Index

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.

Sensitive Species - Species identified by a Regional Forester for which population viability is a concern either (a) because of significant current or predicted downward trends in population numbers or density, or (b) because of significant 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 significant 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.

***SHPO* -** State Historic Preservation Office

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 are sufficiently alike in composition, age, arrangement, and condition to be distinguishable from the forest in adjoining areas.

Stream Class - A classification system for streams according to their beneficial uses. **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's** are all other perennial streams not meeting Class I or II definitions. **Class IV's** are all other intermittent streams not meeting Class I, II, or III definition

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.

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 of 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 significant portion of their range.

TMDL - Total Maximum Daily Load

TSP - Total Suspended Particulates

Understory – May include grass, forbs, shrubs, small trees (such as seedlings and saplings) and other plants found beneath the overstory tree canopy.

Uneven-aged Silviculture System - Method of forest management in which trees of different species in a given stand are maintained at many ages and sizes to permit continuous natural regeneration. Selective cutting is one example of an uneven-aged management method.

USDA **- United** States Department of Agriculture

USDI - United States Department of Interior

USFWS - United States Fish & Wildlife Service

VEMG - Viable Ecosystem Management Guide

Viable Ecosystems Management Guide - A system to classify vegetation on a landscape basis. This system compares existing vegetation with site potential. It focuses on relationships between combinations of vegetation structure and species composition, and habitat requirements for animals, insects, and plants. This guide was devised by the Ochoco National Forest Viable Ecosystem Quality Action Team.

The Viable Ecosystems Management Guide describes a seral/structural matrix for characterizing forest vegetation by plant association groups (PAGs). Each plant association group is further characterized by seral and structural stages. There are three seral stages: E (early), M (middle), and L (late). 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). The seral/structural classification is based on the dominant vegetative features on the site.

W/D - Width to Depth Ratio

Appendix A.

Biological Evaluation

Summary of Conclusion of Effects

TE&S SPECIES BIOLOGICAL EVALUATION
SUMMARY OF CONCLUSION OF EFFECTS

PROJECT NAME : DEEP VEGETATION MANAGEMENT PROJECT

SPECIES	ALT A	ALT B	ALT C	ALT D
1. Bull Trout	NE	NE	NE	NE
2. Redband Trout	NI	WIFV	MIIH	MIIH
3. Mid-Columbia Steelhead	NE	NE	NE	NE
4. Chinook Salmon – Essential Fish Habitat	NE	NE	NE	NE
5. Westslope Cutthroat Trout	NI	NI	NI	NI
6. Malheur Mottled Sculpin	NI	WIFV	MIIH	MIIH
7. Blue Mountain Cryptochian Caddisfly	NI	WIFV	MIIH	MIIH
5. Northern Bald Eagle	NLAA	NLAA	NLAA	NLAA
6. Canada Lynx	NLAA	LAA	NLAA	NLAA
7. American Peregrine Falcon	NI	NI	NI	NI
8. Bufflehead	NI	NI	NI	NI
9. Gray Flycatcher	NI	MIIH	MIIH	MIIH
10. Upland Sandpiper	NI	NI	NI	NI
11. Tricolored Blackbird	NI	NI	NI	NI
12. Western Sage Grouse	NI	NI	NI	NI
13. California Wolverine	NI	MIIH	MIIH	MIIH
14. Pygmy Rabbit	NI	NI	NI	NI
15. Columbia Spotted Frog	NI	NI	NI	NI
16. Achnatherum hendersonii	NI	MIIH	MIIH	MIIH
17. Achnatherum wallowensis	NI	MIIH	MIIH	MIIH
18. Artemisia ludoviciana ssp. estesii	NA	NA	NA	NA
19. Astragalus diaphanus var. diurnus	NA	NA	NA	NA
20. Astragalus peckii	NA	NA	NA	NA
21. Astragalus tegetarioides	NI	MIIH	MIIH	MIIH

TE&S SPECIES BIOLOGICAL EVALUATION
SUMMARY OF CONCLUSION OF EFFECTS

PROJECT NAME : DEEP VEGETATION MANAGEMENT PROJECT

SPECIES	ALT A	ALT B	ALT C	ALT D
22. Botrychium ascendens	NI	MIIH	MIIH	MIIH
23. Botrychium crenulatum	NI	MIIH	MIIH	MIIH
24. Botrychium minganense	NI	MIIH	MIIH	MIIH
25. Botrychium montanum	NI	MIIH	MIIH	MIIH
26. Botrychium paradoxum	NI	MIIH	MIIH	MIIH
27. Botrychium pinnatum	NI	MIIH	MIIH	MIIH
28. Calochortus longebarbatus var. longebarbatus	NA	NA	NA	NA
29. Calochortus longebarbatus var. peckii	NI	MIIH	MIIH	MIIH
30. Carex backii	NA	NA	NA	NA
31. Carex hystercina	NI	MIIH	MIIH	MIIH
32. Carex stenophylla	NA	NA	NA	NA
33. Cypripedium parviflorum	NI	NI	NI	NI
33. Camissonia (Oenothera) pygmaea	NA	NA	NA	NA
34. Lomatium ochocense	NA	NA	NA	NA
35. Mimulus evanescens	NA	NA	NA	NA
36. Penstemmon peckii	NA	NA	NA	NA
37. Rorippa columbiae	NA	NA	NA	NA
38. Thelypodium eucosmum	NA	NA	NA	NA
39. Thelypodium howellii ssp. howellii	NA	NA	NA	NA

Prepared by: /s/ Heather A. Bernier /s/ Richard Vacirca /s/ Debra Mafera

Approved by: /s/ David Zalunardo /s/ Daniel Rife /s/ Katie Grenier

Date:

Wildlife Biologist Fisheries Biologist Botanist

NE	No Effect
LAA	Likely to Adversely Affect
NLAA	Not Likely to Adversely Affect
BE	Beneficial Effect
NLJ	Not Likely to Jeopardize the Continued Existence of the Species or Result in Destruction or Adverse Modification of Proposed Critical Habitat.
LJ	Likely to Jeopardize the Continued Existence of the Species or Result in Destruction or Adverse Modification of Proposed Critical Habitat.
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
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) Updated 5/99

Appendix B

Deep Vegetation Management Project Monitoring Plan

Introduction to the Deep Vegetation Management Project Monitoring Plan

This monitoring plan is intended to be a working draft, to be revised as necessary in order to incorporate new ideas or methods as this project is implemented on the ground. Although this plan describes site-specific monitoring items to be completed for projects described in the Deep Vegetation Management Project Draft Supplemental Environmental Impact Statement (DSEIS), many of these items are intended to be monitored to meet Forest Plan monitoring needs and are not necessarily required as part of the implementation of the actions in this analysis.

This plan contains implementation, effectiveness, and validation monitoring as outlined in the Forest Service Handbook. The focus is on meeting the resource objective while ensuring that project implementation is accomplished as intended. This plan will also identify the need to modify activities or design in order to achieve the desired results.

Implementation monitoring is used to determine if plans, prescriptions, and activities are implemented as designed and in compliance with plan objectives and standards and guidelines Effectiveness monitoring is used to determine if the implementation monitoring was successful in protecting the resource. Validation monitoring is conducted if effectiveness monitoring creates results indicating assumptions, about the resource and its ability to remain stable if not improved, through project implementation is questionable.

Monitoring efforts will be documented after the Final Environmental Impact Statement (FEIS) is approved. Once implementation of the project begins and after the first season of work, the Interdisciplinary Team (IDT) will conduct monitoring trips to review samples of the projects. Monitoring will continue until implementation is complete.

Deep Vegetation Management Project Monitoring Plan

Monitoring Item	Monitoring Site	Management Action	Indicators/ Attributes	Monitoring Procedure	Implementation Monitoring	Effectiveness Monitoring*	Validation Monitoring*
Aspen stand response	Aspen treatment units	Commercial harvest Precommercial thinning Protection of the aspen	Number of new aspen sprouts Increases in the overall deciduous riparian vegetation Increases in the growth of existing aspen sprouts	Visual walk through of each stand	Were the silvicultural prescriptions implemented correctly?	Were the protection devices effective? Did the aspen and deciduous vegetation respond to the treatment? Will the aspen stands be perpetuated through time?	If there is no response, were the contingency measures in the silvicultural prescription followed?
Mountain Mahogany stand		Juniper removal/disposal Protection of Mountain Mahogany	Increases in the number of young plants Protection of young plants	Visual walk through of each stand	Were the silvicultural prescriptions implemented correctly?	Were the protection devices effective? Did the health and vigor of the Mountain Mahogany and other deciduous vegetation respond to the treatment? Was there a vegetative response in new mahogany recruitment as well as the overall amount of vegetation?	If there is no response, were the contingency measures in the silvicultural prescription followed?

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Deep Vegetation Management Project Monitoring Plan

Monitoring Item	Monitoring Site	Management Action	Indicators/ Attributes	Monitoring Procedure	Implementation Monitoring	Effectiveness Monitoring*	Validation Monitoring*
Noxious weeds	Mineral sites used as material sources	Mineral sites that have been surveyed for weeds will be used as a rock source for roadwork If weeds present, no disturbance around weed site	Presence/absence of noxious weeds	Visual assessment	Was the material source infested with noxious weeds? If so, was use prohibited within the infested area of the pit?		
Populations of Moonwart (Botrychium)	Commercial harvest units	Motorized vehicles used during project activities will be restricted to the road prism. The District Botanist will coordinate layout of harvest units with the Presale Forester to provide recommendations for protecting Moonwart populations and/or habitat. Buffers of 50 feet that exclude ground-disturbing activities will be established around plants and/or habitat (exceptions may be reviewed by the District Botanist in coordination with other specialists).	Amount of disturbance, condition of meadow	Visual inventory of plants Visual walk through of the habitat	Were the design elements and/or mitigations correctly implemented? Were the silvicultural prescriptions implemented correctly?	Were the design elements and/or mitigations successful in protecting the Moonwart population? Did the treatment benefit the population?	Did the number of Moonwart plants increase? Is the overall condition of the habitat improved?

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Deep Vegetation Management Project Monitoring Plan

Monitoring Item	Monitoring Site	Management Action	Indicators/ Attributes	Monitoring Procedure	Implementation Monitoring	Effectiveness Monitoring*	Validation Monitoring*
Populations of Moonwart (Botrychium)	Aspen treatment units	Motorized vehicles used during project activities will be restricted to road prism. District Botanist will coordinate layout of harvest units with Pre-sale Forester to provide recommendations for protecting Moonwart populations and/or habitat. 50' buffers to exclude ground-disturbance will be established around plants and/or habitat.	Amount of disturbance, condition of meadow.	Visual inventory of plants Visual walk through of the habitat	Were the design elements and/or mitigations correctly implemented? Were the silvicultural prescriptions implemented correctly?	Were the design elements and/or mitigations successful in protecting the Moonwart population? Did the treatment benefit the population?	Did the number of Moonwart plants increase? Is the overall condition of the habitat improved?

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Deep Vegetation Management Project Monitoring Plan

Monitoring Item	Monitoring Site	Management Action	Indicators/ Attributes	Monitoring Procedure	Implementation Monitoring	Effectiveness Monitoring*	Validation Monitoring*
Populations of Moonwart (Botrychium)	Willow enhancement sites Meadow enhancement sites	Motorized vehicles used during project activities will be restricted to the road. The District Botanist will assist in designing silvicultural treatments enhancing these populations. Areas of known plant sites will be avoided in meadow and/or willow enhancement projects and moonwart sites will be protected with a 50' buffer. The District Botanist will delineate plant sites on the ground.	Amount of disturbance, condition of meadow.	Visual inventory of plants Visual walk through of the habitat	Were the design elements and/or mitigations correctly implemented? Were the silvicultural prescriptions implemented correctly?	Were the design elements and/or mitigations successful in protecting the Moonwart population? Did the treatment benefit the population?	Did the number of Moonwart plants increase? Is the overall condition of the habitat improved?
Populations of Moonwart (Botrychium)	Precommercial thinning units	Motorized vehicles used during project activities will be restricted to the road. The District Botanist will assist in designing silvicultural treatments enhancing these populations. Precommercial thinning within or directly adjacent to Moonwart populations will take place after growing season. No slash piling on top of sensitive plants.	Amount of disturbance, condition of meadow.	Visual inventory of plants Visual walk through of the habitat	Were the design elements and/or mitigations correctly implemented? Were the silvicultural prescriptions implemented correctly?	Were the design elements and/or mitigations successful in protecting the Moonwart population? Did the treatment benefit the population?	Did the number of Moonwart plants increase? Is the overall condition of the habitat improved?

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Deep Vegetation Management Project Monitoring Plan

Monitoring Item	Monitoring Site	Management Action	Indicators/ Attributes	Monitoring Procedure	Implementation Monitoring	Effectiveness Monitoring*	Validation Monitoring*
Selected populations of Peck's mariposa lily (Calochortus longebarbatus var. peckii)	Commercial harvest units	District Botanist will coordinate layout of timber harvest units with Presale Forester to provide recommendations for protecting populations and/or habitat. Protection zones of 100 feet will be placed around sensitive plants and habitat. No mechanical equipment use will take place within this zone. The first 50 feet of this zone will not be treated. Motorized vehicles used during project activities will be restricted to the road prism.	Riparian vegetative cover and number of Peck's lily plants blooming Amount of site disturbance	Visual inventory of plants Visual walk through of the habitat	Were the design elements and/or mitigations correctly implemented? Were the silvicultural prescriptions implemented correctly?	Were the design elements and/or mitigations successful in protecting the lily population? Did the treatment benefit the population?	Did the number of Peck's lily plants increase? Is the overall condition of the habitat improved?
Selected populations of Peck's mariposa lily (Calochortus longebarbatus var. peckii)	Meadow enhancement sites	Meadow restoration within/directly adjacent to lily populations will take place after growing the season. Known plant sites will be avoided; District Botanist will delineate sites on the ground. District Botanist will assist in designing silvicultural treatments to enhance these populations. Motorized vehicles used will be restricted to road prism.	Riparian vegetative cover and number of Peck's lily plants blooming Amount of site disturbance	Visual inventory of plants Visual walk through of the habitat	Were the design elements and/or mitigations correctly implemented? Were the silvicultural prescriptions implemented correctly?	Were the design elements and/or mitigations successful in protecting the lily population? Did the treatment benefit the population?	Did the number of Peck's lily plants increase? Is the overall condition of the habitat improved?

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Deep Vegetation Management Project Monitoring Plan

Monitoring Item	Monitoring Site	Management Action	Indicators/ Attributes	Monitoring Procedure	Implementation Monitoring	Effectiveness Monitoring*	Validation Monitoring*
Selected populations of Peck's mariposa lily (Calochortus longebarba-tus var. peckii)	Riparian planting sites	The District Botanist will coordinate with project specialists in the field prior to riparian planting to ensure sensitive site locations are known. Sites will be delineated on the ground. Motorized vehicles used will be restricted to road prism.	Riparian vegetative cover and number of Peck's lily plants blooming	Visual inventory of plants Visual walk through of the habitat	Were the design elements and/or mitigations correctly implemented? Were the silvicultural prescriptions implemented correctly?	Were the design elements and/or mitigations successful in protecting the lily population? Did the treatment benefit the population?	Did the number of Peck's lily plants increase? Is the overall condition of the habitat improved?
Selected populations of Peck's mariposa lily (Calochortus longebarba-tus var. peckii)	Temporary road construction	50' buffers to exclude ground-disturbance will be established around sensitive plant populations and habitat (District Botanist will coordinate exceptions with other specialists).	Vegetative cover and number of Peck's lily plants blooming. Amount of site disturbance.	Visual inventory of plants Visual walk through of the habitat	Were the design elements and/or mitigations correctly implemented?	Were the design elements and/or mitigations successful in protecting the lily population?	If the design elements and/or mitigations were unsuccessful in protecting plants, what measures would have been more effective?

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Deep Vegetation Management Project Monitoring Plan

Monitoring Item	Monitoring Site	Management Action	Indicators/ Attributes	Monitoring Procedure	Implementation Monitoring	Effectiveness Monitoring*	Validation Monitoring*
Selected populations of Peck's mariposa lily (Calochortus longebarba-tus var. peckii)	Culvert replacement sites	District Botanist will coordinate in the field with project specialists prior to culvert re-placement to ensure sensitive site locations are known. The site will be delineated on the ground Motorized vehicles used will be restricted to road prism.	Riparian vegetative cover and number of Peck's lily plants blooming Amount of site disturbance.	Visual inventory of plants Visual walk through of the habitat	Were the design elements and/or mitigations correctly implemented	Were the design elements and/or mitigations successful in protecting the lily population? Did the treatment benefit the population?	Did the number of Peck's lily plants increase? Is the overall condition of the habitat improved?
Selected populations of Peck's mariposa lily (Calochortus longebarba-tus var. peckii)	Natural fuels burning units	Motorized vehicles used will be restricted to road prism. District Botanist will coordinate in the field with project specialists prior to natural fuels treatment to ensure sensitive site locations are known.	Vegetative cover and number of Peck's lily plants blooming. Ignition points and amount of burning within plant sites.	Visual inventory of plants Visual walk through of the habitat	Were the design elements and/or mitigations correctly implemented? Were the silvicultural prescriptions implemented correctly?	Were the design elements and/or mitigations successful in protecting the lily population? Did the treatment benefit the population?	Did the number of Peck's lily plants increase? Is the overall condition of the habitat improved?
Selected populations of Peck's mariposa lily (Calochortus longebarba-tus var. peckii)	Precommercial thinning units	Motorized vehicles used will be restricted to road prism. Precommercial thinning within or directly adjacent to selected plants will take place after growing season. No slash piling will take place on top of sensitive plants. (continued)	Meadow vegetative cover and number of Peck's lily plants blooming. Amount of slash within plant site.	Visual inventory of plants Visual walk through of the habitat	Were the design elements and/or mitigations correctly implemented? Were the silvicultural prescriptions implemented correctly?	Were the design elements and/or mitigations successful in protecting the lily population? Did the treatment (continued)	Did the number of Peck's lily plants increase? Is the overall condition of the habitat improved?

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Deep Vegetation Management Project Monitoring Plan

Monitoring Item	Monitoring Site	Management Action	Indicators/ Attributes	Monitoring Procedure	Implementation Monitoring	Effectiveness Monitoring*	Validation Monitoring*
		The District Botanist will assist in designing silvicultural treatments to enhance these populations.				benefit the population?	

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Deep Vegetation Management Project Monitoring Plan

Monitoring Item	Monitoring Site	Management Action	Indicators/ Attributes	Monitoring Procedure	Implementation Monitoring	Effectiveness Monitoring*	Validation Monitoring*
Willow stand response	Willow stand S. monochroma & S. lucida var. caudate Willow stand S. drummondiana	Precommercial thinning Protection of willow stands Culvert replacement	Increases in willow other deciduous vegetation. Stability and health of existing willows.	Visual walk through of each stand.	Were the silvicultural prescriptions implemented correctly?	Were the protection devices effective? Did the heath and vigor of the willows and other deciduous vegetation respond to the treatment? Was there a vegetative response in new willow recruitment as well as the overall amount of vegetation?	If there is no response, were the contingency measures in the silvicultural prescriptions followed?
Riparian Management Objectives: RHCA's with Pre-commercial thinning (PCT)	Precommercial thinning units within or adjacent to RHCA's	PCT activities will meet Interim Inland Native Fish Strategy (INFISH) standards and guidelines Prescriptions will be site-specific and designed to meet Riparian Management Objectives (RMO's) No measurable decrease in shade from operations along perennial and/or fish-bearing streams Vegetation will be left intact within 15' of stream channels; no measurable decrease in shade (continued) Within RHCA's, all PCT will be	Distance of activities (i.e. ground based machinery, tree felling, skidding and landings) away from streams, amount of shade, stream temperature, pools, large wood, bank stability, riparian hardwood or other vegetative density/ composition	On-site observations will be conducted in all RHCA precommercial thinning units (including aspen) and in 40% of all other units Temperature loggers Aquatic/riparian inventories	Were the inner RHCA no-harvest buffers (where RHCA treatments were identified to be accomplished except aspen) maintained during the layout and implementation of PCT? Were the RHCA no harvest buffers maintained during the layout and implementation of PCT? (continued) Was thinning slash directionally	Were the PCT treatments in-cluding aspen within RHCA's successful in accomplishing the desired RMO'S? Did PCT activities within RHCA's reduce existing levels of stream shading?	What was the stream shade level before and after PCT activities? Did stream shade and/or temperature progress over time to meet site potential? Did any of the desired aquatic habitat elements (wood, pools, bank stability, (continued) etc.) change

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Deep Vegetation Management Project Monitoring Plan

Monitoring Item	Monitoring Site	Management Action	Indicators/ Attributes	Monitoring Procedure	Implementation Monitoring	Effectiveness Monitoring*	Validation Monitoring*
		directional felled into closed and temporary roads and skid trails Best Management Practices will be utilized to comply with state water quality standards Additional RHCA's located within harvest units will be addressed by the Fisheries Biologist and Riparian Manage-ment Objectives will be reviewed			felled on closed roads and skid trails? Were there any streams, springs or wetlands that needed classification or reclassification by a hydrologist or fisheries biologist prior to marking or implementation?		over time in accordance with the silviculture treatments?

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Deep Vegetation Management Project Monitoring Plan

Monitoring Item	Monitoring Site	Management Action	Indicators/ Attributes	Monitoring Procedure	Implementation Monitoring	Effectiveness Monitoring*	Validation Monitoring*
Riparian Management Objectives: RHCA's with commercial harvest, aspen treatments	Commercial harvest units within or adjacent to RHCA's	Commercial harvest activities will meet INFISH standards and guidelines Winter logging will occur during adequate snow and/or frozen conditions Slash will be placed at the edge of landings to provide roughness to retard overland flow Scarification of landings will be considered on a case-by-case basis and coordinated with the Fish Biologist/ Hydrologist and Soil Scientist Within RHCA's, water bars and drains will be located on roads and skid trails Avoid placement of new skid trails within the RHCA. Utilize existing skid trails where possible, especially within 50-60' of the scab-conifer interface No skidding in Class V swales BMP's will be utilized to comply with state water quality standards Additional RHCA's located within harvest units will be addressed by the Fisheries Biologist and RMO's will be reviewed	Distance of activities (i.e. ground based machinery, tree felling, skidding and landings) away from streams, amount of shade, stream temperature, pools, large wood, bank stability, riparian hard-wood or other vegetative density/ composition	On-site observations will be conducted in all RHCA harvest units (including aspen) and in 40% of all other units Temperature loggers Aquatic/ riparian inventories	Were the inner RHCA no harvest buffers maintained during the layout and implementation of helicopter, winter and tractor harvesting? Were the RHCA no harvest buffers (where RHCA treatments were not identified including springs and wetlands) maintained during the layout and implementation of helicopter, winter and tractor harvesting? Were existing stream crossings on Class IV drainages necessary in winter only logging units? If so, how many crossings were needed? Were the stream crossings on Class IV drainages at least 300' apart?	Were the aspen and commercial harvest treatments within RHCA's successful in accomplishing the desired RMO'S? Did commercial harvest activities within RHCA's reduce existing levels of stream shading? Did commercial harvest activities within RHCA's result in a change of the overall vegetative composition or loss of large down wood within the greenline areas?	What was the stream shade level before and after PCT activities? Did stream shade and/or temperature progress over time to meet site potential? Did any of the desired aquatic habitat elements (wood, pools, bank stability, etc.) change over time in accordance with the silviculture treatments?

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Deep Vegetation Management Project Monitoring Plan

Monitoring Item	Monitoring Site	Management Action	Indicators/ Attributes	Monitoring Procedure	Implementation Monitoring	Effectiveness Monitoring*	Validation Monitoring*
		Ground based equipment within RHCA's restricted to designated crossings at least 300' apart on Class V drainages The District Fisheries Biologist and Botanist will review crossing locations prior to implementation Landings will not be placed in RHCA's or swales. Possible exceptions will be evaluated on a case-by-case basis to determine if they would enhance the recovery of the RHCA and meet RMO's Ground based equipment will be restricted to periods of use to minimize soil compaction and disturbance. No harvest buffers will be applied in order to meet shade and root strength requirements/reduction & sediment delivery			How many passes occurred on these crossings? Was full suspension accomplished for logs yarded over the no-cut buffers (RHCA's)? Were any landings placed within RHCA's or swales (Class V drainages)? Were there any streams, springs or wetlands that needed classification or reclassification by a hydrologist or fisheries biologist prior to marking or implementation?		

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Deep Vegetation Management Project Monitoring Plan

Monitoring Item	Monitoring Site	Management Action	Indicators/ Attributes	Monitoring Procedure	Implementation Monitoring	Effectiveness Monitoring*	Validation Monitoring*
Riparian Management Objectives: RHCA's with prescribed fire/ fuel treatments	Natural Fuels Units within or adjacent to RHCA's All units	Fire/fuel treatments will meet INFISH standards and guidelines Prescribed burning in RHCA's will be designed to improve riparian conditions No lighting or fire line construction will occur in RHCA's Fire behavior will be monitored with the District Fisheries Biologist during burning in order to ensure RMO's are being met and no measurable reduction in shade occurs Fire intensities in Class I,II,III streams will be low and will not result in overall change in current vegetation composition or net loss of large down material within flood plain and greenline areas Grapple piling in commercial harvest units will not occur on slopes greater than 10% Grapple piling in PCT units will need to be reviewed by District Fisheries Biologist	Distance of activities (i.e. ground based machinery, tree felling, skidding and landings) away from streams, amount of shade, stream temperature, pools, large wood, bank stability, riparian hard-wood or other vegetative density/ composition	On-site observations will be conducted in all RHCA harvest units (including aspen) and in 40% of all other units Temperature loggers Aquatic/ riparian inventories	Did any prescribed fire lighting occur within RHCA's? Was prescribed fire behavior low within RHCA's and did it result in a change of the overall vegetation composition or loss of large down wood within the greenline areas? Did grapple piling occur as a part of post-activity (commercial harvest and/or PCT) fuels treatments? Were there any streams, springs, or wetlands that needed classification or reclassification by a hydrologist or fisheries biologist prior to marking or implementation?	Were the fire/fuel treatments in-cluding aspen within RHCA's successful in accomplishing the desired RMO's? Did fire/fuel activities within RHCA's reduce existing levels of stream shading? Did fire/fuel activities within RHCA's result in a change of overall vegetative composition or loss of large down wood within the greenline areas?	What were the fuel loadings before and after fire/fuel treatments? What was the level of stream shade before and after fire/ fuel treatments? Did stream shade as well as temperature progress over time to meet site potential? Did any of the desired aquatic habitat elements (wood, pools, bank stability, etc.) change over time in accordance with the silviculture treatments?
Peak flows	All commercial harvest units All PCT units (continued)	The timing, duration and location designs of harvest thinning and fuels operations will be staged so that (continued)	Stream discharge, bank erosion rates, sediment	Install ISCO's, staff gauges, bank pins, scour chains, pebble (continued)	Were commercial timber harvest, PCT, and prescribed fire (continued)	Did the timing and spatial distribution of (continued)	Was there an aggradation or degrada-tion of the (continued)

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Deep Vegetation Management Project Monitoring Plan

Monitoring Item	Monitoring Site	Management Action	Indicators/ Attributes	Monitoring Procedure	Implementation Monitoring	Effectiveness Monitoring*	Validation Monitoring*
	All natural fuels units	hydrology across the landscape mimics a natural regime		counts, cross-sections, and profiles	activities implemented within the timeframes and by subwatershed as designated by the cumulative effects analysis?	implementation for these commercial harvests, PCT, and prescribed burnings result in a net change in peak flow? Did the riparian planting, large wood placement, and culvert placement activities decrease w/d ratios, increase pools, shade and bank stability, and/or enhance the ability of the stream to move bedload?	streambed? Was there a change in turbidity, particle size distribution, bank erosion, cross-sectional area, or slope? Was there a change in turbidity or particle size distribution? Did skid trails, landings, fire lines and/or closed or decommissioned roads revegetate within a period of 5-6 years?

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Deep Vegetation Management Project Monitoring Plan

Monitoring Item	Monitoring Site	Management Action	Indicators/ Attributes	Monitoring Procedure	Implementation Monitoring	Effectiveness Monitoring*	Validation Monitoring*
Sedimenta-tion	All commercial harvest units 60% of PCT and Natural Fuels Units All road closures and all decommissioned roads All culvert replacement sites	Winter logging will occur during adequate snow or frozen conditions. Slash will be placed at the edge of landings to provide roughness to retard overland flow. Scarification of landings will be considered on a case-by-case basis and coordinated with the Fish Biologist/Hydrologist and Soil Scientist Within RHCA's, water bars and drains will be located on roads and skid trails BMP's will be utilized to comply with state water quality standards Ground based equipment within RHCA's restricted to designated crossings at least 300' apart on Class IV drainages The District Fisheries Biologist and Botanist will review stream crossing locations prior to implementation Landings will not be placed in RHCA's or swales. Possible exceptions evaluated on a case-by case basis to determine if they would enhance recovery of RHCA and meet RMO's Ground based equipment restricted to periods of use to minimize soil compaction and disturbance.	Distance of activities (i.e. ground based machinery, tree felling, skidding and landings) away from streams, particle size distribution, number of skid trails and stream crossings, as well as erosion hazards	On-site observations, installation of ISCO's, and pebble counts	Was scarification utilized on skid trails or landings? If scarification occurred on slopes greater than 10%, was contour tillage utilized? Were any landings placed within RHCA's or swales/Class V drainages? Were new skid trails placed within RHCA's? Were skid trails placed down Class V swales? Were existing skid trails utilized within 50-66' of the scab-conifer interface? Was winter logging accomplished during adequate snow and/or frozen conditions? Was machine piling(i.e. creation of landings) avoided in (continued)	Was there any stream bank or soil disturbance across the floodplain and flood prone areas as a result of com-mercial harvest activities? Did the winter log design work? Were water bars, cross drains, erosion control structures, fire hand line re-habilitation (if needed) and/or other such practices a part of implementing BMP's? If so, how many of these structures were placed during harvest and/or prescribed fire activities and where were/are they located? (continued)	What was the change in suspended sediment before and after all activities were completed?

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Deep Vegetation Management Project Monitoring Plan

Monitoring Item	Monitoring Site	Management Action	Indicators/ Attributes	Monitoring Procedure	Implementation Monitoring	Effectiveness Monitoring*	Validation Monitoring*
		(continued) Avoid placement of new skid trails within the RHCA. No skidding down Class V swales No harvest buffers will be applied to reduce sediment delivery. Erosion control structures if necessary at or near road crossings Relief culverts provided on reconstructed roads with intermittent or ephemeral stream crossings If scarification is needed on or around a skid trail or landing, contour tillage will be used on slopes > than 10% Fire intensities in Class I,II,III streams will be low and not result in overall change in current vegetation composition or net loss of large down material within the flood plain and greenline areas New and temporary road construction will avoid RHCA's New and reopened roads will be hydrologically closed after harvest operations Grapple piling in commercial harvest units will not occur on slopes greater than 10% Grapple piling in PCT units will need to be reviewed by District Fisheries Biologist			areas where slope erosion hazards exhibit moderate to high risk? Were BMP's accomplished during commercial harvest, road decommissioning/ closure, new and temporary road construction, prescribed fire, and culvert replacement activities? Did new and temporary road construction activities avoid RHCA's? Were any stream crossings needed where new and temporary road construction did not avoid RHCA's? Were these necessary crossings installed perpendicular to the stream channel? Were relief culverts used? Were new and re- (continued)	Did these structures function, or are they functioning as designed?	

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Deep Vegetation Management Project Monitoring Plan

Monitoring Item	Monitoring Site	Management Action	Indicators/ Attributes	Monitoring Procedure	Implementation Monitoring	Effectiveness Monitoring*	Validation Monitoring*
		(continued) Prescribed burning in RHCA's will be designed to improve riparian conditions No lighting or fire line construction will occur in RHCA's			opened roads hydrologically closed after harvest operations?		
RHCA burning	Natural Fuels Units	No lighting will occur within RHCA buffers Soil scorching will be minimized: prescribed burning prescriptions will limit the burn intensity and residence time All prescribed fire operations will be in accordance with Oregon Smoke Management Guidelines No hand or machine fire line will be constructed within RHCA's. Exceptions may occur to stop burning activities if RHCA objectives are not being met The Burn Boss and District Fisheries Biologist will be on site for monitoring	Less than 30% of RHCA involved in the burn	Visual walk through of units during burning activities	Were the design elements and/or mitigations correctly implemented?	Did fire enter enter the RHCA? Was handline construction necessary in the RHCA?	What % of the RHCA areas were burned? How much handline was constructed? If these mitigations were not successful in protecting the RHCA's, what protective measures may have been more effective?
Scabland burning	Natural Fuels Units	No lighting will occur in these areas, but fire will be allowed on the scabs. Lighting will occur around the scabs and within the tree line. The Burn Boss will ensure the lighters are aware of the burn plan	No evidence of lighting in scabs	Visual walk through of the burn units	Were the design elements and/or mitigations correctly implemented?	Did fire enter the scab area?	What % of the scabland acreage was burned? If these mitigations were not
		(continued)					(continued)

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Deep Vegetation Management Project Monitoring Plan

Monitoring Item	Monitoring Site	Management Action	Indicators/ Attributes	Monitoring Procedure	Implementation Monitoring	Effectiveness Monitoring*	Validation Monitoring*
		All prescribed fire operations will be in accordance with Oregon Smoke Management Guidelines					successful in protecting the scab areas, what protective measures may have been more effective?

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Deep Vegetation Management Project Monitoring Plan

Monitoring Item	Monitoring Site	Management Action	Indicators/ Attributes	Monitoring Procedure	Implementation Monitoring	Effectiveness Monitoring*	Validation Monitoring*
Historic or Prehistoric archaeological sites	Commercial harvest units	Features contributing to the significance of these sites will be flagged for avoidance and information will be passed on to the Sale Administrator	Were the artifacts or features which reflect the historic significance of these sites unharmed by project activities?	Compare past site documen-tation and/or condition to post-activity site integrity	Were the mitigations carried through to the sale administration level?	Were site features successfully avoided during harvest activities?	If avoidance mitigations were not sufficient, what addition-al mitigations may have been more effective?
	Commercial harvest units: winter logging units	Measurable snow cover is required before harvesting activities may commence Features contributing to the significance of these sites will be flagged for avoidance and information will be passed on to the Sale Administrator	Were the artifacts or features which reflect the historic significance of these sites unharmed by project activities?	Compare past site documen-tation and/or condition to post-activity site integrity	Were the mitigations carried through to the sale administration level?	Were site features successfully avoided during harvest activities?	If winter logging over snow did not successfully protect the site, what additional mitigations may have been more effective?
	Precommercial thinning (PCT) units	Features contributing to the significance of these sites will be flagged for avoidance and information will be passed on to the PCT C.O.R.	Were the artifacts or features which reflect the historic significance of these sites unharmed by project activities?	Compare past site documen-tation and/or condition to post-activity site integrity	Were the mitigations carried through to the PCT level?	Were site features successfully avoided during harvest activities?	If avoidance mitigations were not sufficient, what addition-al mitigations may have been more effective?
	Natural Fuels units	Features contributing to the significance of these sites will be flagged for avoidance and information will be passed on to the Fuels Specialist	Were the artifacts or features which reflect the historic significance of these sites unharmed by project activities?	Compare past site documen-tation and/or condition to post-activity site integrity	Were the mitigations carried through the burning activities?	Were site features successfully avoided during burning activities?	If avoidance mitigations were not sufficient, what addition-al mitigations may have been more effective?
	Aspen treatment units	Features contributing to the significance of these sites will be flagged for avoidance and information will be passed on to the Sale Administrator	Were the artifacts or features which reflect the historic significance of these (continued)	Compare past site documen-tation and/or (continued)	Were the mitigations carried through to (continued)	Were site features successfully (continued)	If avoidance mitigations were not (continued)

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Deep Vegetation Management Project Monitoring Plan

Monitoring Item	Monitoring Site	Management Action	Indicators/ Attributes	Monitoring Procedure	Implementation Monitoring	Effectiveness Monitoring*	Validation Monitoring*
			sites unharmed by project activities?	condition to post-activity site integrity	the sale administration level?	avoided during harvest activities?	sufficient, what addition-al mitigations may have been more effective?

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Deep Vegetation Management Project Monitoring Plan

Monitoring Item	Monitoring Site	Management Action	Indicators/ Attributes	Monitoring Procedure	Implementation Monitoring	Effectiveness Monitoring*	Validation Monitoring*
Historic or Prehistoric archaeological sites	Large woody materials	Features contributing to the significance of these sites will be flagged for avoidance and information will be passed on to the Large Woody Material Project Coordinator	Were the artifacts or features which reflect the historic significance of these sites unharmed by project activities?	Compare past site documentation and/or condition to post-activity site integrity	Were the mitigations carried out by the Large Woody Material Project Coordinator?	Were site features avoided during Large Woody Material Project activities?	If avoidance mitigations were not sufficient, what additional mitigations may have been more effective?
	Meadow enhancement sites	Features contributing to the significance of these sites will be flagged for avoidance and information will be passed on to the Project Leader	Were the artifacts or features which reflect the historic significance of these sites unharmed by project activities? Were any populations of cultural and/or traditional use plants protected during project activities?	Compare past site documentation and/or condition to post-activity site integrity Walk through project area to inventory plant population, health and vigor	Were the mitigations carried out by the Project Leader?	Were site features avoided during meadow enhancement activities? Were any plant populations present avoided and/or protected during project activities?	If avoidance mitigations were not sufficient, what additional mitigations may have been more effective?
	Culvert replacement sites	Features contributing to the significance of these sites will be flagged for avoidance and information will be passed on to the Project Leader	Were the artifacts or features which reflect the historic significance of these sites unharmed by project activities?	Compare past site documentation and/or condition to post-activity site integrity	Were the mitigations carried out by the Project Leader?	Were site features avoided during project activities?	If avoidance mitigations were not sufficient, what additional mitigations may have been more effective?
	Decommissioning of roads	Features contributing to the significance of these sites will be flagged for avoidance and information will be passed on to the Project Leader	Were the artifacts or features which reflect the historic significance of these sites unharmed by project activities?	Compare past site documentation and/or condition to post-activity site integrity	Were the mitigations carried out by the Project Leader?	Were site features avoided during project activities?	If avoidance mitigations were not sufficient, what additional mitigations may have been more effective?

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Deep Vegetation Management Project Monitoring Plan

Monitoring Item	Monitoring Site	Management Action	Indicators/ Attributes	Monitoring Procedure	Implementation Monitoring	Effectiveness Monitoring*	Validation Monitoring*
Historic or Prehistoric archaeological sites	Riparian planting sites	Features contributing to the significance of these sites will be flagged for avoidance and information will be passed on to the Riparian Project Leader	Were the artifacts or features which reflect the historic significance of these sites unharmed by project activities?	Compare past site documentation and/or condition to post-activity site integrity	Were the mitigations carried out by the Riparian Project Leader?	Were site features avoided during the riparian project activities?	If avoidance mitigations were not sufficient, what additional mitigations may have been more effective?

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Deep Vegetation Management Project Monitoring Plan

Monitoring Item	Monitoring Site	Management Action	Indicators/ Attributes	Monitoring Procedure	Implementation Monitoring	Effectiveness Monitoring*	Validation Monitoring*
Silvicultural prescriptions for commercial harvest units	Commercial harvest units (monitored as of 12/12/01)	HTH and/or HIM harvest treatments Leave the basal area for plant association at the level for tree growth, not less than 12/20th of an inch average over the next growth period.	Amount of basal area left Selection quality of trees based on dominance, vigor, species, and insect/ disease indicators	Walk through	Was the prescription correctly implemen-ted?	If the prescription was not imple-mented correctly, what changes need to be made to the site? Was the prescribed treatment successful?	If the prescribed treatment was not (or only marginally) successful, what measures may have been more effective?
Silvicultural prescriptions for regeneration	Commercial harvest units with soil disturbance level 3 regeneration	The unit will receive a subsoiling treatment following the sale activities The unit will not exceed a max-imum of 20% detrimental soil disturbance	Compaction level	Grid unit testing for compaction with the soil scientist	Was the prescription correctly implemen-ted?	If the prescription was not imple-mented correctly, what changes need to be made to the site? Was the prescribed treatment successful?	If the pre-scribed treatment was not (or only marginally) successful, what measures may have been more effective?
Silvicultural prescriptions for RHCA units	Commercial harvest units within RHCA treatments	HIM harvest treatments within the RHCA areas: Riparian Management Objective (RMO): Promote shade development and increase large woody debris in order to decrease stream temperature RMO: Increase density (continued)	Amount of basal area left Selection quality of trees based on dominance, vigor, species, and insect/ disease indicators	Walk through	Was the prescription correctly implemen-ted?	If the prescription was not imple-mented correctly, what changes need to be made to the site? Was the prescribed treatment successful?	If the pre-scribed treatment was not or only marginally successful, what measures may have been more effective?

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Monitoring Item	Monitoring Site	Management Action	Indicators/ Attributes	Monitoring Procedure	Implementation Monitoring	Effectiveness Monitoring*	Validation Monitoring*
		of understory grasses in order to increase channel stability					

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Deep Vegetation Management Project Monitoring Plan

Monitoring Item	Monitoring Site	Management Action	Indicators/ Attributes	Monitoring Procedure	Implementation Monitoring	Effectiveness Monitoring*	Validation Monitoring*
Canopy closure	Connectivity corridors identified in the Wildlife Biological Evaluation	The District Wildlife Biologist will assist in the design of silvi-cultural prescriptions appropriate for maintaining canopy closure within 1/3 of the site's potential	Old growth related wildlife species	10% of the connectivity corridors will be monitored to see if they meet canopy closure requirements	Were the design elements and mitigations correctly implemented?	Did the design elements and mitigations effectively maintain canopy closure within 1/3 of the site's potential? Were the treatment prescriptions effective in reducing the competition for resources, as well as accelerating growth in the remaining trees?	Were the treatment prescriptions used in the connectivity corridors more effect-tive in accelerating large tree growth than the adjacent unit prescriptions?
Goshawk territory	All project activities that occur in PFA's	Treatments within PFA's will be designed to meet goshawk objectives and a seasonal restriction will apply between March 1 and September 30	Use by adult goshawks and active nesting attempts within the PFA	Goshawk surveys during nesting season, March 1-September 30	Were the design elements or mitigations correctly implemented?	Did the imple-mented design elements or mitigations have a positive effect on goshawk breeding success?	Is there a need to modify the mitigations or treatment prescriptions in order to better address goshawk breeding success?
Large woody material	All Commercial Harvest units All Natural Fuels units	Large woody material levels, in the appropriate size classes, will be maintained in the affected units by using the (continued)	Evidence of successful levels of large woody material that is within VEMG range	Large woody material surveys in 10% of the units	Were the design elements or mitigations correctly implemented? Were the large (continued)	Did the large woody material levels that were left, effectively contribute to (continued)	Was the soil nutrient cycling suc-cessful in maintaining site productivity?

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Deep Vegetation Management Project Monitoring Plan

Monitoring Item	Monitoring Site	Management Action	Indicators/ Attributes	Monitoring Procedure	Implementation Monitoring	Effectiveness Monitoring*	Validation Monitoring*
		descriptions in the VEMG			woody material levels maintained within the ranges described for the VEMG?	the processes and functions associated with soil nutrient cycling?	
Wildlife snags	All project activities within the Little Summit and Deep Watersheds	There will be a minimum of 2.25 snags per acre	Evidence that 100% of the maximum potential for primary cavity excavators is being achieved	Snag surveys within all units of the affected subwatersheds	Were the design elements and mitigations correctly implemented?	Were the minimum amounts of 2.25 snags/acre maintained in the size classes where they were available? Did 100% of the pre-disturbance populations remain after the treatment?	Did maintaining 100% of the pre-disturbance populations result in viable population numbers?

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Appendix C

Public Comments and Agency Letters

Introduction

The public comment period for the Draft Supplemental Environmental Impact Statement (DSEIS) for the Deep Vegetation Management Project began on July 10, 2002, and closed September 30, 2002. Agencies, officials, and the public were invited to comment on the Draft SEIS. This appendix contains the responses to public comments. During the public comment period, 10 written responses were received. The substantive comments have been grouped into related topics, and in some cases summarized or paraphrased. The complete text of the public comments is available in the project record, located at the Ranger District Office.

Response to Comments

1. **Legal and Process Issues**

1.1 Comment: *The DSEIS does not meet the stated purpose and need and thus should be either revised or withdrawn.*

Response: Each of the Action Alternatives described in Chapter 2 were designed to meet the purpose and need. Based on the key issues that were addressed, each Alternative meets the purpose and need to a different degree.

1.2 Comment: *The Forest Service does not have the scientific data required by the NFMA to conduct vegetative manipulation on the scale planned in the project area. The DSEIS contains no information on how the diversity of plant and animals will be affected by shift from multistoried canopies to single-storied canopies.*

Response: The Forest Service used the best and most recent scientific information available to asses plant and animal effects based upon the proposed vegetation manipulations. The Viable Ecosystems Management Guide (VEMG) deals extensively with seral/structural stages and multiple successional pathways. In VEMG, habitat relationships are made for the various seral/structural stages to be able to predict the various plant and animals that are present at any particular seral/structural state and how those species change as succession advances. VEMG was also updated in terms of the wildlife habitat relationships as new information has come out, such as the Partners in Flight Landbird Conservation Plans and the publication Wildlife-Habitat Relationships in Oregon and Washington. The SEIS on pages 63-67 and 73-84 contains extensive analyses of changes expected to animals based upon predicted changes in the seral/structural as the result of each alternative.

1.3 Comment: *The DSEIS proposed to change the diversity of plant species from multi-storied canopies to single-storied canopies but it does not provide any documentation to support the reasons for this decision. To be in line with NFMA and NEPA regulations, the DSEIS must include data on the reason for the decision to make such a significant change in the diversity pattern of the forest.*

Response: Pages 3-14 to 3-25 of the FSEIS provides the information that is the basis for proposing treatments. This section describes the current seral and structural diversity of the forest, the seral composition of late and old structured (LOS) stands, and the amount of single and multi-stratum LOS. These components are compared to the historic range of variability (HRV) of stand conditions for the watershed. The current amount of single-strata LOS is below what historically existed (HRV) while the multi-strata LOS is far in excess of what historically existed on this landscape. The risks of insect disease and fire are described for this landscape under its current condition on pages 3-7 through 3-13 and 3-17, 3-25 and 3-26. Historic fire regimes are also described on pages 3-29 through 3-34 and compared to expected fire effects to stands under current conditions. The project proposes to move landscape-level diversity of vegetation closer to historic conditions and to increase the amount of single strata (LOS) stands. The total change in seral and structure changes proposed under any of the action alternatives on this landscape is less than 10%.

1.4 Comment: *The DSEIS totally lacks analysis showing biological, economic, social and environmental design consequences of such actions and the relation of such conversions to the process of natural change as required under 36 C.F.R. 219.27(g). As a result, the Deep DSEIS violates these regulations and thus the Forest Service must show what data it has that supports this action; without this information the Forest Service is in direct violation of NFMA.*

Response: See response to comments 1.2 and 1.3. In addition, see FSEIS pages 4-46 through 4-48 for discussions on social/economics.

1.5 Comment: *Trees that are over 21" dbh are marked to cut in units that overlap the old Shown Sale. The Deep Sale is not supposed to log trees over 21" dbh.*

Response: As stated in the description of the action alternatives, pages 2-3, 2-14, and 2-26, no trees over 21" dbh will be harvested. The trees you refer to are not marked to cut under the Deep sale and will not be cut or removed.

1.6 Comment: *The Forest Service improperly relies on mitigation measures and best management practices rather than the hard look that is required by NEPA. The Forest Service's perfunctory description of mitigation measures is inconsistent with the "hard look" it is required to undertake pursuant to NEPA. Indeed, the DSFEIS lacks a listing or discussion of mitigation measures that will apply to the project. There is no discussion in the SFEIS or its supporting documentation of the implementation of mitigation measures, their use, efficacy, or anything beyond their mere existence. This sort of environmental impact statement does not satisfy NEPA.*

Response: Mitigation measures and project design elements are described on pages 2-37 to 2-52 of the FSEIS. These elements are incorporated into each action alternative and the unit to which each measure applies is also listed. Effects discussions in Chapter 4 are based on the application of these mitigation measures and project design elements.

1.7 Comment: *I strongly urge Alternative D to protect and improve the habitat, or C as a compromise.*

Response: Alternative C has been identified as the preferred alternative.

1.8 Comment: *Alternative B should be chosen as the preferred alternative instead of Alternative C, because it will produce more long-term positive results.*

Response: See comment 1.7.

1.9 Comment: *Community stability should have a higher priority. Your economic assessment needs to be more detailed and weighted heavier in your proposed action alternative.*

Response: The Purpose and Need includes the need to provide timber to contribute to the health of the local and regional economies (page 1-9). The Deciding Official will consider how well the alternatives provide opportunities for communities to benefit through jobs and income (page 1-11). The Social/Economic assessment, page 4-41 is provided so that the Deciding Official can see economic difference in the alternatives, and how that translates into jobs.

2. **Range of Alternatives**

2.1 Comment: *There is an insufficient range of alternatives. Design or implement a new restoration only alternative with no commercial logging or road building. Without considering a restoration-only alternative, the public is misled to believe that the restoration activities that are presented in the DSFEIS cannot occur without the commercial logging activity that is proposed.*

Response: Chapter 2, page 2-1 describes the Alternatives that were briefly considered, but not studies in detail. An alternative that included no commercial harvest activities was considered. This type of alternative would not meet a major portion of the purpose and need. It would do little to move the upland vegetation closer to the historic ranges or to develop single strata LOS stands.

2.2 Comment: *The Forest Service could have considered an alternative that proposed to engage in active restoration of previously poorly managed areas. An alternative should have been fully considered that consisted of removal and restoration of Forest Service roads, control of exotic invasive species established as a result of past Forest Service grazing and logging activities, sediment control activities, and other measures that would help the forest recover and become stable. Disregarding a viable alternative that would meet the purpose and need of the project is inconsistent with NEPA's requirement that a range of alternatives be considered in an environmental analysis, especially given the repeated public requests (and an EPA suggestion) that a restoration alternative be considered.*

Response: Watershed improvement activities, such as road closures, are included in each of the action alternatives. The FSEIS recognized that future planning efforts would focus on stream restoration and grazing allotment management (page 1-5). In addition, the Forest Service is currently in the planning stages of a Watershed Restoration project. An environmental assessment is being prepared that addresses many of the objectives and recommendations in the Deep Watershed Roads Analysis and the Deep Creek Water Quality Restoration Plan.

3. **Vegetative Treatments and Prescribed Burning**

3.1 Comment: *The "Deep" planning area, on the Paulina District of the Ochoco National Forest, is not suitable for logging, with forest cover mostly confined to narrow strips along drainages between rocky uplands too arid to support trees.*

Response: Chapter 3 of the FSEIS describes the affected environment of the Deep planning area. The soils section describes the existing landtypes and recognizes that most of the watershed is scab stringer terrain which generally has an average of 30 percent scabland plateaus dissected by timbered stringers. The Ochoco National Forest Plan allows timber harvest only on lands classified as available, capable, and suitable (Forest Plan 4-200). INFISH buffers (which amended the forest plan) remove much of the central portion of the stringers for RHCAs. The upland scab/stringer interfaces have minimum activity buffers of 50 to 66 feet (FSEIS 2-46, 2-48). The combination of these two sets of buffers serves to minimize erosion and delivered sediment.

3.2 Comment: *Ideal restoration projects would include a restoration assessment, which identifies the root causes of ecosystem degradation at the ecoregional, intermediate (watershed) and site level. It would then determine appropriate methods for restoring degraded ecosystems. It would seem that your analysis falls short here, especially with regards to grazing.*

Response: The purpose and need for the Deep project is based on watershed analysis that was completed for the Deep Creek Watershed as well as the Deep Creek Water Quality Restoration Plan and the Deep Creek Roads Analysis. These documents provide information on the causes of the current conditions in the watershed and identify recommendations and priorities for restoration of the watershed.

3.3 Comment: *The Forest Service's current preferred alternative C would commercially log in 3,315 acres of existing "late and old structure" (old growth habitat), theoretically to return the area to historic conditions of open, single canopy layer old growth ponderosa pine and larch but actually artificially converting historic mixed conifer habitat with large live fir (centuries old) and many old growth fir stumps and logs from past logging that are evidence of naturally denser forest.*

Response: No old trees will be removed since no trees greater than 21 inches dbh will be cut. Also, based upon the Viable Ecosystem Management Guide (VEMG), the amount or degree of mixtures of species is dependant upon the Plant Association Group. For example, in the dry grand fir plant association (the most common in Deep), for a stand to meet the VEMG classification of single strata late and old structure, the stand needs only be less than 55% crown closure and have at least 75% of the overstory trees be ponderosa pine, western larch or lodgepole pine. This still allows for up to 25% of the dominate tree layer to be Douglas-fir and other true firs.

3.4 Comment: *Our intensive field-checking has found, in just half the total sale which has already been marked, at least 34 sale units with riparian concerns, 42 units adjacent to treeless rocky upland, 12 units with additional soil concerns (compaction, rocky, easily displaced soils, erosion) and 9 units with steep slopes (25 degrees or more).*

Response: Refer to the Fisheries and Water Quality sections in regards to Riparian Habitat Conservation Areas (RHCAs). RHCA buffers are standard throughout this project with the exception of aspen enhancement activities. Upland buffers along the scab/stringer interfaces are standard mitigations for this project (DSFEIS 2-46, 2-48). Also see the unit by unit evaluations and recommendations in Appendix G. These evaluations address existing soil conditions and tillability. The unit by unit harvest proposals and logging systems listed in Appendix F included evaluation of slopes.

3.5 Comment: *The levels of proposed burning are too high. The extensive area of land slated for burning does not exhibit the near-catastrophic level of fuel loading that the Forest Service claims is present in the planning area. Rather these forest areas represent a diverse mosaic of forest stands including high elevation moist conditions not subject to frequent fire intervals. From field surveys, NEDC has discovered that there is actually a low level of fuel loading in many Deep planning area units.*

Response: The proposed levels of prescribed fire are based on analysis of watershed conditions which is disclosed in the DSEIS Chapter 3 displaying the current conditions of the analysis area. The levels of natural fuels reduction proposed with fire treatments consider numerous conditions including fuel accumulation and stand structure (fine fuels, multi-story canopy conditions and tree crown arraignment). Historical fire regimes are disclosed and described (pages 3-29 through pages 3-37) for this landscape. Figure 3-6 shows that the dominant fire regime was the Non-lethal, low intensity fire that had a frequent return interval of less than 25 years (page 3-29 and Table 3-12). Levels of burning proposed are commensurate with returning this watershed to historic fuel conditions. Burning is proposed to start the process of incrementally reducing current fuels levels to return to levels that sustain Non-leathal, low intensity fires.

3.6 Comment: *There is no burn proposal for the Deep planning area. A fire proposal or burn plan is an integral part of the purpose and need of the proposed project, and without one, it is impossible to determine whether the prescriptions are appropriate for each treatment unit.*

Response: A burn plan is required to be written prior to ignition of prescribed fire. Following this requirement is consistent with the Air Quality Policy on Wildland and Prescribed fires. Refer to Appendix E of the FSEIS.

3.7 Comment: *The Forest Service has not had a positive record of being able to set and control prescribed burns, especially in dry climates like the Deep planning area. Thus, considering this and that there is no site-specific description and analysis, NEPA is violated because the decision maker is denied information necessary to make a reasoned decision regarding the project. Until these deficiencies are cured, the DSFEIS is inadequate and must be revised or withdrawn.*

Response: Refer to Appendix E for information on effects of proposed fuel treatments. The Appendix includes a unit-by-unit description of the prescribed fire objective and the expected effects. This analysis is summarized in Chapter 4, pages 4-29 through 4-33.

3.8 Comment: *The Deep Vegetative Management Project is unnecessary to reduce fuel loading in the planning area.*

Response: The Purpose and Need section in Chapter 1 identifies the need to reduce the forest's susceptibility to moderate and high severity fires and bring the area's fuels closer to levels expected under natural fire disturbance regimes. The project was developed to meet this and the other needs identified. Pages 3-29 through 3-35 describe the existing conditions of fuels and fire hazard in the planning area.

3.9 Comment: *The project area has been severely damaged by the combination of past logging and grazing to the point where it would not be possible to return it to its historic forest conditions due to the present soil conditions. The fire pattern has been irreversibly affected due to the complete destruction of the soils by grazing.*

Response: The current condition of fuel levels, fire regime, and soils are described in the FSEIS, Chapter 3. The combination of past logging, grazing, and fire suppression have contributed to the current condition of soils (page 3-46). Although the Forest Service is not fully restoring the entire project area with this project, we are returning much of the area to a sustainable historic range in terms of vegetation seral and structural state. It is recognized that there are other needs and opportunities in the rehabilitation of streamways.

3.10 Comment: *Most of the rocky areas will no longer support fires because there is little fuel* *remaining. The grasslands have been replaced by rocks and sagebrush and still the grazing continues even though the destruction has been completed and it will support few cows. The grazing damage in forested drainages is must more severe than would be expected if it were treated on a cow per acre basis. Little forage remains for wildlife and few mammals inhabit the area that at one time must have been rich in fauna diversity.*

Response: Most of the current scablands were present for thousands of years. These substrates are currently quite well armored with rock and erosion pavement. The lichen lines on the rocks serve as a good indicator that these soils are currently stable. Fred Hall, former USFS ecologist emeritus, has been monitoring these sites for more than 45 years and has found these sites to have exhibited very little change in vegetative composition and in surface characteristics. My opinion (Jim David, ONF Forest Soil Scientist) is that these sites were relict features from the Altathermal period (4 to 8 thousand years ago) of the recent Holocene (last 10,000 years) period. The relatively recent volcanic ash from the Mount Mazama eruption (6700 years ago) was eroded by wind and water from these substrates long before the advent of modern grazing.

Grazing impacts on scablands are very minimal due to the normally dry grazing season, the rocky nature of the scabland soils and the paucity of desirable grass species on the scabs.

Yes, it is recognized that cattle impacts are often concentrated in the bottoms of timbered stringers and in meadows along the stringers. The USFS has been actively treating these problem areas (such as Timothy Meadows and Derr Meadows) with fencing and/or stream structures.

This comment assumes that grasses comprise the total forage base for wildlife species. In fact, grasses could only potentially be a forage base for herbivores and even within the herbivore group, a wide variety of plant materials such as browse (shrubs), seeds and forbs (weeds) provide forage. While it is possible that the mix of species of animals inhabiting the Deep sale area have changed because of domestic livestock grazing, saying few mammals are present is not accurate.

3.11 Comment: *An objective study of the area will show that due to past management practices it is rapidly evolving to a sagebrush steppe desert. There is no hope of restoring the Deep sale area without eliminating grazing and giving the area a prolonged rest as part of an overall plan. I see no evidence of such a plan or any meaningful plan for a partial recovery. Your logging plans seem to confirm that you have "written off" this area and only desire to salvage the remaining resources before this evolution is completed.*

Response: The areas that are classified as shrub steppe vegetation in the Deep sale area are that way because of extremely shallow soils with poor water holding capability. Although management practices can have effects on changing the ability of some areas, there is no way that past management created the scablands where shrub steppe vegetation exists today. That is a function of past geological events.

See the response to 3.10 describing the scablands.

3.12 Comment: *Encroaching conifers around meadows could be a sign of a lowered water table and fire suppression, neither of which is addressed by cutting conifers, unless you are going to burn and use them as biomass, in which case the meadows should be rested before and after burning.*

Response: The FSEIS describes the current condition of the meadows in the project area. Channel incision caused from a lack of vegetative stability (primarily from road crossing and grazing) has contributed to the lowered water tables (page 4-5). Conifer encroachment further contributes to lowered water tables. The combination of conifer encroachment and channel incision has led to the loss of understory riparian/wetland species such as rushes, grasses, and sedges (page 3-29). Removing the encroaching conifers by precommercially thinning is expected to increase understory riparian/wetland species. This should also increase bank stability where headcuts have not occurred (page 4-5).

3.13 Comment: *What we are looking for in restoration projects is not so much stand structure as ecological health and resiliency.*

Response: The HRV analysis conducted in the Deep watershed shows the distribution of seral and structural stages by plant association group. This information is summarized on pages 3-14 to 3-17 of the FSEIS. The 70% of the structural conditions and 72% of the seral conditions are outside their historic ranges. This deviation is the result of stand development continuing in the absence of fire, the primary historic disturbance within this watershed. Treatments are designed to move stands closer to within their HRVs, which will improve the forest's resilience, reduce the risk of high severity wildfire, and improve overall forest health.

3.14 Comment: *One of your main management goals should be to reduce stand density to help improve overall forest health conditions.*

Response: The Purpose and Need section, pages 1-5 to 1-9, includes the reduction in stand density as an objective in the planning area to meet the need of developing single-strata LOS, reducing susceptibility to higher severity wildfires and insects and diseases, and promote landscape and provide long-term sustainable habitat for wildlife.

3.15 Comment: *You need to do more commercial thinning than proposed in either alternatives B or C. This is the most economical way to control stand density and reduce the ladder fuels. Mechanical treatment in reducing fuel loading is more effective than just broadcast burning. Fire is not real selective in what it takes out when conditions aren't just ideal.*

Response: The levels of commercial thinning proposed consider other resource objectives and attempt to balance competing needs for maintaining habitat and water quality.

3.16 Comment: *Burning should follow harvesting operations.*

Response: Burning is proposed to follow harvest activities. See Alternative Summaries pages 2-3, 2-13 and 2-25 and Table 2-1 on page 2-35.

3.17 Comment: *The EIS does not define the scale of the HRV assessment or the conclusions stated.*

Response: HRV assessment is discussed on pages 3-13 to 3-19. The assessment describes seral and structural diversity by plant association group at the watershed scale.

3.18 Comment: *Protect large trees and snags. Large trees are underrepresented in the landscape and must be protected by keeping workers a safe distance away.*

Response: No trees over 21" dbh are proposed to be harvested, except those identified by the Oregon OSHA as hazard trees. Snag levels are displayed in table 3-24, page 3-56. Page 2-39 includes measures to identify where snag patches occur to ensure safety and protect them from being felled.

3.19 Comment: *Because junipers have many unusual growth forms, the Forest Service should use diameter at knee height instead of breast height, but keep the same or smaller diameter limits.*

Response: One common method for characterizing juniper species diameters was diameter at one foot (12 inches) as used by International Paper Company. Since Forest Service personnel are used to measuring at DBH or Diameter at Breast Height (4.5 feet), we use that s a standardized measure.

3.20 Comment: *The DSEIS admits that fire exclusion and past high grading are to blame for high fire risks and also admits that opening the canopy will allow more brush to establish and the DSEIS fails to reconcile this with the purpose and need to address ladder fuels.*

Response: Most shrub species typically found in the forested plant associations identified in the analysis area are low shrubs such as grouse huckleberry and common snowberry and are generally not expected to be primary ladder fuels unless tree crowns are low to the ground. Small trees that reach heights where tree crowns interlock or are in close proximity in a vertical arraignment are considered a greater risk as a ladder fuel than the common shrubs found in this area.

3.21 Comment: *The DSEIS admits in the description of proposed treatments that only prescribed fire and jackpot burning will reduce the risk of high severity fire. All the logging prescriptions are presented in terms of forestry and logs, not fire/fuels.*

Response: Discussions of how logging prescriptions will reduce fuels and fire hazard are located on pages 4-23, 4-30 to 4-31. Commercial and precommercial thinning will reduce stand density and ladder fuels, thereby reducing the overall hazards of fire. Tree and crown density and continuity would be altered; therefore fire would not carry as rapidly through the stand. Post-harvest treatment of the activity fuels generated will reduce surface and ladder fuels.

3.22 Comment: *Commercial log volume is not a part of the purpose and need for this project and the purpose and need can be met without logging larger trees. The FS should have considered an alternative with a much smaller diameter limit.*

Response: Reference comments 1.9 and 2.1 above.

3.23 Comment: *The EIS does not disclose whether risk reduction on "high risk" areas is being accomplished through logging, prescribed fire, or other treatments.*

Response: The risk of insect and disease related mortality, as described on page 3-25 is based on stand density. High risk stands are in the upper third of site potential. Reduction of stand density is accomplished through intermediate stand treatments such as commercial thinning and improvement cutting.

3.24 Comment: *The intermediate treatments (thinning and improvement cuts) justify the removal of ladder fuels but not the removal of larger trees that are part of the higher canopy.*

Response: Understory thinning of small diameter trees would only partially modify the stand conditions in high priority stands most in need of treatment. To create conditions for increased tree growth over sustained periods and promote additional LOS development, overstocking of trees that are greater than 7” dbh needs to be addressed. Also, by only thinning small trees, would not address the need to reduce the risk of insect and disease impacts.

3.25 Comment: *Regen harvest is proposed in order to deal with various tree disease issues. The EIS does not explain that sick trees are part of healthy forests and that the small scale of the proposed regen is a strong indication that the tree diseases are well within the HRV for a planning area of this scale. Please drop all regen units and accept the small patches of disease as good for the forest.*

Response: The small scale of the proposed regeneration treatments are not indicative of forest health conditions. The scale proposed is based on the IDT’s balancing of multiple resource objectives.

3.26 Comment: *The invasive weed sites in the analysis area and along all log and gravel haul routes should be fully inventoried and documented as part of the NEPA process for this project. In the absence of valid and complete weed survey information, harvest and road and fuel treatment activities planned as part of this project might exacerbate the problem instead of contain it.*

Response: **I**nformation on existing weed sites is located on page 3-39 of the FSEIS. Mitigation measures are in place to prevent the introduction and spread of noxious weeds.

3.27 Comment: *Late LOS dry Grand fir is outside HRV, and the majority of the proposed harvest is in dry grand fir type, yet the DEIS does not say if any of this late LOS type is being cut.*

Response: Table 4-6, page 4-20 displays the amount of vegetation treatments proposed in LOS stands of the dry grand fir associations for each alternative. Late seral species will be removed, and more fire-resistant species such as western larch and ponderosa pine will be favored. No trees over 21” will be removed, except to meet OSHA safety standards. The intermediate treatments would increase the proportion of early seral species and reduce stand densities without reducing the number of large trees.

3.28 Comment: *Artificial conversion of naturally occurring mixed conifer multi-layer stands to single layer single canopy stands mimicking “open park-like” ponderosa pine stands will result in loss of native biodiversity in return for a lowering of potential fuel for fire and forage for insects.*

Response: **I**ncreasing the amount of single-strata LOS stands and improving the development of more LOS will move the watershed closer to historic conditions as well as reducing the risk of loss from insects and high severity fire. The FSEIS describes expected changes in vegetation diversity expected impacts to wildlife.

3.29 Comment: *At these higher moister elevations there is less chance of naturally occurring fire and the insects occur only at naturally low endemic levels in apart or all of the planning area.*

Response: Annual precipitation within the planning area is 17 – 25 inches. The highest elevation is 6,314 feet abs and receives a relatively low 25 inches of precipitation annually, mostly in the form of snow between October and March. The planning area is affected by a rain shadow generated from the Cascade Mountains. Strong influences of a dry continental climate contribute to limited moisture, especially during summer months. Summers typically have long and warm droughty periods during the growing season, and the vegetation found in the upper elevations of the analysis area reflect this dry moisture regime.

The drier plant associations, described on page 3-7, reflect the relatively dry climate that influences the area. The low moisture gradient and frequent fire disturbances common to this watershed have strongly influenced past stand development and the VEMG recognizes that historically, single stratum stand structures were very common.

When stands are at higher densities, the insects have a greater potential to create disturbances. In the Dry Grand Fir plant association (42% of the planning area), as stand densities increase, western pine beetles will become more important in removing large pines in the overstory and the Douglas-fir beetle would remove the largest Douglas-fir from the overstory (page 3-9).

3.30 Comment: *While the DSEIS does discuss some of the cumulative and direct effects from the proposed burning and other burning projects in the area, it does not analyze the impacts to soil, water quality, and wildlife as a result of burning a large portion of the watershed. The FS did not assess the cumulative impacts to wildlife such as denning mammals, plants, amphibians, and birds among others. Neither did the FS discuss impacts to seed propagation, soils, and aquatic resources from burning in and around the Deep planning area.*

Response: The effects of prescribed burning to those resources are described in Chapter 4. On page 4-6, find the expected effects of prescribed fire to water quality; on pages 4-44 to 4-46, 4-50 to 4-53 find the effects of prescribed burning on the soil resource; and throughout pages 4-73 to4-81 are the effects to wildlife habitat. Cumulative effects are analyzed under each resource.

4. Water Quality & Fish Habitat

4.1 Comment: *Removal of commercial logs would reduce the already sparse shading in the forested areas and stream banks increasing evaporation and further damage and possibly eliminate streams.*

Response: There are 24 acres of RHCA commercial treatment proposed under Alternatives B and C. This is approximately 0.03% of the watershed's RHCAs. Watershed/Fisheries design elements have been established to mitigate any adverse effects due to loss of shade (pages 2-45, 2-46). Under Alt. B there is one RHCA unit (#189) that would have harvest along a Class III stream, however there would be a "no-touch" buffer of 100 feet to ensure no measurable adverse effects to shade. All other RHCA commercial harvest treatments, under Alternatives B and C, would occur in class IV ephemeral channels and would have a 20-foot buffer. There is no commercial harvest in RHCAs proposed for Alt. D. RHCA treatments are intended to increase individual tree growth and promote the development of larger trees. Harvest in RHCAs would promote Riparian Management Objectives, and would decrease the risk of adverse effects to aquatics due to wildfire and/or disease within RHCAs. There would be no measurable increase in stream temperature due to decreased shade in perennial systems.

4.2 Comment: *The proposed action presents a risk of fish habitat degradation.*

Response: As stated on page 4-11 of the FSEIS, of the action alternatives, Alternative B does pose the highest risk to fish and aquatic habitats between 2004 and 2009. Alternatives C and D were designed to address the fish habitat and water quality issues.

4.3 Comment: *Chinook EFH was not considered or consulted on.*

Response: Page 4-57 explains that essential fish habitat for the Chinook salmon was not considered in the analysis because of natural migration barriers at the lower and upper falls on the North Fork Crooked River and downstream blockage by dam.

4.4 Comment: *The DSEIS fails to acknowledge any impacts to redband trout.*

Response: Effects to redband trout are displayed in table 4-25 of the FSEIS and discussed on pages 4-58 to 4-59.

4.5 Comment: *Due to sensitive soils and rocky lands where tree growth is impossible, logging could seriously disrupt hydrologic flows, impeding reserve capacity for holding water in duff and soils for the rainless periods of summer through removal of moisture-retaining tree cover, creating hotter drier micro-climate conditions and higher peak overland flows that can cause increased erosion and sedimentation of streams.*

Response: The risk of effects from increased peak flows due to timber harvest activities within the watershed are discussed on pages 4-1, 4-2, 4-8, 4-9, and 4-10 of the FSEIS. The Equivalent Harvest Area (EHA) Model was used to evaluate the effects of harvest on the hydrologic cycle. Research by Hibbert (1965), Troendle and Olson (1993), Troendle and King (1985, 1987), and Troendle (1983) found that there is no one specific threshold as to how much a watershed can be harvested before a change in peak flow can be documented. EHA thresholds, in relation to changes in peak flow, have been documented from 20% to 40%. However, this threshold is highly dependant upon the physical characteristics of the watershed. Forest Plan Standard is 25% for this watershed. The Relative Erosion Rate (RER) Model displays the risk of erosion due to harvest on pages 4-1, 4-2, 4-7, and 4-8 of the FSEIS. Watershed/Fisheries/Soils Design elements have been established to mitigate possible effects due to erosion and sedimentation (FSEIS pages 2-43 through 2-48).

4.6 Comment: *In the case of heavier cutting (such as the 132 acres of "clearcuts with reserves", "group selection" and "shelterwood"), streams could drop underground altogether with lowered water tables and cease to be available to fish and wildlife, as already seen in old clearcuts in the Deep planning area, where streams shown on the map have dried up.*

Response: All harvest activities and their effects on water yield have been discussed on pages 4-1, 4-2, 4-8, 4-9, and 4-10 of the FSEIS. RHCA buffers would be implied in all of the "clearcut with reserves", "group selection", and "shelterwood" treatments. These treatments would decrease tree evapotranspiration and potentially make more water available for ground water storage. RHCA buffers would maintain the wet line influence of the stream and riparian vegetation. Water tables are not expected to drop as a result of these harvest activities.

4.7 Comment: *Planned riparian area logging is euphemistically presented as enhancing future streamside shading (though it actually would remove existing shading and raise water temperatures now, threatening fish survival) and includes marking of mature and young live trees to cut all along streambanks and right up to stream edges (some trees marked to cut* *actually have roots in the stream channel). Logging these streamside trees would inevitably de-stabilize streambanks and increase sedimentation in streams.*

Response: There are 24 acres of RHCA commercial treatment proposed under Alternatives B and C. This is approximately 0.03% of the watersheds RHCAs. There is no commercial harvest in RHCAs proposed for Alternative D. There would be no more than 6% of RHCA areas precommercial thinned under all alternatives. Watershed/Fisheries design elements have been established to mitigate any adverse effects due to loss of shade (pg 2-45, 2-46). Under Alternative B there is one RHCA unit (#189) that would have commercial harvest along a Class III stream, however there would be a "no-touch" buffer of 100 ft to ensure no measurable adverse effects to shade. All other RHCA commercial harvest treatments, under Alternatives B and C, would occur in Class IV ephemeral channels and would have a 15ft buffer. All precommercial thin units would maintain a 15ft buffer and would be thinned from below so that the dominant seedlings or saplings would be left. The smaller trees cut would not be of a size capable of casting shade on the stream. RHCA treatments are designed and intended to increase individual tree growth and promote the development of larger trees. Harvest in RHCAs would promote Riparian Management Objectives, and would decrease the risk of adverse effects to aquatics due to wildfire and/or disease within RHCAs. There would be no measurable reduction in stream shade along perennial systems.

Design elements and Best Management Practices are in place to avoid de-stabilizing stream banks and causing sedimentation (refer to Chapter 2).

4.8 Comment: *Further management in riparian habitat conservation areas is ill conceived. The DSEIS itself states that fires are not completely controllable and that negative effects from alternative B are high, and are lower, but still existing under alternatives C and D.*

Response: The expected impacts to water quality and fish habitat are described in Chapter 4, pages 4-2 to 4-7. All management treatments within RHCAs will reduce the risk of losing stands due to disease and wildfire. Watershed/Fisheries design elements have been established to mitigate potential adverse effects to aquatics (pg 2-43 through 2-46). Prescribed fire will be allowed to back into RHCAs and are intended to leave a mosaic burn pattern. Prescribed fire will be monitored and if desired objectives are not being met, then suppression would occur (i.e. if large trees are have long residence burning times around the trunks, or if high severity burns are occurring along the waters edge in willow and alder stands then suppression would occur). Prescribed burning within RHCAs will reduce the risk of disease and wildfire by naturally thinning some of the small trees and ladder fuels.

The FSEIS states that the ***potential*** for negative effects are higher under Alternative B and the lowest potential for negative effects exists with Alternative C. These effects are potential impacts. The management actions proposed within RHCAs are intended to improve aquatic conditions.

4.9 Comment: *The Clean Water Act does not permit "short term" degradations of water quality, and that any project that proposes such degradations is unlawful. The DSEIS states that the greatest concern for increasing stream temperatures comes from prescribed fire activities in RHCAs. We are pleased to see that alternative C and D reduce the amount of burning in RHCAs, but we feel that it is imperative that these areas be left in their already degraded state to recover naturally. Burning will only serve to further hinder the already degraded functions of this area.*

Response: See response to comments 4.7 and 4.8. Currently, there are ten streams within the planning area that do not meet State Standards, hence these are in violation of the Clean Water Act. Riparian buffers have been established for all treatments (except Aspen treatments) to protect from stream degradation. Design elements have been established to mitigate potential effects. Prescribed fire will be monitored and if desired objectives are not being met, then suppression would occur (i.e. if large trees are have long residence burning times around the trunks, or if high severity burns are occurring along the waters edge in willow and alder stands then suppression would occur). Prescribed burning within RHCAs will reduce the risk of disease and wildfire by naturally thinning some of the small trees and ladder fuels.

4.10 Comment: *RHCAs do not need further disruption from Forest Service management. The Forest Service is proposing to fix previous poor management practices that have degraded the area by using new questionable management practices. NEDC urges the Forest Service to remove all logging from the RHCAs in the Deep planning area in order to let them recover and reach a state of balance.*

Response: See response to comments 4.1, 4.6, 4.7, 4.8, and 4.9. The FSEIS discusses design criteria and Best Management Practices that are intended to address fish and water quality issues. One significant difference from past practices is the establishment of Riparian Habitat Conservation Areas (RHCAs). Vegetation treatments are proposed within these zones only where Riparian Management Objectives are met. Timber sale units, logging systems, prescribed fire units, and pre-commercial thinning units were all designed to decrease the likelihood of negative cumulative impacts to water quality. This project also proposes riparian planting, large woody material placement, dispersed campsite rehabilitation, culvert replacements, and road closures that would assist in watershed recovery.

4.11 Comment: *The DSFEIS inadequately analyzes impacts to aquatic systems. The analysis of existing conditions of the creeks and rivers in the planning area is not based on high quality science, fails to adequately describe the current conditions of these aquatic systems, and does not accurately represent the impacts on these systems from the proposed alternatives. The DSEIS acknowledges that the water quality, quantity, and timing within the watershed have been altered, and that the alternatives may adversely impact water quality.*

Response: The existing conditions for water quality and fish habitat are found on pages 3-1 to 3-6 of the FSEIS. These conditions are summarized from standard Forest Service surveys and procedures, as well as personal observations. The potential effects of all alternatives are found in Chapter 4 (pages 4-1 to 4-12 of the FSEIS). There is some risk associated with all treatments, however the detrimental aquatic effects due to a catastrophic wildfire or disease would be much worse. The designed treatments would minimize these risks and would retain RHCA buffers and design elements to mitigate potential effects.

4.12 Comment: *Stream temperatures preclude additional management in the planning area. The DSEIS states that the Forest Service standard of greater than 80% surface shade is not being met in 94 percent of the planning area. Even though 303(d) listed streams lack adequate stream shade, commercial and precommercial thinning, prescribed fire and aspen treatments are expected to remove additional shade from Class I, II, and III streams. NEDC questions the reasonableness of creating a plan that would remove any canopy cover from streams in the planning area. Moreover, since many of the streams in the planning area are already listed for temperature under the CWA, any additional increase in temperature violates that Act. How will the Forest Service comply with state water quality standards, required by a number of different statues and case law, under these conditions?*

Response: See response to comments 4.1, 4.7, 4.9, 4.10. There are no expected measurable changes in perennial stream temperatures under all alternatives. The Deep WQRP outlines a plan to improve watershed health and meet state water quality standards.

The 80% shade Forest Standard may not be attainable in many streams within this watershed due to past management activities and different site conditions. This, along with site potential tree heights (based on stream type) are discussed within the Deep WQRP (Appendix D).

4.13 Comment: *The creation of a Water Quality Restoration Plan (WQRP) does not meet the Forest Service's burden to create a Total Maximum Daily Load (TMDL) in order to protect degraded waterbodies. While a WQRP may have aspects of a TMDL and may actually contain TMDLs, the proposed WQRP for the Deep project fails to meet the requirements for a TMDL. As a result, NEDC feels that the Forest Service must withdraw the project until an adequate TMDL can be created for the watershed.*

Response: It is recommended that WQRPs be completed prior to the development of State TMDLs, however it is not regulation. In this case, the Paulina Ranger District has created a WQRP (Appendix D) to assist Oregon Dept. of Environmental Quality (ODEQ) in the development of TMDLs, scheduled to occur in 2004 for the Upper Crooked Sub-basin. This WQRP has been approved by ODEQ and is the current plan for moving toward attainment of state water quality standards. The WQRP is intended to help reduce summer stream temperatures and achieve compliance with water quality standards by identifying the reasons why streams

4.14 Comment: *Sedimentation and peak flows will increase as a result of the Deep Vegetation Management Project. NEDC is concerned about the effects of sedimentation and peak flows will have on fish habitat and water quality.*

Response: The potential for sedimentation is discussed on page 4-7 and changes in peak flows as the result of implementing the alternatives are discussed on page 4-9. See also response to comments 4.5 and 4.7.

4.15 Comment: *How will the project meet state water quality standards when increases in livestock use will increase the level of sedimentation to already-degraded water bodies?*

Response: The Deep Creek Water Quality Restoration Plan provides a framework (including grazing) for watershed enhancement and achieving compliance with water quality standards. Current efforts to address grazing management are discussed on page 1-11 of the FSEIS. Allotment Management Plan (AMP) updates are scheduled to occur within the next 1-2 years.

4.16 Comment: *The Forest Service has incorrectly assessed the effects from peak flows. The Forest Service notes that peak flows may increase, but has not identified any impacts on water quality and wildlife habitat from these increases.*

Response: Increased peak flows may impact fish and aquatic habitats. The discussion is located in the FSEIS at 4-8 to 4-10.

4.17 Comment: *We suggest that the Forest Service develop an adequate baseline for peak flows by conducting an adequate monitoring plan at the planning area level.*

Response: The Paulina Ranger District is currently involved in monitoring peak flows throughout the district. This data will allow the Forest Service to perform flood frequency analyses on a localized scale. As a current surrogate, EHA is the Forest Plan standard to estimating detrimental impacts from peak flows.

4.18 Comment: *The Forest Service should use a more accurate model than the equivalent harvest model used in the DSEIS. This model is flawed because it does not look at the direct effects of peak flow increases, as required by NEPA.*

Response: The Equivalent Harvest Area (EHA) model is required by the Ochoco National Forest Land and Resource Management Plan. It is used to estimate the relative cumulative effects of timber harvest activities and forest vegetative conditions within the watershed. The Forest Plan has established threshold values for each watershed on the Forest (Forest Plan page 4-35 and 4-208). Values above the established threshold levels indicate that there may be direct and indirect effects from increased peak flows. As discussed in the Deep FSEIS, the EHA threshold value for the Deep watershed is 25%. However, based on the existing condition of the watershed and research by Hibbert (1965), the Alternatives were also evaluated against a more conservative value of 20%. The analysis concluded that all Alternatives would remain below the Forest Plan's threshold of 25%, but that Alternative B would exceed the 20% figure for 6 years. Alternative C was designed so that the timing of timber sales would better address the risk from increased peak flows, thus keeping EHA values below 20%. Alternative D remains below the threshold of 20% as well. The direct effects of increased peak flows are described on pages 4-8 through 4-10.

4.19 Comment: *The data presented in the cumulative effects section on water quality has not been incorporated into the proposed actions. The Forest Service must withdraw this project until the plan does not propose to violate state water quality standards by further degrading water quality.*

Response: The water quality cumulative effects discussion includes all past and present actions. Reasonably foreseeable actions are on page 4-55 of the FSEIS. State water quality standards would not be expected to further degrade with the incorporation of this plan. This plan is consistent with the Deep WQRP, which was approved by Oregon Department of Environmental Quality in an effort to achieve compliance with water quality standards. See response to comments 4.1, 4.7, 4.9, 4.10, and 4.13.

4.20 Comment: *While the DSEIS states that a restoration and range EAs will be prepared in the future and will analyze the effects of grazing management, this is not adequate, as the courts have repeatedly stated that cumulative effects analysis cannot be postponed. The law requires agencies to address the impacts of a project and the effects of past, present, and reasonably foreseeable future projects in a single environmental document.*

Response: The effects of past and current grazing regimes are taken into account in the cumulative effects analysis throughout Chapter 4 of the FSEIS. This plan considers the effects of ongoing grazing, however does not incorporate modifications of grazing regimes for several reasons (page 1-11 of the FSEIS). In formulating the decision on this vegetation management project, consideration will be given to the cumulative effects of current grazing schemes, the effect that grazing may have on the success of treatments identified in the alternatives, and how well an alternative meets the purpose and need objectives. In addition, the Deep WQRP provides a framework (including grazing) for watershed enhancement and achieving compliance with water quality standards. Allotment Management Plan (AMP) updates are scheduled to occur within the next 1-2 years.

4.21 Comment: *I am nervous about the achievement of an INFISH standard through the mechanical placement of large wood (or other artificial engineering solutions). Men have been* *trying to imitate beaver for several decades now with weirs, check dams, and gabions and they mostly failed because they address symptoms not causes. While pools might be created, cooler water temperatures and the restoration of vegetation diversity won't likely happen.*

Response: The placement of large wood would be designed to improve fish habitat and water quality by increasing the frequency of pools and cover, improving width to depth ratios by stabilizing stream banks, providing roughness, and increasing shade. Cooler water temperatures may not be measurable, however shaded cover will be provided for fisheries. The placement of large wood would target both the symptoms and causes of stream degradation and lack of large wood. Adding large wood along streams and floodplains will provide roughness to capture the fine sediment and seed source necessary to promote the development of vegetation diversity.

4.22 Comment: *Past hardwood planting has achieved limited success. Even the caging of naturally occurring hardwoods and shrubs is dubious and the Grant County Conservationists oppose this practice on the grounds that it is proof that you have a management activity out of control. Shrub response can be achieved by removing livestock and allowing continued presence of wild ungulates.*

Response: See response to comment 4.20 regarding grazing.

4.23 Comment: *The thinning of trees in RHCAs to create future large woody material seems the flimsiest of fantasies. Can you provide us with some proof that this works? An earlier document apparently states that shade is not met in 94% of the area. Yet one goal is to release deciduous trees from shade. Until we know these deciduous trees are going to e able to thrive naturally (and not in a cage) this activity also seems suspect.*

Response: Thinning of trees within RHCAs would only occur outside the "no touch" buffers, as established in design elements. See response to comment 4.1, 4.7, 4.8, 4.10, and 4.12. Thinning outside these "no touch" zones will promote large tree growth. Over a period of many years it would be expected that these large trees might be tall enough to fall into the influence of the stream and become large wood. Class I, II, and III streams all have "no touch" buffers of 100ft, so trees would need to be approximately 100 ft tall to become large wood. Without some treatment in these areas, there is risk of losing the stand to wildfire and/or disease.

There are a total of 23 acres of Aspen treatment within Class III streams (perennial, non-fish bearing). This is approximately 0.03% of the watersheds RHCAs. All other treatments lie within streams that are intermittent and ephemeral. It has been observed on the Paulina Ranger District, that this type of treatment has allowed aspen to thrive and release their clones much better. There would be no measurable increase in stream temperature due to this treatment in perennial systems.

The 80% shade Forest Standard may not be attainable in many streams within this watershed due to past management activities and different site conditions. This, along with site potential tree heights and potential shade (based on stream type) are discussed within the Deep WQRP (Appendix D). See also response to comment 4.12.

4.24 Comment: *A plan for beaver habitat restoration should be included in any restoration project.*

Response: The Paulina Ranger District is known to have a population of beaver that are doing quite well. However, many of the stream systems have changed dramatically from the time beaver were thriving in this area. The District has not yet analyzed the effects of the reintroduction of beaver on a large scale.

4.25 Comment: *Creating hotter drier micro-climate conditions that cause erosion and sedimentation of streams – leading to streams dropping underground-thereby being unavailable to fish and wildlife as evidenced by old clear cut areas where streams have dried up.*

Response: The Relative Erosion Rate (RER) Model displays the risk of erosion due to harvest on pages 4-1, 4-2, 4-7, and 4-8 of the FSEIS. Watershed/Fisheries/Soils Design elements have been established to prevent possible effects due to erosion and sedimentation (FSEIS pages 2-43 through 2-48).

All harvest activities and their effects on water yield have been discussed on pages 4-1, 4-2, 4-8, 4-9, and 4-10 of the FSEIS. RHCA buffers would be implied in all of the treatments (except aspen). These treatments would decrease tree evapotranspiration and potentially make more water available for ground water storage. RHCA buffers would maintain the wet line influence of the stream and riparian vegetation. Water tables are not expected to drop as a result of these harvest activities. See also the response to comments 4.1, 4.5, and 4.6.

4.26 Comment*: Logging would vastly disrupt hydrologic flows. Riparian areas are already so fragile and isolated that logging would most likely remove moisture retaining tree cover, and increase erosion and sedimentation into streams, among other things.*

Response: All harvest activities and their effects on water yield have been discussed on pages 4-1, 4-2, 4-8, 4-9, and 4-10 of the FSEIS. RHCA buffers would be implied in all of the treatments (except aspen). These treatments would decrease tree evapotranspiration and potentially make more water available for ground water storage. RHCA buffers would maintain the wet line influence of the stream and riparian vegetation. Water tables are not expected to drop as a result of these harvest activities. See also the response to comments 4.1, 4.5, and 4.6.

The Relative Erosion Rate (RER) Model displays the risk of erosion due to harvest on pages 4-1, 4-2, 4-7, and 4-8 of the FSEIS. Watershed/Fisheries/Soils Design elements have been established to mitigate possible effects due to erosion and sedimentation (FSEIS pages 2-43 through 2-48).

4.27 Comment: *The EIS contains no real discussion of the water quality effects of new road construction. More harvest and road construction will make water-quality limited streams worse, in violation of the Clean Water Act.*

Response: Effects to water quality from road construction, road closures, and culvert replacements are discussed on page 4-4 of the FSEIS, while the effects of harvest begin on page 4-6. The primary concern from road construction would be the potential for sedimentation. Design elements and Best Management Practices have been established to prevent possible adverse effects. At this time, no streams within the Deep watershed are on the State's 303(d) list for sedimentation or turbidity.

4.28 Comment: *A TMDL/water quality management plan should precede further actions that could increase stream temperature, nutrients, or sediment.*

Response: It is recommended that WQRPs be completed prior to the development of State TMDLs, however it is not regulation. In this case, the Paulina Ranger District has created a WQRP (Appendix D) to assist Oregon Dept. of Environmental Quality (ODEQ) in the development of TMDLs, scheduled to occur in 2004 for the Upper Crooked Sub-basin. This WQRP has been approved by ODEQ and is the current plan for moving toward attainment of state water quality standards. The WQRP is intended to help reduce summer stream temperatures and achieve compliance with water quality standards by identifying the reasons streams do not meet the standard and also identifying recovery goals and objectives.

4.29 Comment: *The NEPA analysis must address the cumulative effects of logging and grazing on water quality and discuss the fact that further grazing will retard the attainment of riparian and aquatic management objectives in violation of the applicable land management plan as amended.*

Response: The effects of past and current grazing regimes are taken into account in the cumulative effects analysis throughout Chapter 4 of the FSEIS. Cumulative effects to water quality from grazing and harvest begin on page 4-10. Harvest cumulative effects are partially addressed with the EHA model. The FSEIS considers the effects of ongoing grazing, however does not incorporate modifications of grazing regimes for several reasons (page 1-11 of the FSEIS). In formulating the decision on this vegetation management project, consideration will be given to the cumulative effects of current grazing schemes, the effect that grazing may have on the success of treatments identified in the alternatives, and how well an alternative meets the purpose and need objectives. In addition, the Deep WQRP provides a framework (including grazing) for watershed enhancement and achieving compliance with water quality standards. Allotment Management Plan (AMP) updates are scheduled to occur within the next 1-2 years.

4.30 Comment: *Livestock impacts need to be analyzed and livestock control actions must be incorporated within this EIS, since there is inadequate streamside vegetation. Replanting native riparian plants is essential to accomplish restoration of this area, as is control of livestock use to prevent further stream-bank instability. The EIS fails to address or act to control livestock use as a cause of stream-bank instability and loss of stream shading.*

Response: The FSEIS considers the effects of ongoing grazing, however does not incorporate modifications of grazing regimes for several reasons (page 1-11 of the FSEIS). In formulating the decision on this vegetation management project, consideration will be given to the cumulative effects of current grazing schemes, the effect that grazing may have on the success of treatments identified in the alternatives, and how well an alternative meets the purpose and need objectives. In addition, the Deep WQRP provides a framework (including grazing) for watershed enhancement and achieving compliance with water quality standards. Allotment Management Plan (AMP) updates are scheduled to occur within the next 1-2 years.

Riparian planting is proposed in all action alternatives, and measures for protecting the plants from browsing will be undertaken. The current conditions within the watershed are ascribed to various activities including livestock grazing (see page 3-4). The management of livestock grazing is outside the scope of this project, except where control is required to protect riparian planting.

4.31 Comment: *Riparian conditions within the watershed need protection from logging, burning, and roading and livestock grazing impacts.*

Response: See response to comments 4.1, 4.6, 4.7, 4.8, 4.9, 4.10, 4.12, 4.23, 4.26, 4.27, 4.29, and 4.30.

4.32 Comment: *All action alternatives would reduce stream shading further with prescribed fire, aspen stand modifications and conifer thinning on 825 acres within or adjacent to RHCA buffers. Two of the three alternatives would also incorporate commercial logging within RHCAs.*

Response: Prescribed fires will be allowed to back into RHCAs and are intended to leave a mosaic burn pattern. In order to meet INFISH (1995) RMOs, the objectives of the Deep WQRP, and Forest Plan Standards and Guidelines, it may be necessary to extinguish fire where unexpected conditions are encountered. Activities that would warrant the suppression of fire include burning of large woody debris within the stream influence, burning of willow, alder, or other riparian hardwood species, and/or long residence burning times around the base of large shade-producing trees.

There are 24 acres of RHCA commercial treatment proposed under Alternatives B and C. This is approximately 0.03% of the watersheds RHCAs. Watershed/Fisheries design elements have been established to prevent any adverse effects due to loss of shade (pg 2-45, 2-46). Under Alternative B there is one RHCA unit (#189) that would have harvest along a Class III stream, however there would be a "no-touch" buffer of 100 ft to ensure no measurable adverse effects to shade. All other RHCA commercial harvest treatments, under Alternatives B and C, would occur in Class IV ephemeral channels and would have a 20ft buffer. There is no commercial harvest in RHCAs proposed for Alternative D. All precommercial thin units would maintain a 15ft buffer and would be thinned from below so that the dominant seedlings or saplings would be left. The smaller trees cut would not be of a size capable of casting shade on the stream. RHCA treatments are designed and intended to increase individual tree growth and promote the development of larger trees. Harvest in RHCAs would promote Riparian Management Objectives, and would decrease the risk of adverse effects to aquatics due to wildfire and/or disease within RHCAs. There would be no measurable reduction in stream shade along perennial systems.

There are a total of 23 acres of Aspen treatment within Class III streams (perennial, non-fish bearing). This is approximately 0.03% of the watersheds RHCAs. All other aspen treatments lie within streams that are intermittent and ephemeral. There are no expected measurable increases in stream temperatures from these activities.

5. <u>Wildlife Habitat</u>

5.1 Comment: *Species dependent on multi-layer old growth habitat that are using the area and would be threatened by this logging include: pileated woodpecker (seen, hear, or fresh foraging found in 21 sale units), northern goshawk (seen in 3 sale units, including one with a nest and fledgling nearby), black-backed woodpecker (seen in 3 units) and potentially lynx, neotropical migrant songbirds and pine marten, for which there is suitable habitat.*

Response: Effects to these species are discussed on 4-65 for lynx, 4-73 to 4-77 for goshawk, 4-79 to 4-81 for pileated woodpecker and 4-78 to 4-79 and 4-81 to 4-82 for the black-backed woodpecker. Effects of the action alternatives are discussed for neotropical migrant songbirds on 4-83 to 4-84. Pine marten effects are not discussed because the species is not present in the project area.

5.2 Comment: *With regards to "connectivity", we need to know what you are connecting, why and how (especially with regards to measuring effectiveness).*

Response: Connections were identified between designated old growth (1,267 acres) and all late and old-structured (LOS) stands (11,002 acres) that are greater than five acres in size. A connectivety network was established because the Regional Forester's Eastside Amendment #2 required this analysis. To meet this amendment, all LOS and old growth had to be connected by two or more corridors of trees at least 400 feet in width, greater than 9 inches DBH with a crown closure in the upper 2/3's of the site potential.

5.3 Comment: *There is little or no discussion of impacts on forest fragmentation, biological corridors, and dispersal of late successional species.*

Response: Fragmentation and corridors are discussed on page 4-77. Dispersal of many wildlife species is discussed throughout the T,E, and S and Wildlife section, through analyzing the quantity of different specie's habitats in relation to historic quantities. As habitats fall within historic quantities (HRV), dispersal requirements should be satisfied.

5.4 Comment: *Since population studies are lacking for the planning area, the Forest Service is precluded from determining that the project is not likely to adversely affect the listed species under section 7 of the ESA.*

Response: The Ochoco National Forest has consulted with both the National Marine Fisheries Service and the U.S. Fish and Wildlife Service on project design criteria (PDC) for all listed species in the project area. The regulatory agencies concurred with the Forest Service that if a particular project met the PDC for the listed species in the project area the project would "not likely adversely affect" the species. Deep projects meet the PDC for listed species within the project boundary.

5.5 Comment: *The cumulative effects analysis on wildlife and wildlife habitat is inadequate because it lacks any substantive discussion of cumulative effects. In discussing the cumulative effects to Northern goshawk, the DSEIS states that there were a number of projects that occurred in the past, but it did not go on to discuss how the Deep project was going to add to these impacts. This limited and cursory cumulative effects analysis does not meet the requirements laid out in NEPA regulations.*

Response: On page 4-77, the cumulative effects section states that the addition of Deep will maintain current goshawk populations since it will maintain a two decade trend in the amount of habitat that has had timber management projects placed in it.

5.6 Comment: *Snags should be carefully inventoried by species, size, decay status, quality, and location during project planning and treated as special habitats given special protection. The EIS does not adequately address the need to protect and provide snag habitat.*

Response: Extensive snag inventories were done in the Deep project area (3-55 to 3-58). The EIS looks at snag numbers present and in relation to management guidelines for snag retention and provides for the protection of ALL snags in the project area except those that are safety concerns.

5.7 Comment: *The snag retention requirements fail to retain enough snags to provide habitat for viable populations of cavity dependent species. Past surveys to determine snag abundance have underestimated and the Agency has underestimated the number of snags necessary to protect species. This new information must be disclosed and document and it requires a forest plan amendment.*

Response: No snags are being commercially harvested. Existing snags in the project area are being retained except for the occasional snag that is located next to where harvest operations will occur that poses a safety hazard.

5.8 Comment: *The agency must do away with the caveat that they will protect snags "except where they create a safety hazard." Save snags by keeping people out of the hazard zone around the snags.*

Response: The Forest Service must follow OSHA.

5.9 Comment: *The document must disclose how many large snags will be protected vs. felled for safety under the preferred alternative.*

Response: The number of snags on the landscape is dynamic with some trees dying every year and older snags decaying and either breaking or falling down. It is unknown at this time how many snags will exist at the time harvest activities begin and where all these snags will be located in relation to where harvest activities will occur. Snags considered a hazard by OSHA standards are identified at the time harvest activities begin.

5.10 Comment: *The document fails to disclose the effects of the project on the Canada lynx. The project relies on conservation measures in the LCAS to protect lynx without project specific design and analysis. The document relies on PDCs for lynx that have not been subject to NEPA review and comment. The FS cannot rely on these PDC until they have subjected the PDC and the LCAS to NEPA.*

Response: Refer to page 4-61 for the beginning of the Canada lynx discussion. Analysis of the project area, based on a scientific description of what constitutes sufficient habitat for Canada lynx, found no habitat within the Deep watershed. There also have been no occurrences of Canada lynx in the project area. The lack of habitat and the absence any occurrence of the species led to the determination that there would be "No Effect" to Canada lynx or its habitat as a result of the Deep project.

5.11 Comment: *The EIS makes a serious mistake by relying on the regional direction for lynx and completely dismissing the fact that lynx habitat exists on the forest, that the Ochoco NF is a critical migration corridor, and that this project could have adverse impacts on Threatened lynx. The EIS contains no project analysis and no NEPA analysis of project design criteria.*

Response: See response to Comment 5.10 above.

5.12 Comment*:* *The DEIS fails to disclose that Bull recommends 900 acres for pileated woodpeckers, while the forest plan only allocates 300 acre areas.*

Response: All alternatives propose to maintain far more pileated woodpecker habitat (16,231 to 16,775 acres) than that just provided by the allocated areas (1.267 acres). This acreage is far more than the 3,600 acres that Bull would recommend.

5.13 Comment: *The wolverine model fails to address road density and increased human activity represented by logging, grazing, and recreation.*

Response: These components are addressed in the effects section, pages 4-62 to 4-64.

5.14 Comment: *Goshawk PFAs are not meeting desired conditions yet 9 acres of medium/large sawtimber is being harvested in PFAs. These areas must be dropped.*

Response: The treatment has been designed by the project wildlife biologist and silviculturist and will maintain the desired stand structure while promoting a healthier stand condition. This treatment has been designed to benefit the goshawk PFA conditions (pages 4-73 and 4-74). Habitat for the goshawk is expected to increase with treatments (page 4-76).

5.15 Comment: *The DEIS does not provide sufficient cumulative analysis for the effects of this sale on numerous species known to inhabit this area including northern goshawk, Canada lynx, wolverine, redband trout, Columbia spotted frog, Malheur mottled sculpin, and Blue Mountain cryptochian.*

Response: On page 4-76 and 4-77 please find the goshawk cumulative effects. The Canada lynx is not present in the project area (page 4-64 and 4-66). The wolverine cumulative effects are displayed on pages 4-67 and 4-68. The Columbia spotted frog is not present in this analysis area (pages 4-61 and 4-66). The cumulative effects on redband trout, Malheur Mottled sculpin and Blue Mountain cryptochian are described on pages 4-60 through 4-63.

5.16 Comment: *All action alternatives propose to reduce the "big game" habitat effectiveness from 42% to 19% (as compared to the target HEI of 35%) under all action alternatives. This is an unacceptable decline in habitat effectiveness and is a step backward.*

Response: Big Game habitat effectiveness is discussed on page 4-79. The reduction of HEI to 20% is consistent with the Forest Plan. Short term HEI may be reduced in order to meet management area emphasis if long-term HEI values are achieved (LRMP 4-258).

6. <u>Soils</u>

6.1 Comment: *This area has been severely damaged by the combination of past logging and grazing to the point where it would not be possible to return it to its historic forest conditions due to the present soil conditions. The forested areas exist primarily in strips surrounding drainages and these are surrounded by rocky areas, most of which bear evidence of being overgrazed former grasslands.*

Response: It is possible to return the forested areas to the within the HRV in regards to seral and structural states over time.

Most of the current scablands were present for thousands of years. These substrates are currently quite well armored with rock and erosion pavement. The lichen lines on the rocks serve as a good indicator that these soils are currently stable. Fred Hall, former USFS ecologist emeritus, has been monitoring these sites for more than 45 years and has found these sites to have exhibited very little change in vegetative composition and in surface characteristics. My opinion (Jim David, ONF Forest Soil Scientist) is that these sites were relict features from the Altithermal period (4 to 8 thousand years ago) of the recent Holocene (last 10,000 years) period. The relatively recent volcanic ash from the Mount Mazama eruption (6700 years ago) was eroded by wind and water from these substrates long before the advent of modern grazing.

Grazing impacts on scablands are very minimal due to the normally dry grazing season, the rocky nature of the scabland soils and the paucity of desirable grass species on the scabs.

Yes, it is recognized that cattle impacts are often concentrated in the bottoms of timbered stringers and in meadows along the stringers. The USFS has been actively treating these problem areas (such as Timothy Meadows and Derr Meadows) with fencing and/or stream structures.

6.2 Comment: *The existing soil in the forested areas and draws is composed of a fragile layer of ash covering basalt. These soils are easily disturbed and compacted. They can in no way tolerate tractor logging and road building.*

Response: We recognize the sensitive nature of these soils and have made a unit-by-unit evaluation of these areas (see Appendix G). The activities proposed in this project have been designed to meet Regional Standards and Guidelines for soils (see page 4-48 FSEIS). The proposed activities are largely on *existing* skid trails, landings, and roads, and are not contributing to an overall net increase in detrimental soil conditions.

6.3 Comment: *The level of analysis on the impacts to soils is deficient. The DSFEIS does not adequately look at the direct, indirect, and cumulative effects on soil and soil productivity. There is no supporting data for the statement that management activities will have less of an effect on soil than a severe wildfire. The Forest Service does not look at the effects of their management activities.*

Response: Refer to Chapter 4 where soils impacts are discussed (starting on page 4-45). The direct, indirect, and cumulative effects of this proposal on soils are discussed in detail.

6.4 Comment: *The DSFEIS states that soil compaction will be mitigated through the use of skyline, helicopter, and winter logging, but the plan still proposes from 3 to 4 thousand acres of tractor logging.*

Response: Appendix G contains unit-specific recommendations for compaction issues. Skyline, helicopter, and winter logging were incorporated into the alternatives to address various resource concerns (road development, creek crossings, sensitive plants, soils, etc.). See Chapter 2 for these discussions.

6.5 Comment: *This project will violate NFMA because it will permanently impair the productivity of the area due to degradation of soil productivity, significant changes to watershed functions, the introduction of exotic weeds and the increase in the already high rates of erosion and sedimentation.*

Response: Soil productivity is addressed on pages 4-47, 4-53, 4-54, and 4-57. This project provides for buffering above and beyond the riparian buffers required by INFISH. Scabland/stringer upland buffers along the interfaces between these areas are included in the project mitigations (see page 2-48). The Soils Specialist Report states that infiltration buffering is needed along the scab/forest interface to mitigate alteration of sensitive hydrologic conditions. The recommended width of 50 to 66 feet in which the number of crossings, landings, and road impacts would be kept to a minimum is identified on page 2-48. It is recognized that there will be crossings and landings along this interface for practical logging operations to occur, however.

6.6 Comment: *The project area has been severely damaged by the combination of past logging and grazing to the point where it would not be possible to return it to its historic forest conditions due to the present soil conditions.*

Response: This project is intended to return the vegetative conditions to a more sustainable mix of structural and seral stages. The Forest Service is proposing to change vegetative conditions on many of the stands into those that can support ground fires and will not result in stand replacement fires.

6.7 Comment: *The existing soils are easily disturbed and compacted. They can in no way tolerate tractor logging and road building.*

Response: The various soil types are described in Chapter 3 of the FSEIS. Alternate logging systems are proposed in areas with resource concerns. See response to 6.5

6.8 Comment: *You have given too much attention to soil protection measures by proposing helicopter logging in areas than can be tractor logged or skyline logged. Helicopter logging is expensive and is overused in your proposed plans. Cheaper mitigation measures for improving soil conditions and winter logging activities should be given more consideration than what they have been given.*

Response: Helicopter logging is proposed primarily on steeper slopes where there is poor road access or where road construction would be expensive or difficult. Where helicopter logging is proposed on flatter ground, it is to address soil and watershed concerns (SFEIS page 4-48).

6.9 Comment: *Many of the existing harvest units are in violation of soil quality standards. The EIS proposed scarification as a mitigation, but the EIS contains no discussion of the environmental consequences of such scarification.*

Response: See FSEIS pages 2-46 and 2-47 and Appendix G. Effects of scarification, of "tillage", are included on pages 4-47, 4-48, and 4-49. The Soil Specialist Report includes a more detailed discussion of tillage

6.10 Comment: *Tractor logging will cause predictable soil compaction and erosion and disruption of mycorrhizal fungal communities, leading to declines in forest health*.

Response: See soils discussion pages 4-45 to 4-57 disclosing effects to soils from the proposed activities.

6.11 Comment: *The EIS does not do a unit-by-unit or acre by acre correlation between existing and expected soil impacts and the ability to mitigate those impacts. Mitigation should not be used as an excuse for violation of the regional soil guidelines.*

Response: Impacts from all project activities to soil components is described in detail, and a unit-by-unit determination of soil disturbance is provided in Appendix G. Mitigation measures outlined in Chapter 2 were included so that impacts could be reduced or avoided.

6.12 Comment: *Scarification, ripping, and subsoiling do not alleviate negative impacts (i.e. compaction, alteration of hydrology, alteration of plant communities, disruption of soil food web) there fore not completely mitigating.*

Response: These activities do vary in effectiveness but allow for continued production. Ground based harvest systems will generally result in some level of yield reduction.

6.13 Comment: *This project will cause unacceptable impacts to soil resources. The document needs to consider impacts and alternative ways to avoid them.*

Response: Chapter 4, pages 4-43 to 4-55, describe the effects to the soil resource from implementation of project alternatives. Impacts from all project activities to soil components is described in detail, and a unit-by-unit determination of soil disturbance is provided in Appendix G. Mitigation measures outlined in Chapter 2 were included so that impacts could be reduced or avoided.

6.14 Comment: *The existing level of soil disturbance has not been measured and disclosed in the NEPA document so the Agency cannot say with any factual basis whether forest plan standards will be met. This is arbitrary and capricious. Existing soil impacts must be measured and future impacts estimated so that an adequate cumulative effects analysis can be prepared and included in a supplemental EIS.*

Response: The existing soil conditions are discussed in Chapter 3 of the FSEIS as well as a unit-by-unit analysis in Appendix G. Reasons are discussed on page 4-50.

6.15 Comment: *The EIS failed to disclose the probable benefits of hydraulic lift whereby large trees with deep roots lift water and deliver it to the shallower soil profile. How will heavy thinning of larger trees affect this process and what are the implications for fire and fuels?*

Response: The East-side forests are moisture-limited systems in which the zone of effective moisture is often quite shallow. Thinning of trees in general will aid the remaining trees in overcoming this continued moisture deficit. If precipitation is less than potential evapotranspiration (PET), which is quite large in the southwest Blue Mountains, soil water storage is drawn down to meet water demand *as long as soil water is available*. After soil water is exhausted, unmet demand accrues as soil water deficit and actual evapotranspiration (AET) is less than potential evapotranspiration. This deficit in climatic moisture and high PET would make delivery of deep water to shallower soil profiles in this area highly unlikely

Intact big sagebrush plants are documented to provide surface water through hydraulic lift. Evidence suggests that this phenomenon occurs mainly at night and is driven by the water potential gradient existing between the upper and lower soil horizons (Richards and Caldwell 1987). Hydraulic lift has been documented in big sagebrush and maple. We are unaware of documentation in regards to conifer species.

7. <u>Cumulative Effects</u>

7.1 Comment: *The DSEIS Cumulative Effects Analysis is inadequate in its analysis of the impacts* *of the project. The cumulative effects analysis lacks a discussion of the impacts to wildlife habitat from vegetation management.*

Response: See pages 4-74 through 4-86 of the FSEIS.

7.2 Comment: *The analysis of the impacts from past management activities in the Deep Creek Watershed is inadequate. There is no one section in the DSEIS that addresses the impacts from past, present and future management activities. The discussion is piecemeal and does not satisfy the hard look at the cumulative environmental consequences as required by NEPA.*

Response: Past management activities are discussed under each resource area as appropriate to understanding cumulative effects on each of the key issues identified for this analysis. Not all past management activities have similar or the same measurable effects on all resources. The discussions are arraigned to track measurable effects by key issues.

7.3 Comment: *The DSEIS fails to assess the impacts of past, present and reasonably foreseeable timber sale projects in the planning area. For example, while the DSEIS states that there are other projects ongoing in the watershed, it fails to do any analysis on these major projects impacts to habitat fragmentation, species disturbance, increase in recreation, increase in poaching and other adverse impacts. NEPA requires this analysis and the failure to provide it violates the law.*

Response: Activities which have measurable effects pertinent to that resource are considered in the cumulative effects for each resource area (Chapter 4, FSEIS). See also Response to 7.2.

7.4 Comment: *The lack of an adequate cumulative impact analysis to assess the fragmentation of habitat corridors, degradation of water quality, impacts to plant and animal species and soil health is especially problematic given the cursory admissions throughout the administrative record that the analysis area has been highly impacted by past logging and other management activities. Simply stating that other activities are occurring or will occur does not suffice as an adequate cumulative impacts analysis.*

Response: Effects of pertinent activities which contribute to cumulative effects for each resource area are analyzed and discussed for each resource (Chapter 4, FSEIS).

7.5 Comment: *The DSFEIS is inadequate in that it does not fully discuss the cumulative impacts to watershed integrity. The Forest Service must describe how the selected alternative for the Deep Vegetation Management Project complies with Oregon's water quality standards. The DSEIS does nothing to indicate how logging in the planning area – in addition to logging in other timber project areas – will meet water quality standards. The DSEIS acknowledges that there are other projects in the area in the past and present, but it fails to analyze these projects and their impacts on water quality. NEPA does not allow the agency to forgo a cumulative impacts analysis.*

Response: Effects to water quality are thoroughly discussed on pages 4-1 to 12. Cumulative effects to water quality are addressed on pages 4-2, 4-10, and 4-11.

7.6 Comment: *We urge you to create a new program that restricts or eliminates grazing and not to consider further logging in an area that is already a patchwork of past destructive logging operations.*

Response: Creation of programs that restrict grazing activities is outside the scope of this analysis. Logging is a legitimate tool to address forest health where stand conditions require removal of commercial sized trees and reduction of woody biomass on the site to promote desirable stand conditions and reduce fuel levels.

7.7 Comment: *The DSFEIS needs to address the cumulative effects of fire and fire suppression activities. Since the actions are designed to reduce fire severity and probability, and because fire is a reasonable foreseeable future action, then the Forest Service must look at this under the cumulative effects analysis as required by NEPA.*

Response: No large wildfires fires have occurred within this watershed that contribute towards a cumulative effect. No fire suppression activities of a size or intensity that cause measurable cumulative effects have occurred in this watershed.

7.8 Comment: *The Forest Service must examine the cumulative effects of fire and the related aspects of it, such as firefighting activities, fire rehabilitation activities, post-fire salvage logging, and any replanting that will be done; as well as fire reduction activities designed to reduce fire.*

Response: No project fires have occurred, no large-scale fire suppression activities have occurred and no fire salvage activities have occurred in the last 10 years. Fire reduction activities are discussed in 2-4, 2-14, 2-26, 2-35; and 4-31 through 4-38.

7.9 Comment: *The watershed is highly roaded and the past regen harvest and roads interact to cause serious adverse cumulative effects that are not disclosed in the EIS. Further road construction and regen harvest should not be allowed.*

Response: All roads and all past harvest activities are considered in the analysis of effects of the proposed alternatives. See Chapter 3 and 4 of the FSEIS.

7.10 Comment: *The Equivalent Clearcut Area (ECA) is inappropriate because the model has not been calibrated for each watershed; we really cannot know the thresholds that trigger adverse impacts from the cumulative logging of native forests. The ECA model is not presented as a complete CWE analysis method and the theoretical foundation for the model is weak.*

Response: The Equivalent Harvest Area (EHA) model is required by the Ochoco National Forest Land and Resource Management Plan (1989). The model was developed to estimate the relative cumulative effects of timber harvest activities and forest vegetative conditions within a watershed. The Forest Plan has established threshold values for each watershed on the Forest (Forest Plan page 4-35 and 4-208). These values have been derived from past experiments and over 100 years of watershed research. EHA thresholds, in relation to changes in peak flow and adverse impacts, have been documented as low as 25% and as high as 40%. As discussed in the Deep FSEIS, the EHA threshold value for the Deep watershed is 25%. However, based on the existing condition of the watershed and research by Hibbert (1965), the alternatives were also evaluated against a more conservative value of 20%.

7.11 Comment: *The DEIS does not recognize and correct past logging, roading, burning, and grazing activities that have impacted this area, and that if continued, will continue to degrade water and soil quality, hiding cover, and wildlife habitat and introduction of noxious weeds is more likely.*

Response: The Purpose and Need is based upon the current existing condition of the watershed as identified in the Deep Watershed Analysis. Many of the proposed actions move these existing conditions to more desirable and sustainable conditions. See chapters 1 and 2 of the FSEIS and effects of the proposed actions in Chapter 4.

8. Grazing

8.1 Comment: *The EIS must discuss the forest health effects of livestock grazing as an integral part of vegetation management. There is no reason these issues cannot be dealt with in one comprehensive NEPA analysis that addresses the cumulative effects of grazing and fire suppression and logging on fire and fuels and makes necessary decisions to restore natural processes by removing livestock.*

Response: The effect of livestock grazing on vegetation is discussed under noxious weeds cumulative effects on page 4-35 of the DSEIS. The cumulative effect of livestock grazing on sensitive plant species is found on page 4-52. Also see pages 4-43 through 4-44.

Livestock grazing as a permitted activity will be addressed in a separate NEPA analysis.

8.2 Comment: *The document fails to consider alternative ways of avoiding impacts by not grazing. For logging and prescribed fire to be effective, livestock grazing must be eliminated. Grazing and logging cause cumulative effects that must be considered together in one NEPA document.*

Response: The logging and prescribed fire activities proposed in this project are expected to move the vegetation closer to historic conditions. The effects of past grazing and logging have been considered in the FSEIS and are included in cumulative effects discussions in 4-2 through 11.

8.3 Comment: *Impacts from grazing are not adequately dealt with given the key importance of water quality and fish habitat in the project. The continued grazing in riparian areas should be addressed in the DSFEIS.*

Response: Impacts from grazing are discussed in the context of cumulative effects and the development of the current condition of riparian areas. The future management of grazing is addressed on page 1-11.

8.4 Comment: *Impacts from livestock grazing in the Deep project area should be analyzed and addressed within the scope of this project and its NEPA documentation.*

Response: See response to Comment 8.3.

8.5 Comment: *Full-time riders may not be effective because units are large and livestock hazed out of riparian areas can be back and doing serious damage before the rider can return.*

Response: The current use of grazing allotments is described on pages 3-40 to 3-42. The effectiveness of riders on range management is outside the scope of the Deep project.

8.6 Comment: *The Forest Service should drastically reduce the amount of livestock utilization within the riparian areas. Until this is done the project is in violation of a number of different laws.*

Response: See response to Comment 8.3.

8.7 Comment: *The Draft SEIS states that livestock play no role in stand composition, structure, or density aspects. Current science supports that livestock grazing causes "disclimax" in forest ecosystems equal to episodic (catastrophic) fire.*

Response: The FSEIS states that the seral species conditions are the result of stand development continuing in the absence of fire. Fire was historically the primary disturbance in the Deep watershed (page 3-17).

Appendix D

Water Quality Restoration Plan

Deep Creek Water Quality Restoration Plan

A watershed enhancement plan to reduce summer stream temperatures and achieve compliance with water quality standards for Deep Creek, Crazy Creek, East Fork Crazy Creek, West Fork Crazy Creek, Little Summit Creek, Happy Camp Creek, Jackson Creek, Double Corral Creek, Toggle Creek, and Derr Creek.

Deep Creek Watershed
Located in the Ochoco Mountains of Crook County, Oregon
A tributary of North Fork Crooked River
Upper Crooked River Sub-basin

Ochoco National Forest
Paulina Ranger District
Paulina, Oregon
June 2002

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INTRODUCTION:

The Deep Creek Watershed, Hydrologic Unit Code 1707030409, is located in the western portion of the Paulina Ranger District, approximately 60 miles east of Prineville, Oregon. The watershed encompasses 55,368 acres on the south slope of the eastern Ochoco Mountains and incorporates four subwatersheds; Happy Camp, Jackson, Lower Deep, and Little Summit Prairie (Figure 1). It is located within the Upper Crooked River sub-basin, is part of the larger Deschutes River Basin, and drains into the North Fork Crooked River. The Ochoco National Forest owns approximately 98 percent of the watershed, while the remaining 2 percent of the watershed is privately owned (Table 1). Private ownerships are located at Little Summit Prairie (T14S R23E S25 and 26) and Toggle Creek (T13S R23E S35). Private land within the area covered by this WQRP is managed under the Oregon Forest Practices Act of 1971.

Table 1. Ownership in the Deep Creek Watershed.

Ownership	Area	Ownership Percent
U.S. Forest Service	54,261	98.0
Private	1,107	2.0

The climate of Deep Creek Watershed is characterized by low precipitation, low humidity, large daily temperature fluctuations, high evaporation potentials, and dominant winds from the southwest. Summers are typically hot and dry and winters are cool and moist. The average annual precipitation ranges from 17 inches at the North Fork Crooked River confluence to 25 inches at the headwaters of Happy Camp and Jackson Creeks. Most precipitation occurs between November and April in the form of snow. Summer precipitation primarily comes from convective frontal storms that deposit 0.1 to 0.5 inches of rain. The watershed ranges in elevation from 4,500 feet at the mouth of Deep Creek to 6,314 feet at the watershed divide.

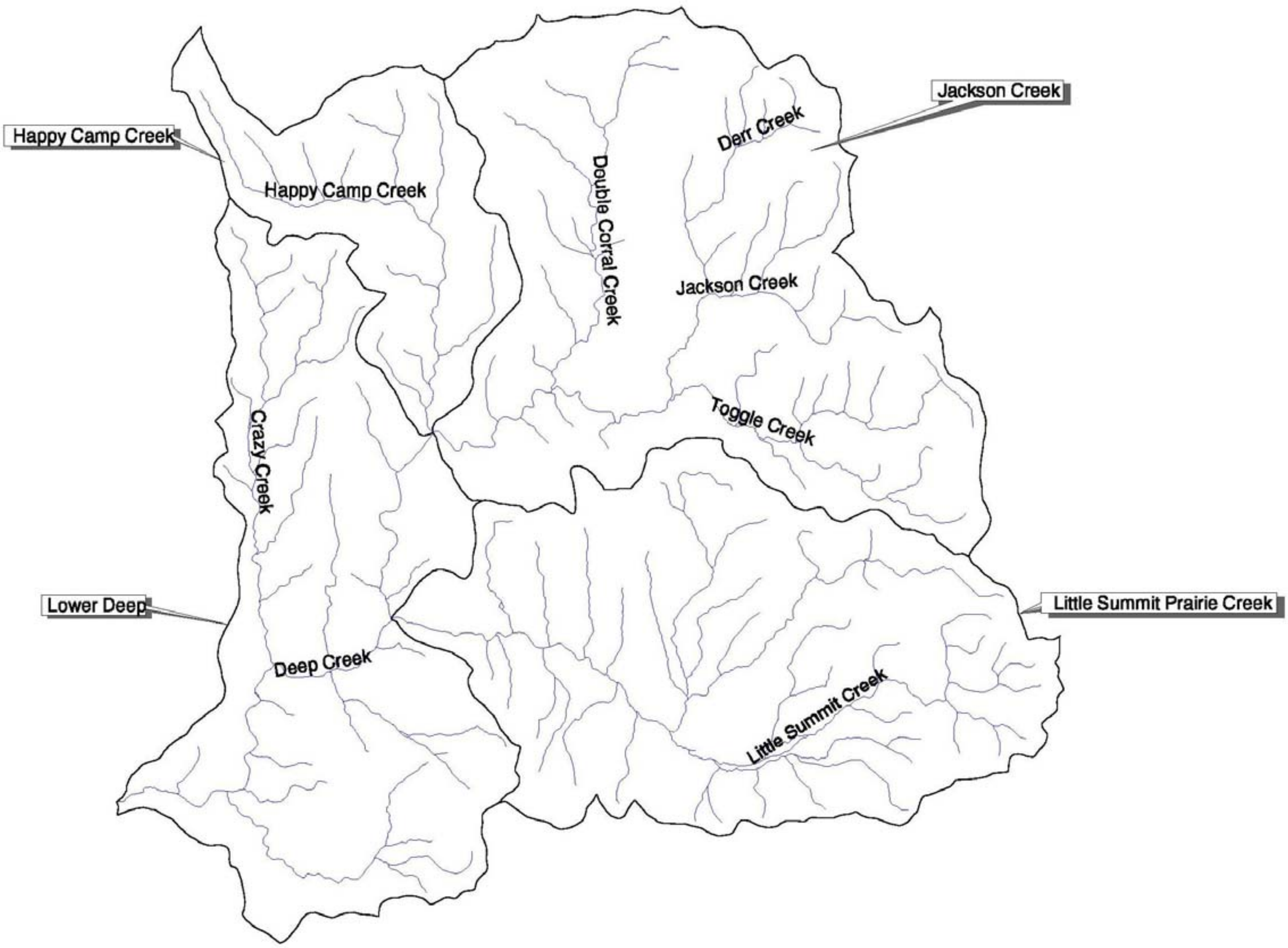
Snowmelt is the principal source for run-off from the Deep Creek Watershed. Elevated flows and groundwater recharge occur from February through May, with greatest runoff usually occurring in April. Stream flows during the summer months may be attributed almost entirely to groundwater discharge (baseflow). As summer groundwater levels decline, discharge from springs and seeps decrease and flow in low-order channels become disconnected or intermittent. Stream losses to groundwater and evaporation become apparent in lower-elevation reaches and tributaries of Deep Creek, Little Summit Creek, Happy Camp Creek, and Jackson Creek.

Occasional summer thunderstorms can cause brief increases in streamflow and decreases in stream temperature, but the measurable effects generally last for one day or less. Summer rains are usually inadequate to overcome moisture deficiencies and recharge groundwater at lower elevations, but some summer recharge may occur from prolonged storms at higher elevations where evaporation potentials are lower and soil moisture levels are higher. The cloud cover associated with storm fronts may cause measurable reductions in stream temperatures, but the effects last only as long as the cloud cover.

Stream temperature and flow vary seasonally and annually. In the winter months water temperatures are cool. State standards are exceeded in the summer months from June to September when stream flows are lowest and incoming solar radiation is highest.

The shaping of the landforms in the watershed are a reflection of the past climate and geologic history of the area. Mainly a mixture of basalt, andesite and sedimentary rocks underlies the watershed. The climate 60 million years ago to the present has evolved from a warm moist tropical regime to the temperate four distinct seasons of today. The tectonic movement, uplift of the Blue Mountain anticline and mass wasting process has combined to create two distinct landforms consisting of broad gently sloping ridges

Figure 1. Deep Creek Watershed, Subwatersheds, and Water Quality Limited Streams.



with steep-sided draws and a small area of hummocky bench terrain. In general, the erosion has occurred through sheet and rill with minor mass wasting in the form of landslides, rock topple and slope creep along the draws and along the south slope of Little Summit Prairie. Existing linear features (tectonic faults) support recharge for the regional and local aquifers.

During the last 60 million years before present (Ma), the central Oregon area has been the scene of major episodes of volcanic activity interspersed by periods of sedimentation (Walker, 1990). Most tectonic movement ceased between 8 and 10 million years before present. Vegetated lineations, drainage development, small scarps, springs, moist areas are the physical traces of the movement. Within the past 100,000 years, the present day stream systems developed, mass wasting events shaped the slopes and more recently within the past 7,000 years, a succession of volcanic ashfalls from nearby Mt. Mazama and Newberry Crater carpeted the terrain.

The Deep watershed is underlain by three distinct geologic formations. The oldest lithology, the Picture Gorge Basalt (Tcp) underlies 99 percent of the watershed (Brown and Thayer, 1966 and Swanson, 1969). The flood basalt was deposited between 15 to 16.4 Ma (million years ago). The formation consists of olivine-bearing basalt flows with thin ashy sedimentary beds between the lower flows. The thin sedimentary beds between the flows often allow subsurface water flow to express on the surface as springs and seeps. They often are reflected by 'stringers' of timber and shrubs running parallel to the contours, scribing the contact between the lava flows. The formation is resistant to mechanical and chemical weathering. The slide surfaces for the landslides are predominately deep. The majority of the dormant landslide scarps and debris are located on the upper slopes, associated with ridge tops and on slopes greater than 40 percent. The heavier basalt is sliding on weaker clay zones within the basalts or on the underlying Clarno and John Day Formations. The fractures in the basalt, due to tectonic activity and jointing, are areas of concentration for groundwater infiltration.

Landslide debris (Qls) (2 Ma to Present) covers approximately 0.01 percent of the analysis area (Brown and Thayer, 1966 and Swanson, 1969). The debris is mapped on the northern slope of the Happy Camp Creek subwatershed. The unconsolidated material is highly susceptible to mechanical and chemical weathering. The landslides associated with the debris are located on the crest of the ridge.

Quaternary alluvium, the youngest lithology (2 Ma to Present), covers 1 percent of the analysis area (Brown and Thayer, 1966 and Swanson, 1969). The mappable alluvium is confined to Little Summit Prairie. The landslides associated with the alluvium are located on the crest of the ridge on the south side of Little Summit Prairie. The unconsolidated material is highly susceptible to mechanical and chemical weathering.

Natural disturbance mechanisms, such as wildfire, have and will play a role in all habitat development, including riparian (Ochoco National Forest, 1999). Floods due to storm events have an important role in stream channel development and can be a major factor that contributes to stream temperature. It is recognized that these natural processes influencing riparian areas and stream temperature will fluctuate within the Deep Creek Watershed and are outside the scope of this plan.

Interior redband trout (*Oncorhynchus mykiss gairderi*) are widely distributed throughout the Crooked River Basin and occupy most of the perennial flowing streams found within the Deep Creek Watershed. The redband trout is included on the Regional Foresters sensitive species list and is utilized as one of the primary indicator species, which reflects watershed, aquatic, and riparian condition.

The beneficial uses of the waters of the Deep Creek Watershed include resident fish and aquatic life support, livestock watering, aesthetic quality, fishing and wildlife, and water contact recreation.

SECTION 1 - CONDITION ASSESSMENT AND PROBLEM DESCRIPTION:

The present conditions of degraded water quality have resulted from impacts on the forest during more than a century of use. Past streamside management activities in Deep Creek Watershed have left a mosaic of vegetation age classes. As a result of riparian timber harvest, domestic livestock and native wildlife grazing, and road construction, many riparian areas have lost shade-producing vegetation. Some channels have widened due to bank destabilization, primarily from domestic grazing. Past management activities have resulted in changes such as channels with less overhanging banks, lower sinuosity, less riparian vegetation and shade, entrenchment, and higher susceptibility to bank erosion due to loss of rooting strength from over-utilization of riparian vegetation.

Stream Temperature:

There are many elements that interact with stream temperature and can be described in terms of heat energy. The elements involved in determining net heat energy include solar energy, longwave radiation, evaporation, convection, streambed conduction, and groundwater exchange (Boyd and Sturdevant, 1997). These elements are complex and will fluctuate given different environmental conditions. Any increase in solar radiation during daytime conditions will directly increase stream temperature (Brown, 1972). Natural and management induced activities have been shown to increase stream temperatures. To assess the current stream temperature problems and the conditions contributing to these problems, the water quality limited streams in the Deep Creek Watershed were analyzed for channel form and evolution, stream shade, and stream flow.

Regular monitoring of stream temperatures during the past decade in Deep Creek Watershed has established that summer maximum water temperatures exceed the statutory standard of the State of Oregon in Deep Creek, Crazy Creek, East Fork Crazy Creek, West Fork Crazy Creek, Little Summit Creek, Happy Camp Creek, Jackson Creek, Double Corral Creek, Toggle Creek, and Derr Creek (Table 2). The Oregon Department of Environmental Quality (DEQ) stipulates that, for support of resident fish, the average of the daily maximum stream temperature during any seven consecutive days shall not exceed 64^{o}F (ODEQ 1995). Furthermore, the average of the daily maximum stream temperature during any seven consecutive days shall not exceed 55^{o} F in times of spawning and shall not exceed 50^{o} F in waters that support bull trout (*Salvelinus confluentus*). The seven-day means of the daily maximum stream temperatures in the named streams (Table 2) have consistently surpassed the 64^{o}F standard.

Table 2. Deep Creek Watershed Stream Temperature Summary (^{o}F).

Stream	1994	1995	1996	1997	1998	1999	2000
Deep Creek	73.5	73.4	74.9	74.0	ND	73.9	77.8
Crazy Creek	64.5	ND	ND	ND	ND	69.5	ND
East Fork Crazy Creek	64.3	ND	ND	ND	61.3	ND	ND
West Fork Crazy Creek	72.7	ND	ND	ND	ND	71.9	ND
Little Summit Creek	64.5	71.3	69.3	67.7	70.7	85.8	70.5
Happy Camp Creek	78.3	ND	ND	ND	74.1	73.7	76.7
Jackson Creek	76.7	ND	ND	ND	ND	77.0	75.6
Double Corral Creek	71.3	ND	ND	ND	ND	75.8	ND
Toggle Creek	72.0	ND	ND	ND	66.4	73.2	ND
Derr Creek	78.0	ND	ND	ND	ND	72.0	ND

1994: This is the average maximum temperature for the entire period of record.
1995-2000: This is the average of the 7-day moving mean of the daily maximum temperature for the period of record.
ND: No data available.

In accordance with Section 303(d) of the 1972 Federal Clean Water Act, the Oregon Department of Environmental Quality has identified these ten streams as non-compliant, water quality limited bodies of water. Such water quality limited bodies of water require the application of Total Maximum Daily Loads

(TMDLs) or other pollution control requirements. However, local stream temperature conditions may officially be recognized as the local standard when "natural" conditions drive stream temperatures above 64^{o}F. The 303(d) listed streams for the Deep Creek Watershed are in Table 3. These streams account for approximately 80% of the volume of water in the watershed. Impaired beneficial uses for the listed parameters are resident fish and aquatic life, salmonid fish spawning, and rearing.

All water quality limited streams within the Deep Creek Watershed are perennial, fish-bearing streams and provide habitat for redband trout and other resident species. This watershed represents the most interconnected habitat for redband trout in the Crooked River basin. Degradation of instream habitat resulting from high road densities, overstory tree removal, livestock grazing, and recreational fishery management are reasons for decline in salmonid production.

An ongoing redband trout study, started in 1997, assessed the population condition and migratory behavioral patterns throughout the watershed (Grover and Hodgson 1999). Preliminary population estimates show Deep Creek, Little Summit Creek, Happy Camp Creek, and Double Corral Creek to have higher densities of individuals. Data results suggest seasonal migration of redband trout to be very limited (i.e. they are predominately local species).

Table 3. 303(d) Listed Streams in the Deep Creek Watershed.

Location	Listing Parameter	Segment
Deep Creek	Temperature and Habitat Modification	Mouth to Headwaters
Crazy Creek	Temperature and Habitat Modification	Mouth to Headwaters
East Fork Crazy Creek	Temperature and Habitat Modification	Mouth to Headwaters
West Fork Crazy Creek	Temperature and Habitat Modification	Mouth to Headwaters
Little Summit Creek	Temperature and Habitat Modification	Mouth to Headwaters
Happy Camp Creek	Temperature and Habitat Modification	Mouth to Headwaters
Jackson Creek	Temperature and Habitat Modification	Mouth to Headwaters
Double Corral Creek	Temperature and Habitat Modification	Mouth to Headwaters
Toggle Creek	Temperature	Mouth to Headwaters
Derr Creek	Temperature	Mouth to Headwaters

Two other genetic studies on redband trout were performed in the Crooked River basin, which included Deep Creek. Currens (1994) showed that this particular redband trout population did not group with other populations from streams in the immediate vicinity. In contrast, Phelps (1996) showed that the Deep Creek population matched geographically with other streams. It was noted, however, that the low sample size (nonrepresentational) in the 1996 study contributed to those results.

In 1998 a large-scale fish mortality occurred on Little Summit Creek. The estimated fish loss was 660 redband trout and 2904 speckled dace, *Rhinichthys osculus*, which later showed to be one-third of the fish population within the two mile affected reach. The cause of this event was an outbreak of an external parasite, *Ichthyoptherius multifilis,* which favors warm water temperatures and high fish densities.

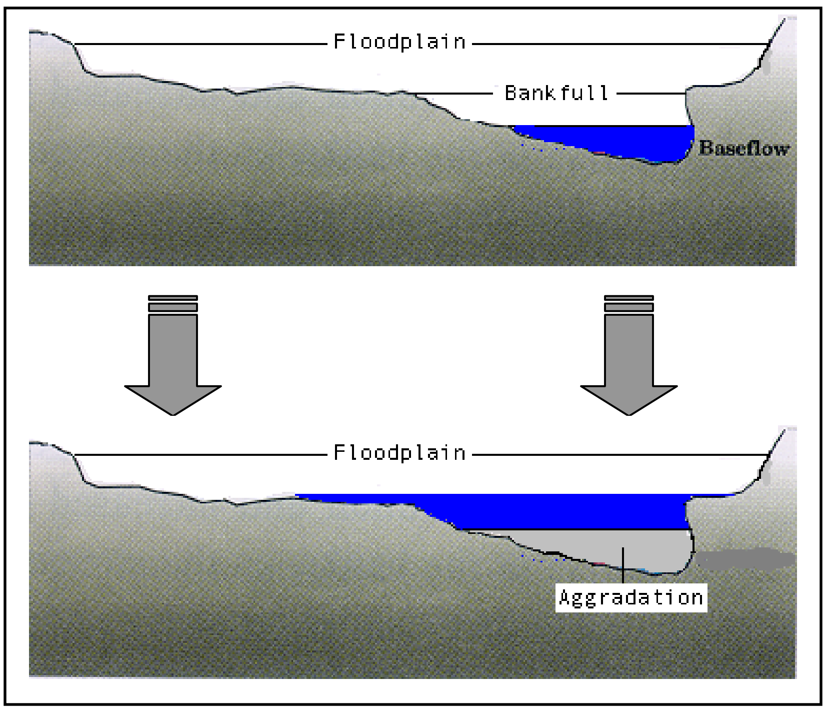
Channel Form and Evolution:

One major cause of elevated stream temperatures and loss of fish habitat is a change in channel form over time. The following section will discuss the importance of channel form and its role in the Deep Creek Watershed.

Natural channel stability is achieved by allowing stream systems to develop a stable dimension, pattern, and profile such that, over time, channel features are maintained and the stream system neither aggrades nor degrades (Rosgen 1996). In order for a stream channel to be stable it must be allowed to transport sediment load (both size and type). Channel instability occurs when the scouring process leads to degradation, or excessive sediment deposition results in aggradation (Rosgen 1996). In the Deep Creek Watershed, channel degradation and aggradation has directly affected stream width and depth. Channel erosion and sedimentation have reduced pool depths and increased channel widths. Channel adjustments in stream width and depth have occurred partially to changes in stream flow magnitude and/or timing, sediment supply and/or size, direct disturbance, and riparian vegetative changes. Changes in riparian vegetation have altered boundary resistance and have left stream banks susceptible to erosion.

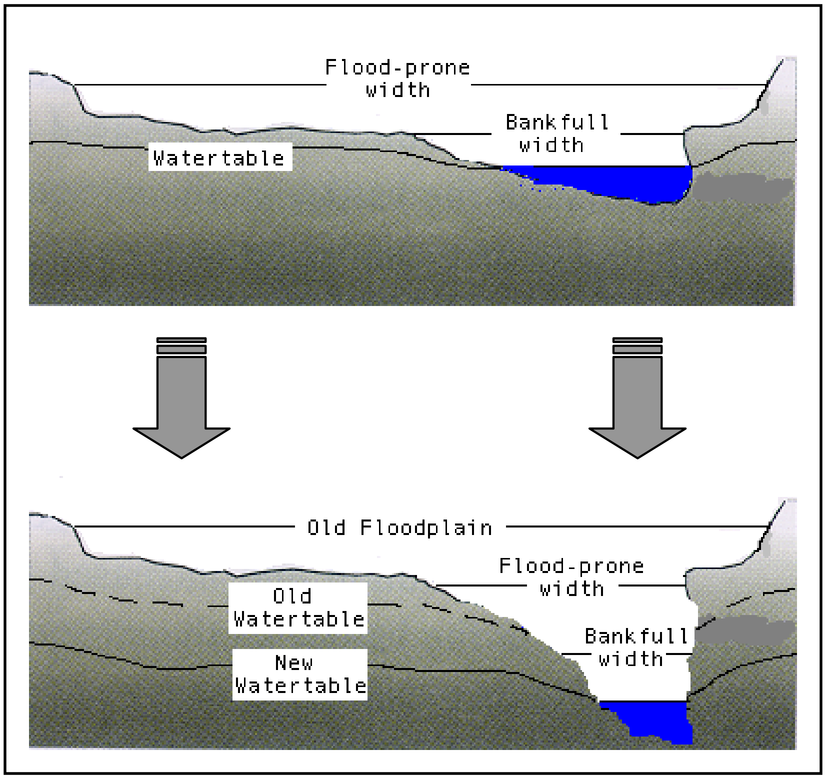
Channels that experience aggradation frequently have high width to depth ratios (i.e. bankfull channel width is several times larger than bankfull channel depth). When aggradation occurs, the channels water capacity is forced to the floodplain, which may be many times wider than the channel. Figure 2 displays the changes that occur in channel form and water surface area due to aggradation. It has been shown that channels with greater surface areas (high width to depth ratios) will heat faster than streams that are narrower and deeper (Brown 1972). Historic management practices such as domestic grazing and timber harvest, within the Deep Creek Watershed, have been associated with reducing riparian vegetation and accelerating changes in channel form (primarily width and depth). Changes such as these have the potential to increase stream temperatures and degrade fish habitat. In addition to this document, current and projected planning documents (Restoration Environmental Analysis, Allotment Management Plan revisions, etc.) will address these issues, as discussed in the proceeding sections.

Figure 2. Changes in Channel Form and Surface Water Area Associated with Aggradation.



Channels that experience degradation, as a result of scouring, frequently have an entrenchment ratio that approaches the value of one. A value of one indicates that the streams flood-prone width approximates bankfull width (i.e. entrenchment has occurred and streams have lost access to flood plains). Figure 3 demonstrates this concept. Entrenchment frequently results in lowering of the existing water table, making it difficult or impossible for riparian vegetation to acquire water from the new, lower water table. Consequently, entrenchment has the potential to reduce streamside vegetation, increase stream temperatures, and allow encroachment of conifers and other plants that are adapted to drier conditions.

Figure 3. Changes in Channel Form and Water Table Elevation Associated with Degradation from Scouring.



Channel Form Classification:

Broad-level descriptions of the major stream types have allowed for a rapid initial morphological delineation of stream types, and generally illustrate the distribution of these types that would be encountered within watersheds (Rosgen, 1996). Delineation has allowed land managers to evaluate morphological changes in channel form over many years. Rosgen (1996) has developed such a classification and delineation process that provides a general characterization of valley types and landforms, and identifies the corresponding major stream types. The following six paragraphs describe the major stream types as classified by Rosgen (1996). Figure 4 provides a visual reference for further assistance.

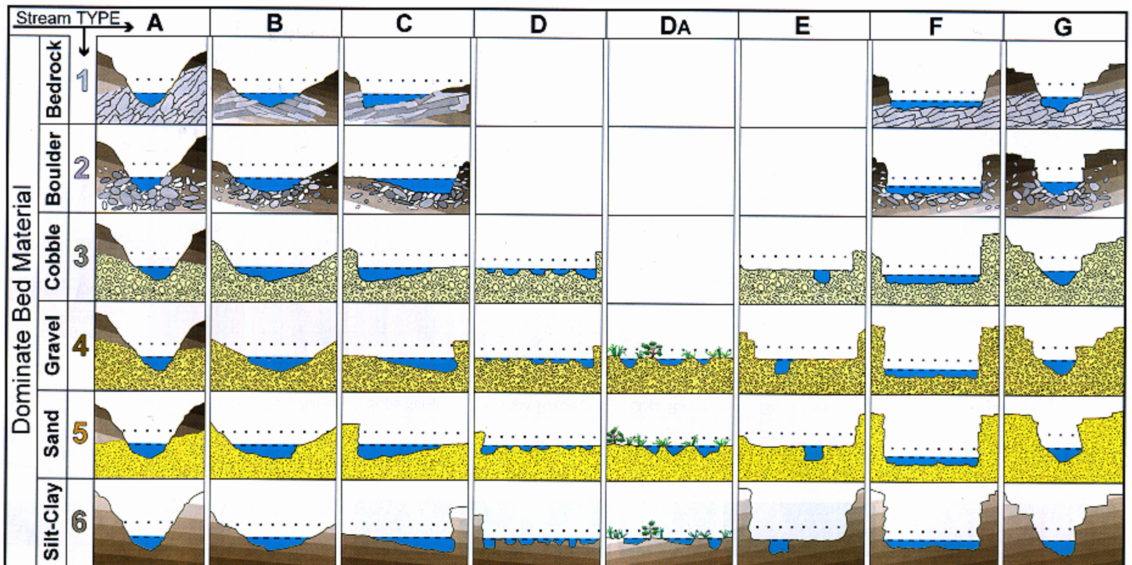
Rosgen type "A" streams are relatively steep (4-10%) and streamflows at the bankfull stage are typically described as step/pools, with attendant plunge or scour pools. These stream types are typically found within valley types that due to their inherent channel steepness, exhibit a high sediment transport potential and a relatively low in-channel sediment storage capacity. Entrenchment ratios, or ratio of the width of the flood-prone area to the surface width of the bankfull channel, are generally less than 1.4, and width to depth ratios are less than 12 at bankfull stage. Sinuosity, or ratio of stream length to valley length, ranges from 1.0 to 1.2.

Type "B" streams exist primarily on moderately steep to gently sloped terrain (2-4%), with the predominant landform seen as a narrow and moderately sloping basin. These streams are moderately entrenched (1.4 to 2.2), have a width/depth ratio greater than 12, and display low channel sinuosity (>1.2). Bedform morphology typically produces scour pools and characteristic riffles. Channel aggradation/degradation process rates are normally low.

Type “C” streams are located in narrow to wide valleys, constructed from alluvial deposition. The primary morphological features of the “C” stream type are the sinuous, low relief channel, the well developed floodplains built by the river, and characteristic “point bars” within the active channel. These streams have a well-developed floodplain (slightly entrenched), are relatively sinuous (>1.4) with a channel slope of 2% or less, and width to depth ratios generally exceed 12. Bedform morphology is indicative of a riffle/pool configuration. These streams can be significantly altered and rapidly de-stabilized when the effect of imposed changes in bank stability, watershed condition, or flow regime are combined to exceed channel stability threshold.

Type “D” streams are uniquely configured as multiple channel systems exhibiting a braided pattern, with very high width to depth ratios (>40) and channel slopes generally less than 4%. While the very wide and shallow “D” streams are not deeply incised, they can be laterally contained in narrower or confined valleys. Bank erosion rates are characteristically high and aggradation and lateral extension are dominant channel adjustment processes.

Figure 4. Delineative Criteria and Characteristics for the Major Stream Types (Rosgen 1996).



Stream TYPE	A	B	C	D	DA	E	F	G
Entrchmnt.	< 1.4	1.4 - 2.2	> 2.2	n/a	> 4.0	> 2.2	< 1.4	< 1.4
W/D Ratio	< 12	> 12	> 12	> 40	< 40	< 12	> 12	< 12
Sinuosity	1 - 1.2	> 1.2	> 1.2	n/a	variable	>1.5	> 1.2	>1.2
Slope	.04-.099	.02-.039	< .02	< .04	< .005	< .02	< .02	.02-.039

Type “E” streams represent the developmental “end-point” of channel stability and fluvial process efficiency, primarily because they have relatively large floodplains to dissipate erosive processes, have high sinousities (>1.5), and occur on slopes less than 2%. The “E” type streams are slightly entrenched (>2.2) and exhibit low channel width/depth ratios (<12). Bedform features are predominantly a consistent series of riffle/pool reaches. While the “E” stream type is considered a highly stable system, they are very sensitive to disturbance and can be rapidly adjusted and converted to other stream types in relatively short time periods.

Type “G” or “gully” streams are entrenched (<1.4), narrow, and deep, step/pool channels with a low to moderate sinuosity (>1.2). Width to depth ratios are generally less than 12, and slope ranges from 2 to 4%, although channels may be associated with gentler slopes where they occur as “down-cut” gullies in meadows. With the exception of those channels containing bedrock and boulder materials, the “G” stream types have very high bank erosion rates and a high sediment supply.

Further delineation by "numbering" is based upon channel material (i.e. C1, C2, C3, etc). A "C1" stream exhibits the characteristics of a "C" stream, yet has a bedrock substrate. A "C6" stream is the same, yet has a silt/clay substrate (Figure 4).

Although a change in channel form over time is a very complex process, Rosgen (1996) identified some of the distinguishing characteristics that may be altered when a channel changes form. For example, when a C-type stream changes to a D-type stream, or an E-type changes to a C-type, the width to depth ratio increases due to lateral erosion, which exposes more surface water to solar radiation (Figures 2 and 5). When an E-type channel changes to a G-type channel the entrenchment ratio approaches a value of one, which indicates that the channel no longer has access to the normal floodplain to dissipate energy during high flows (Figures 3 and 6).

Figure 5. Evolutionary Channel Changes Associated with Stream Bank Alteration (Rosgen 1996).

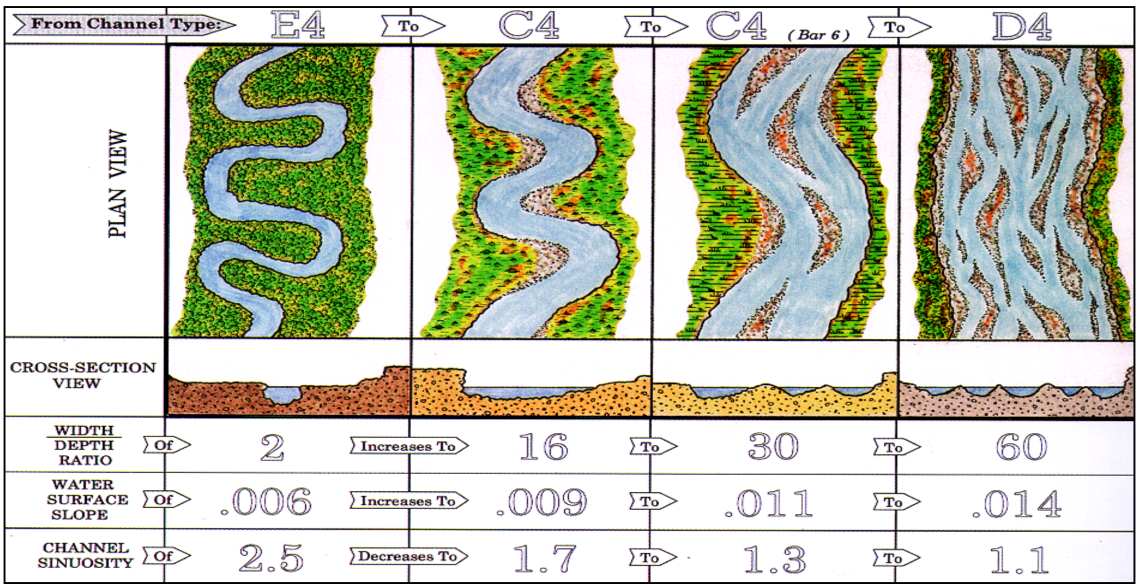
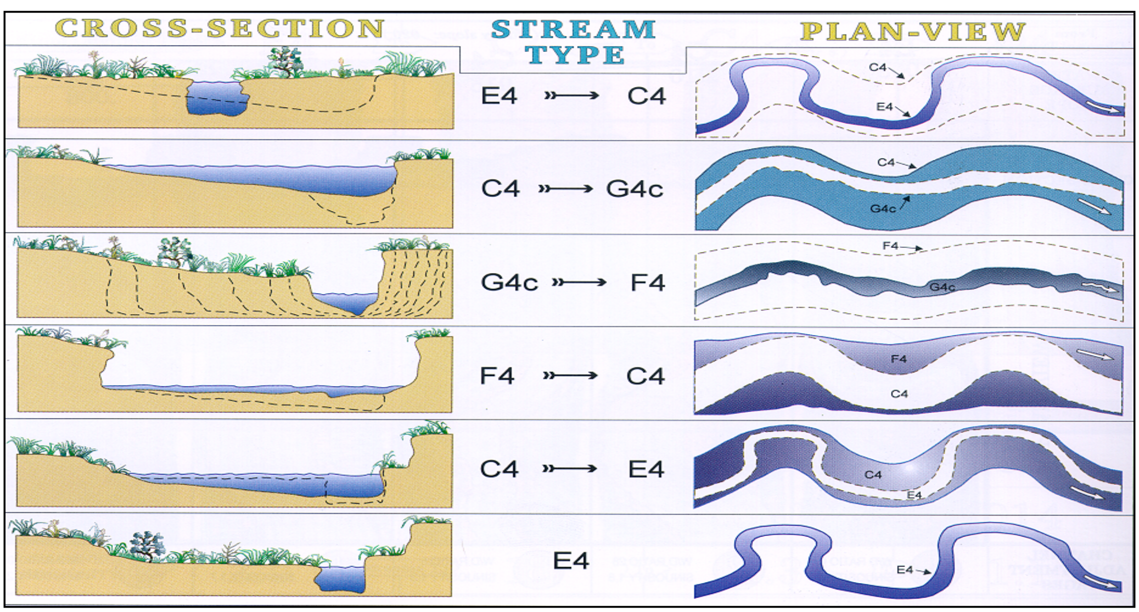


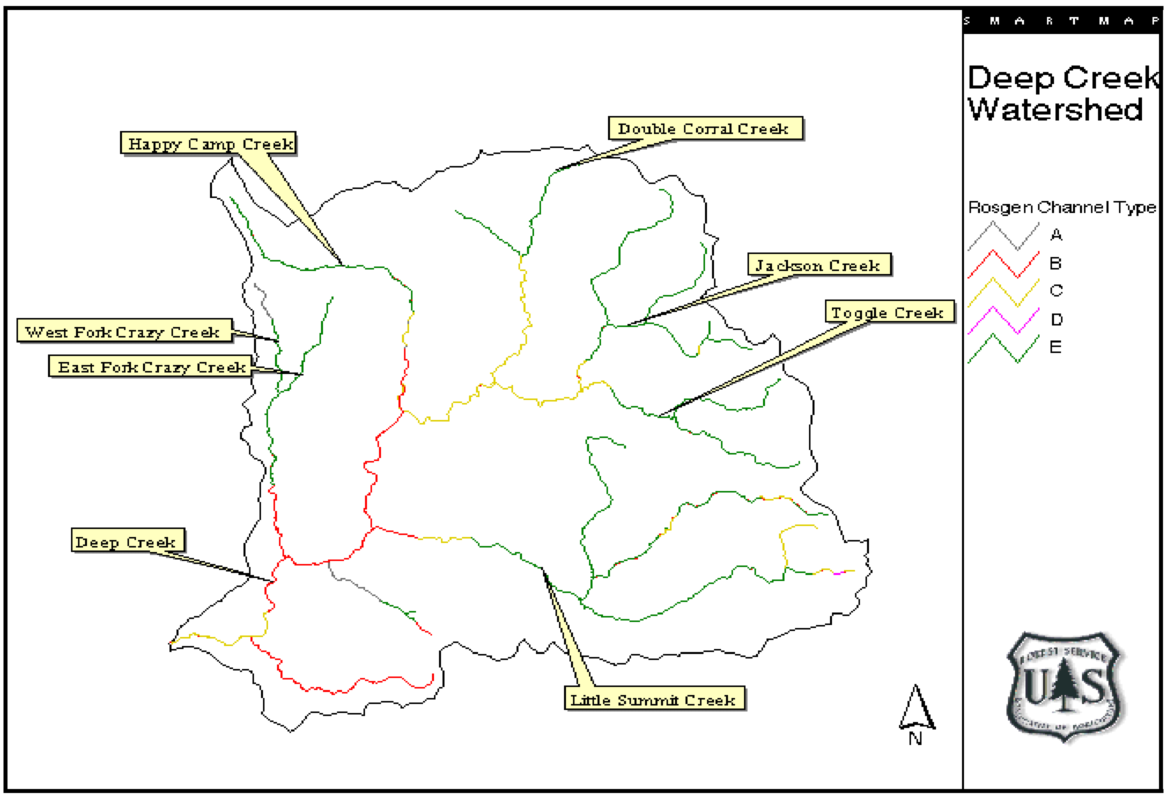
Figure 6. Adjustments in Channel Form as Stream Types Change (Rosgen 1996).



Historic aerial photos and surveys indicate that channel morphology in the upper headwater drainages of Deep Creek, was dominated by Rosgen E4, E5, C3, C4, and C5 stream types. The lower watershed was characteristic of C2, C3, B2, A1 and A2 streams. These channels with the exception of "A" stream types (valley controlled) had active floodplains and stable riparian vegetation consistent of most wetlands. Figure 7 shows historic Rosgen channel types within the Deep Creek Watershed.

Currently, channel form within Deep Creek watershed exhibits B3, B4, C3, C4, C5, E5, and G5 in the upper headwater drainages. Stream types of the lower watershed consists of A1, A2, B2, B3, C3 and D3 systems. "A" stream types, like the lower first mile of Big Springs Creek, have not changed over time, due to lateral confinement by valley walls. Figure 8 shows current Rosgen channel types within the Deep Creek Watershed.

Figure 7. Historic Rosgen Channel Types in the Deep Creek Watershed.



Changes in channel type such as these, fall within a morphologic evolutionary pattern typical of a drainage network that has been/is degrading. Figure 9 demonstrates some of the morphological changes that have occurred on streams in the Deep Creek Watershed.

Figure 8. Current Rosgen Channel Types in the Deep Creek Watershed.

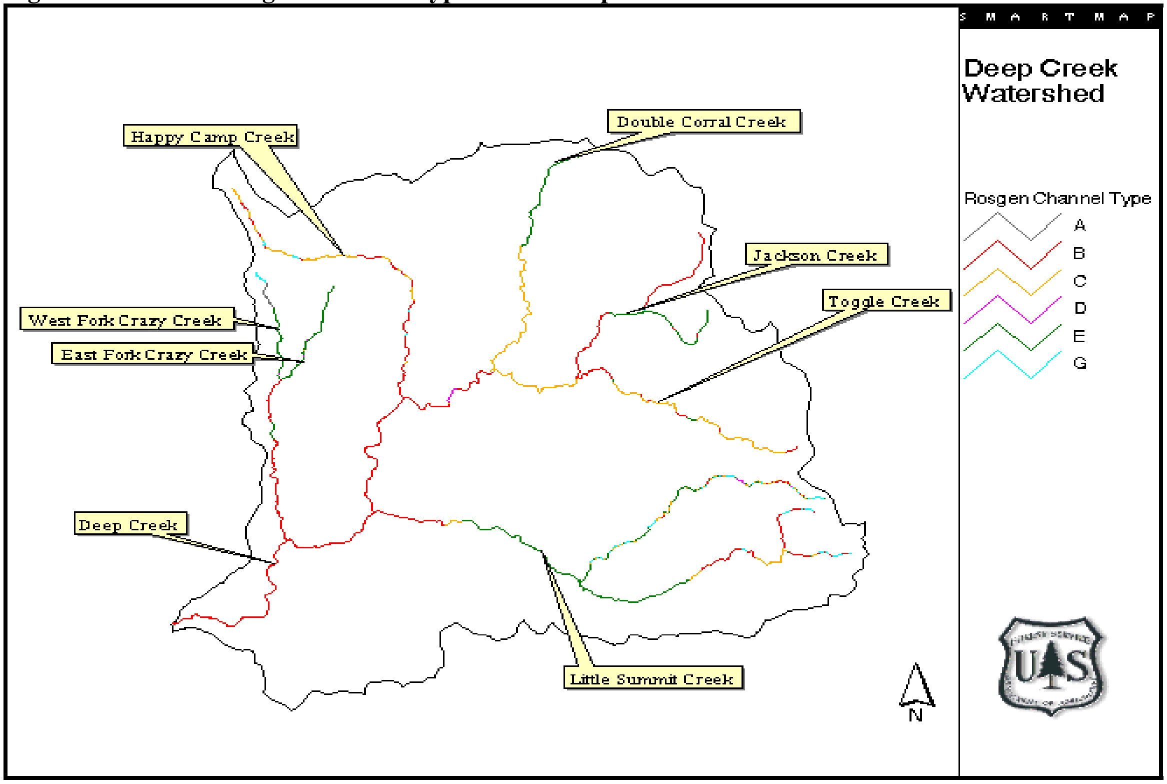
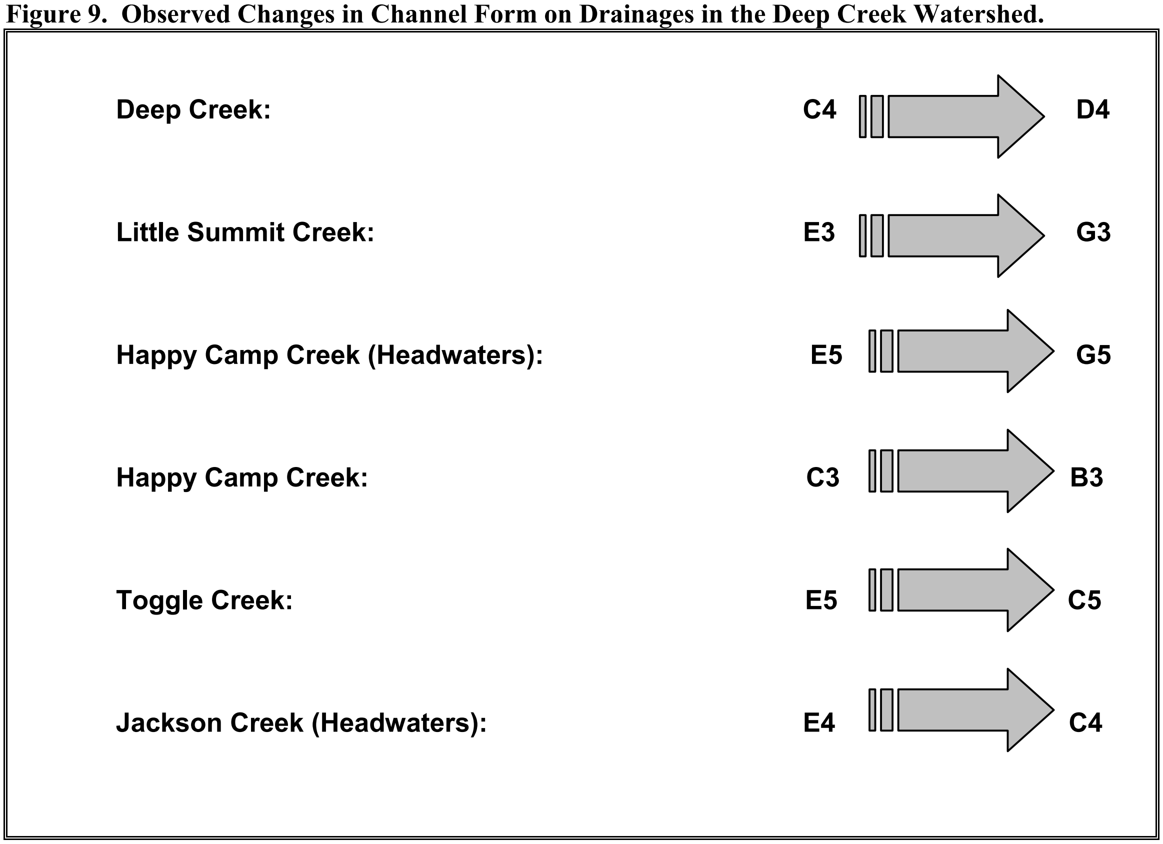


Figure 9. Observed Changes in Channel Form on Drainages in the Deep Creek Watershed.



Stream Shade:

The principal cause of heating of surface waters is the absorption of direct solar radiation (Brown, 1972). Riparian shade trees intercept direct sunlight and suppress the diurnal stream temperature range. Riparian canopies shade streams to various extents, reducing incident solar radiation and maintaining lower temperatures than would be the case in the absence of vegetation (La Marche, Dubin and Lettenmair, 1997). Table 4 summarizes the general shade conditions within the Deep Creek Watershed. This table is a general overview of the Deep Creek Watershed, and is not used for development of load allocations. Currently, the Forest standard of >80 percent surface shade is not being met in 94 percent of the watershed (data on existing shade conditions were compiled from Bottom Line Surveys, Level II Surveys, and Oregon Department of Fish and Wildlife (ODFW) Physical and Biological aquatic habitat inventories). However, the forest standard of 80% shade was not developed in reference to different vegetation types, and according to plant physiologists may be an extreme standard for any National Forest ecosystem. Likewise it would not make sense to base site potential shade values on a system that has been altered over time and no longer has the same vegetative structure. Hence, with the aid of plant physiologists, Simpson (personal

Table 4. Existing Shade and Solar Load Conditions and Types of Disturbance for the Water Quality Limited Streams in the Deep Creek Watershed.

Stream	Length of Stream Surveyed (ft)	Average Existing Shade (%)*	Average Existing Solar Load ($btu/ft^2/day$)	Types of Disturbance (Human-Caused)#
Deep Creek	42,240	40	1467	Timber Harvest Livestock Grazing Road Construction
Crazy Creek	20,600	48	1271	Timber Harvest Livestock Grazing Road Construction
East Fork Crazy Creek	12,300	49	1247	Timber Harvest Livestock Grazing Road Construction
West Fork Crazy Creek	14,800	39	1491	Timber Harvest Livestock Grazing Road Construction
Little Summit Creek	48,870	46	1320	Timber Harvest Livestock Grazing Road Construction
Happy Camp Creek	44,000	31	1687	Timber Harvest Livestock Grazing Road Construction
Jackson Creek	47,300	32	1663	Timber Harvest Livestock Grazing Road Construction
Double Corral Creek	27,800	25	1834	Timber Harvest Livestock Grazing Road Construction
Toggle Creek	31,680	28	1760	Timber Harvest Livestock Grazing Road Construction
Derr Creek	19,540	10	2201	Timber Harvest Livestock Grazing Road Construction

* Shade was measured every 100 feet, as the percent of stream surface shaded by streamside vegetation.
\# These disturbances are man-induced and do not include natural disturbance such as wildfire and floods.

communication, 2001), Kovalchik (1987), and Crow and Clausnitzer (1997), vegetative shade potential was predicted over time, according to existing vegetation and channel type. Average shade potentials were predicted based on vegetation composition (Table 5). Note that a very small proportion of the Deep Watershed is made of Moist Grand Fir (<1%), therefore a very small proportion of the watershed has potential to reach the 80% potential shade. The majority of the watershed (45%) is made up of Dry Grand Fir.

Table 5. Predicted Shade Values Associated with Vegetation Type in the Deep Creek Watershed.

Vegetation Type	Description and Characteristic Geomorphic Environment	Predicted Average Potential Shade (%)*
Moist Grand Fir	Includes stands dominated by Ponderosa Pine, Lodgepole Pine, Douglas Fir, Grand Fir, Western Larch, or Aspen with various associated understory components including Common Snowberry, Pine grass or other grasses, alder, willow, and others. Occurs in medium (>4500 ft) and high elevation areas throughout the watershed and some northern exposures at lower elevations.	70-80
Dry Grand Fir	Includes stands dominated by Ponderosa Pine, Lodgepole Pine, Douglas Fir, Grand Fir, or Aspen with various associated understory components such as Bluebunch Wheatgrass, Pine Grass, or other grasses, Common Snowberry, willow, and others. Most common at lower elevations (<4500 ft) and on southern exposures.	65-75
Shrub	Shrubs and small trees that line channel bank including alders and willows.	60-65
Sedge and Rush	Found in open bench meadows associated with springs and seeps. May occur with an overstory of aspen or shrubs.	55-60

*These values only include shade produced by vegetation, and do not include topographic shade.

Existing shade values were obtained with a solar pathfinder on every 100 feet of stream over the last six summers. Shade values represent the percent of total potential mid-summer daily solar input that is blocked by streamside vegetation. With the use of existing shade values, existing solar loads were developed in British thermal units (BTUs) (Table 4). Implicit to the development of existing solar loads is the assumption that the Deep Creek Watershed has an effective energy input of 2445 btus/ft^2/day during summer months. This is an extreme value, and provides a margin of safety when estimating solar load reductions. This value was derived from the solar pathfinder documentation and represents the solar input on a horizontal surface at Redmond, OR (latitude 44.3^o), approximately 85 miles west of the Deep Creek Watershed. Average monthly solar input values were compiled by Solar Pathways Corporation, from horizontal data given in University of Wisconsin E.E.S. report #44-2 [f-chart data] (Table 6).

Table 6. Average Monthly Solar Input for Redmond, OR (Solar Pathways Corp).

Month	Solar Input (btu/ft^2/day)	Month	Solar Input (btu/ft^2/day)	Month	Solar Input (btu/ft^2/day)
January	490	May	2078	September	1583
February	774	June	2286	August	999
March	1190	July	2445*	November	572
April	1682	August	2068	December	424

*This value was assumed to be the average summer-time daily solar input for the Deep Creek Watershed.

For the development of load allocations, streams were delineated into reaches based on Rosgen channel types. It has been shown that the classification of streams into channel type is useful for indexing the potential and distribution of vegetation within riparian areas (Padgett et al. 1989, Burton et al 1992, Prineville R.D. 1995, Simpson personal communication 2001). The amount and distribution of individual fluvial surfaces change with alteration in channel type and riparian vegetation, and changes in channel form/type dramatically affect the ability of a site to produce a specific plant community type.

The Trout Creek Watershed Analysis (Prineville R.D., 1995) discussed the link between Rosgen channel type and existing and potential vegetation (the Trout Watershed is located approximately 70 miles northwest of Deep Creek and is similar in elevation). Within the Trout Creek Watershed Analysis, an assessment was performed to identify existing plant community types associated with Rosgen channel types. Upon review of the Trout Watershed Analysis, field-truthing was performed on several stream reaches within the Deep Creek Watershed. Results from the Deep Creek Watershed field observations verified similar associations between plant and channel type. Riparian zone associations and potentials found in the Deschutes, Ochoco, Fremont, and Winema National Forests are described by Kovalchik (1987).

It is understood that riparian vegetation throughout the Deep Creek Watershed will recover to sight potential heights and densities at different rates. The rates are based on site potential characteristics such as existing channel type and existing vegetation composition. Recovery is not based on natural channel recovery over time, which may take a century or more. This eliminates the error that may be associated with predicting changes, if any, that may occur in channel form, over many years. The rate of natural channel recovery is uncertain, therefore recovery timelines are based on existing channel types and vegetation. If natural channel recovery occurs in the future, objectives will be achieved sooner than expected. Active channel recovery activities (channel reconstruction, head-cut stabilizations) will speed up the recovery process. It is assumed that site potential shade will be achieved when site potential vegetation is met.

As discussed previously, A-type stream channels generally occur in upper watershed reaches with narrow, steep-sided valleys. Consequently, these channel types can almost entirely be shaded by valley landform, depending on orientation of the stream. With riparian vegetation, these channel types have high shade potentials. Recovery of shade producing vegetation should proceed rapidly where shade is lacking.

The upland slopes surrounding A-type channels are commonly vegetated with conifers and have shrubs and forbs lining the channels. On average in the Deep Creek Watershed, the dominant shade-producing vegetation types for A-type channels is Lodgepole Pine (*Pinus contorta*), Ponderosa Pine (*Pinus ponderosa*), Douglas Fir (*Pseudotsuga menziesii*), Western Larch (*Larix occidentalis*), and Grand Fir (*Abies grandis*). Average height of vegetation along A-type channels is 90-110 feet. Existing average shade for A-type channels in the Deep Creek Watershed is 48% (Table 7). For this channel type, shrubs like alder generally play a role in producing shade, yet many shrubs are not well established in the Deep Creek Watershed primarily due to past over-utilization by cattle.

B-type stream channels generally occur in stream reaches with moderate valley gradients. The upland slopes surrounding B-type channels are commonly vegetated with conifers and have shrubs and forbs lining the channels. On average, in the Deep Creek Watershed, the dominant shade-producing vegetation types for B-type channels are Lodgepole Pine and Western Larch. Average height of this vegetation is 90 to 115 feet. Subdominant vegetation types are White fir (*Abies concolor*) and Douglas fir. Average height of these vegetation types is 30-45 feet. Mountain Alder (*Alnus tenuifolia*) is present within 15 feet of these channel types and has an average height of 10 feet and appears unhealthy and dying. Ponderosa Pine was found on south facing slopes, and were approximately 130 ft in height. Average shade for B-type channels in the Deep Creek Watershed is 34% (Table 7).

C-type channels occur on gentle gradients throughout the watershed. Shade is produced mostly from sedges, rushes, and shrubs. Many deciduous trees are considered dead or remnant (partially dead with some new sprouting). Hardwood recruitment is little to none with the primary factor being livestock and big game grazing. Some shade is produced by encroaching Lodgepole Pine (average of 50 feet in height) and upper terrace areas with Ponderosa Pine (average of 100 feet in height). Average shade for C-type channels in the Deep Creek Watershed is 42% (Table 7).

Table 7. Existing and Predicted Shade Values Associated with Rosgen Channel Types for the Deep Creek Watershed.

Existing Rosgen Channel Type	Average Existing Shade (%)	Predicted Potential Shade (%)*	Increase Needed to Achieve Predicted Potential Shade (%)
A	48	80	32
B	34	75	41
C	42	60	18
D	13	70	57
E	45	65	20
G	25	70	45

* These values only include shade produced by vegetation, and do not include topographic shade.

D-type channels are relatively infrequent throughout the Deep Creek Watershed. Although infrequent, D-type channels may be major contributors to thermal loading due to high width to depth ratios. The shade producing vegetation is predominately Lodgepole Pine that is 75-90 ft tall. Other shade is produced by grasses, sedges, and rushes. Average shade for D-type channels in the Deep Creek Watershed is 13% (Table 7).

E-type channels occur on gentle gradients throughout meadow areas in the watershed. On average, sedges and rushes dominate these channel types. Additionally, these channels are narrow and deep and generally get some shade from overhanging banks. Lodgepole Pine has encroached into many of these meadow areas and produces some shade along with upper terrace Ponderosa Pines. Overhanging banks, along with sedge and rush communities that occupy the immediate banks and floodplain, produce most of the shade for E-type channels. On average, height of sedges and rushes are 1.5 to 3.0 feet. Average shade for E-type channels in the Deep Creek Watershed is 45% (Table 7).

G-type channels are degraded and have altered vegetation types. This channel type has a lower water table than was historically present, primarily due to over-utilization from livestock grazing as discussed previously. Present riparian vegetation is mostly grasses and forbs with encroaching conifer such as Lodgepole Pine (approximately 50-60 ft tall). G-type channels also receive some shade from their stream banks, due to incision. Average shade for G-type channels in the Deep Creek Watershed is 25% (Table 7).

Predicted potential shade and solar load values were developed as a reference objective for pollutant reduction needed. Predicted loading capacities were derived from potential shade values, and represents average stream heat load values projected for each channel type with site potential vegetation. Conclusions on potential shade and potential solar load values are professional estimates, derived from existing channel type and site potential vegetation. Tables 7 and 8 provide specific load allocations according to existing channel type.

Table 8. Existing and Predicted Solar Load Values Associated with Rosgen Channel Type for the Deep Creek Watershed.

Existing Rosgen Channel Type	Average Existing Solar Loading (btu/ft^2/day)	Average Predicted Potential Solar Loading (btu/ft^2/day)	Reduction Needed to achieve Potential Solar Load (btu/ft^2/day)
A	1271	489	782
B	1614	611	1003
C	1418	978	440
D	2127	734	1393
E	1345	856	489
G	1834	734	1100

Stream Flow:

In the summer months of late June through late September stream flow is attributed almost entirely to groundwater discharge. Brown (1984) noted that temperature produced by a given amount of heat is inversely proportional to the volume of water heated, or discharge of the stream. Given the current drought and the dry geographic location of the watershed, this factor is prevalent. From a heat-loading standpoint, at base flow, this condition can only be controlled by managing for desired shade and channel form conditions.

Changes in stream flow have been attributed to a number of historic activities within the watershed. Wildfire historically burned over large areas of land generating higher tree spacing with the establishment of grass communities in between. Over the last century, fire suppression techniques have lessened burned over areas, and have promoted high forest canopy/understory densities. There is a positive correlation between forest density and interception and evapotranspiration. Management activities that increase interception and evapotranspiration generally support a hydrograph that has lower peak flows with longer lag times and longer durations.

Other activities, such as road construction and timber harvest, have resulted in compaction of soils in upland and wetland areas and have decreased water infiltration and retention. Mid-slope roads and ditches have decreased retention by intercepting shallow groundwater and increasing surface runoff from storms. All of these activities result in higher peak flows with shorter lag times and shorter durations.

Within the Deep Creek Watershed, there are no Federal or private water withdrawals for irrigation or other purposes. Stream flow within the watershed will change overtime as the U.S. Forest Service implements various management practices intended to improve the timing and amount of flow, and recover or improve streamside vegetation.

Grazing and Range Management:

Historically, intensive unregulated sheep grazing took place in the Deep Creek Watershed from 1880-1907. Without the application of herders, sheep tended to stay in riparian areas, thus over-utilizing vegetation along many streams. This activity contributed to the loss of topsoil, amount of bare soil compaction of soils, stream bank degradation, and channel erosion. Beginning in 1907 and extending through the 1930's livestock grazing became regulated due to the overuse and the inception of the Forest Service in the area. A range management change occurred in the early 1960's when many of the allotments were converted from sheep to cattle. Today, the Deep Creek Watershed contains all or part of four grazing allotments (Deep, Little Summit, Happy, and Derr) with a combined 780 permitted cow/calf pairs (Figure 10).

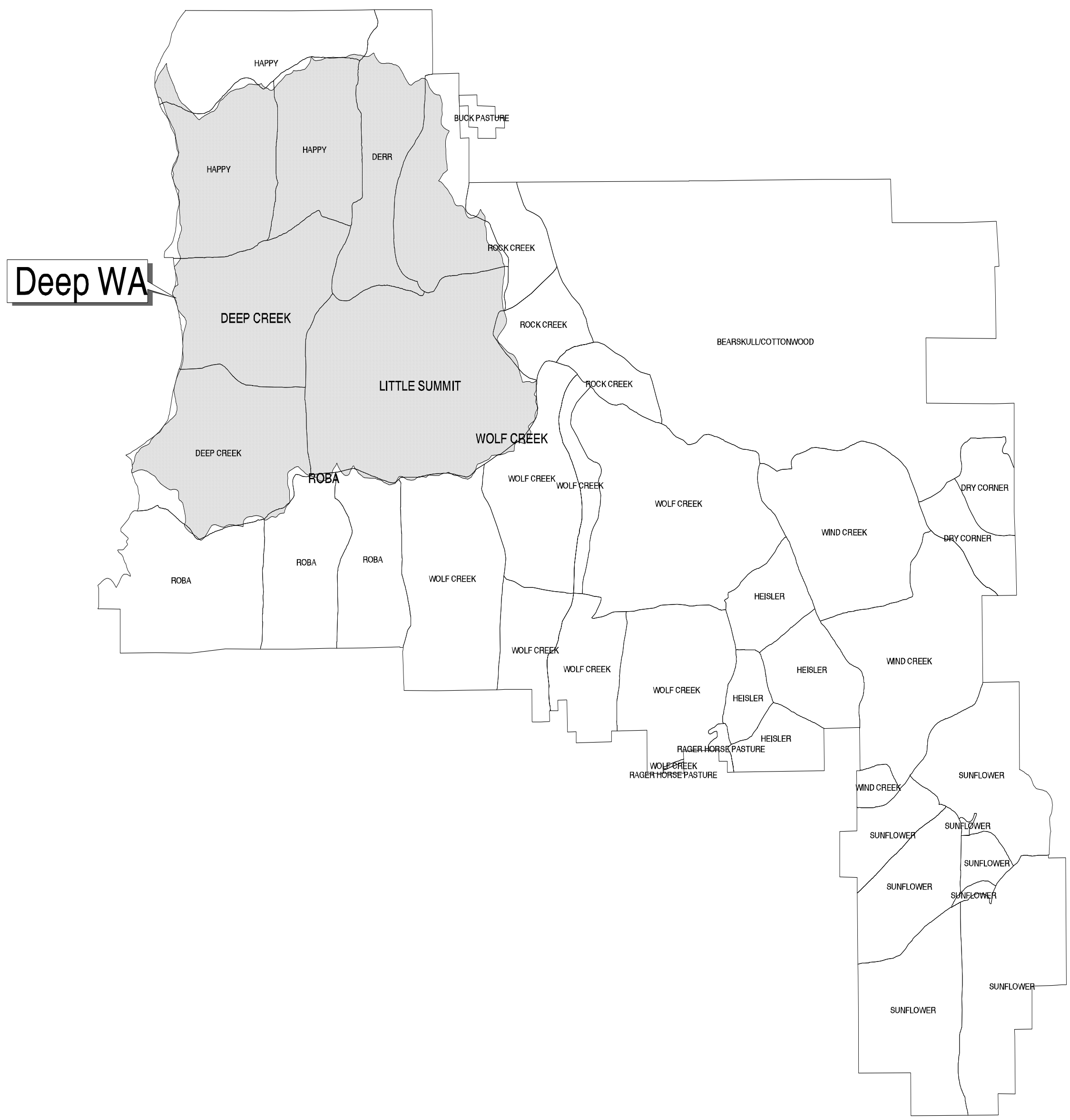
Over-utilization of stream areas by sheep and cattle has reduced the density and diversity of riparian vegetation and has left stream banks susceptible to erosion from hoof shearing, post holing, and bank sloughing. Over-utilization of streamside areas by cattle have been linked to high stream temperatures (Maloney et. al. 1999, Platts 1990 and 1991).

***Timber Harvest and Road Construction*:**

Timber harvest has occurred in the watershed since the late 1800's. Many of the practices used in the early days were based on contractors' discretion and did not fully consider elements of ecology, hydrology, and environmental science. In the mid-1900's, post-war technology and timber management policies accelerated the harvesting process. Harvest practices in the watershed from 1970 to 1980 included selection of high-risk large trees and overstory removal, and the period from 1980 and 1990 saw applications of even-age management, including overstory removal and clearcutting.

During the early years of timber harvest, there was a demand for access to locations with large wood. With limited technology and machinery, roads were built in the easiest and quickest ways. Many roads were built on floodplains and low terrace areas because of the distinctive gentle slope. Hence, many roads were

Figure 10. Existing Allotments within Deep Creek Watershed.



built in areas that would not meet the standards of today. At present, there are 190 miles of open roads within the Deep Creek Watershed. The road density for the entire watershed is 2.19 miles per square mile. For the area within 200 feet of stream channels, road density is 4.12 miles per square mile. Road density is much higher in riparian areas primarily due to the preference of building roads on gentle terrace and floodplain areas.

Fire

Fire historically has played an important role as a disturbance regime in the development of stand and landscape structure through time. Since European settlement, fire suppression has reduced the natural role of fire on the landscape. Stand composition has been altered as a result and has, generally, left the Deep Creek Watershed with higher stocked stands than historically. The amount of watershed that is currently susceptible to higher severity fire has increased as a result of changes in the abundance and continuity of fuels.

SECTION 2 - GOALS AND OBJECTIVES:

All recovery goals and objectives for this plan employ an ecosystem management strategy that maintains those components of the ecosystem that are currently functioning and improves those components of the ecosystem that are not. All goals and objectives that incorporate non-functioning systems will be restored in the shortest available time frame.

The primary goal for this watershed is the attainment of DEQ water quality standards by implementation of appropriate management practices on all water quality listed streams, at the earliest possible date. Management activities such as grazing will continue, but may me modified as discussed in Sections 3 and 4. Management practices will follow all existing standards and guidelines, as described in the Ochoco National Forest Land and Resource Management Plan (1989) and amended by the interim management strategy for Inland Native Fish (INFISH, 1995). Within INFISH, Riparian Management Objectives (RMOs) (Appendix A) provide targets toward which managers aim to achieve over time (i.e. it is not expected that the objectives would be met instantaneously). For the purpose of this document, attainment of DEQ standards is top priority, and RMOs will only provide targets (above and beyond DEQ standards) toward which managers aim to achieve over a longer period of time. When approved and signed, the Interior Columbia Basin Ecosystem Management Project (ICBEMP) will amend INFISH and become the guide for implementation.

The supporting goals for this watershed are to:

1) Reduce stream temperatures on the 303(d) listed streams to meet water quality standards or to include their range of natural variability. (Natural variability would be defined only in cases where non-anthropogenic causes, like geothermal activity, are known to be the cause for violation of DEQ standards).

2) Maintain and improve Riparian Habitat Conservation Areas (Appendix A) as defined by INFISH (1995) across the watershed so that streams approach their maximum site-potential vegetation and shade.

3) Improve aquatic habitat potential and bank stabilization through recovery of riparian vegetation and placement of Large Woody Debris (LWD).

4) Restore channel form and flow regime to mitigate elevated stream temperatures and degraded aquatic habitat.

Measurable objectives for the Deep Creek Watershed are to:

1) *Increase the riparian hardwood component along all 303(d) listed streams*.
Current plans (Draft EIS) project that 40,000 riparian hardwoods will be planted in the Deep Creek Watershed over the next several years. Of these, the U.S. Forest Service will plant 70% along streams that are listed for temperature and habitat modification. Future riparian planting will continue in designated areas and progress will be deemed acceptable, upon achievement of site potential shade, stream temperature standards, and targeted solar loads (all defined below).

2) *Attain average potential shade and targeted solar load values on all 303(d) listed streams at the earliest possible date.*
Objective 1 will assist in achievement of this objective. Existing shade and solar load values will be measured, with a solar pathfinder, at least once every five years by the U.S. Forest Service. It is projected that full achievement of this objective will take many years and will vary upon site characteristics. Progress will be deemed acceptable if shade values continue to increase and solar loads continue to decrease every five years, so that values are on track to meet milestones and full target values as discussed in Sections 1 and 4.

3) *Attain stream temperatures that do not exceed DEQ standards, or fall within their natural range, on all 303(d) listed streams at the earliest possible date.*

Objectives 1 and 2 will assist in achievement of this goal. Stream temperatures are regularly, if not annually, measured during summer months to establish long-term records. Currently, there are approximately twenty-five stream temperature monitoring locations within the watershed, eleven of which are base-line stations with longer period of record. The base-line stations include:

Deep Creek at the Mouth	Little Summit Creek at the Mouth
Little Summit Creek above Little Summit Prairie	Crazy Creek at the Mouth
East Fork Crazy Creek at the Mouth	West Fork Crazy Creek at the Mouth
Happy Camp Creek at the Mouth	Jackson Creek at the Mouth
Derr Creek at the Mouth	Toggle Creek at the Mouth
Double Corral at the Mouth	

Progress will be gauged by how shade and stream temperature values change over time. An evaluation will occur every five years to assess progress. Stream temperatures need to decrease so that a trend indicates full achievement of water quality standards in the long-term. The collection of stream temperatures will continue on at least an annual basis in the summers, and will continue to be administered by the Paulina Ranger District and implemented by the District Fisheries Biologist.

4) *Maintain and/or assess the effectiveness of Allotment Management Plans (AMPs) to assure progress toward water quality standards and riparian area recovery.*

AMPs will be assessed to reinforce compliance with INFISH. Furthermore, the Grazing Implementation Monitoring Module (GIMM 2000) will be assessed to ensure an implementation monitoring strategy that documents compliance with INFISH. The GIMM incorporates measurement protocols for stubble height, bank alteration, and riparian shrub use. This module states that all three of these indicators are to be measured at least once at the end of each growing season, and are important indicators when considering the goals of this plan. The GIMM also classifies pastures into three categories (Appendix B) to prioritize land management agency monitoring efforts.

Further guidance, with consultation from National Marine Fisheries Service (NMFS) and the United States Fish and Wildlife Service (USFWS), led to the development of a Programmatic Biological Assessment (2001), which amends the stubble height monitoring protocol from GIMM. The Programmatic BA states that stubble height will be monitored at least two times per year (post-stocking and end of growing season). However, the Paulina Ranger District has elected to monitor three times per year (pre-stocking, post-stocking, and end of growing season).

Progress will be deemed successful upon completion of revised AMPs and compliance with INFISH, GIMM, and Programmatic BA guidelines. Compliance may require exclusion of cattle (fencing) from sensitive areas or riparian pasture management where grazing is controlled in short durations (i.e. two week period).

5) *Restore degraded channel form to improve aquatic habitat potential at the earliest possible date.*

Objectives 1 and 4 will assist in achievement of this goal. Active stream restoration projects (i.e. channel reconstructions, head-cut stabilizations, road decommissionings, culvert replacements) have been completed in the Deep Creek Watershed and are projected to continue on an annual basis. Streams will be prioritized based on restoration potential, as discussed in Section 3.

Large woody debris placement is projected to occur over the next five years. LWD will be used to reinforce active stream channel reconstruction and stream bank stabilization. Streams with active channel reconstruction and with the least LWD will be the highest priority. Progress will be deemed successful upon decreasing the mileage of degraded channel form and increasing the LWD values such that an upward trend continues into the future. All restoration projects will be carried out and monitored by the Deschutes/Ochoco National Forest.

SECTION 3 - PROPOSED MANAGEMENT MEASURES:

As mentioned previously, all management measures will require proper adherence to regulations and standards and guidelines, as described in the Ochoco National Forest Land and Resource Management Plan (1989) and amended by INFISH. Future recovery and guidance is projected to occur under the Interior Columbia Basin Ecosystem Management Project (currently unsigned). All restoration activities will require analysis under the National Environmental Policy Act (NEPA).

The following applications are included as part of this Water Quality Restoration Plan and Deep EIS. Inclusion of these activities in a Restoration Environmental Analysis will occur within the next two years.

1. Riparian Hardwood Restoration – Riparian plantings are prescribed to: increase the riparian hardwood component along selected stream reaches (Objective 1), increase shade and decrease solar loading (Objective 2), decrease water temperatures (Objective 3), and promote bank stability (part of Objectives 4 and 5). Within the past 5 years, the Paulina Ranger District has planted 8,000 hardwood shrubs in riparian areas in the Deep Creek Watershed. Approximately 1600 shrubs were planted in Timothy and Toggle meadows in 2000.

Current plans (Deep EIS) project that 40,000 riparian hardwoods, over 28 miles, will be planted in Deep Creek Watershed over the next several years (Figure 11). Of these, 70% will be planted along streams that are water quality limited. Highest priority will be streams that are water quality limited, have degraded channel form, and lack riparian vegetation. Greatest reductions in thermal loading, per unit input of labor and materials, will occur along the over-widened and poorly shaded stream reaches. Restored riparian hardwoods in upper stream reaches will serve as shade sources for downstream reaches. Native hardwood species such as willow, alder, cottonwood, aspen, and others will be planted and protected from browsing by a combination of tubing, cages, fencing, and/or high density planting.

2. Springs and Wetlands Protection/Development – In accordance with the Forest Plan, water developments are occurring across the forest to improve availability of upland water to cattle on range allotments. Many improvement projects have included exclusion fences around springs and riparian areas for added protection (i.e. Timothy and Toggle meadows). In addition, riparian pasture fences are being designed to allow short duration grazing, as well as, facilitate stream recovery. Old watering tanks that were located in channels or riparian areas are being/will be relocated to xeric, upland areas. These types of management measures are projected to continue throughout the watershed as administered by the Paulina Ranger District. The protection of springs, seeps, and wetland areas will improve the abundance of vegetation around those areas (Objective 1), increase shade and decrease solar input (Objective 2), improve stream temperatures (Objective 3), minimize grazing disturbance (part of Objective 4), and protect aquatic habitat (part of Objective 5)

3. Channel Stabilization and Fish Habitat Improvement – Stream improvement and stabilization projects have been completed in the Deep Creek Watershed. For example, a stream restoration project occurred on Happy Camp Creek, which entailed stabilizing a 5-foot head-cut in a wet meadow. The next phase of this project will be to explore long-term solutions, such as, reconstructing a new channel that will bypass the head-cut and gully, therefore, restoring the old floodplain.

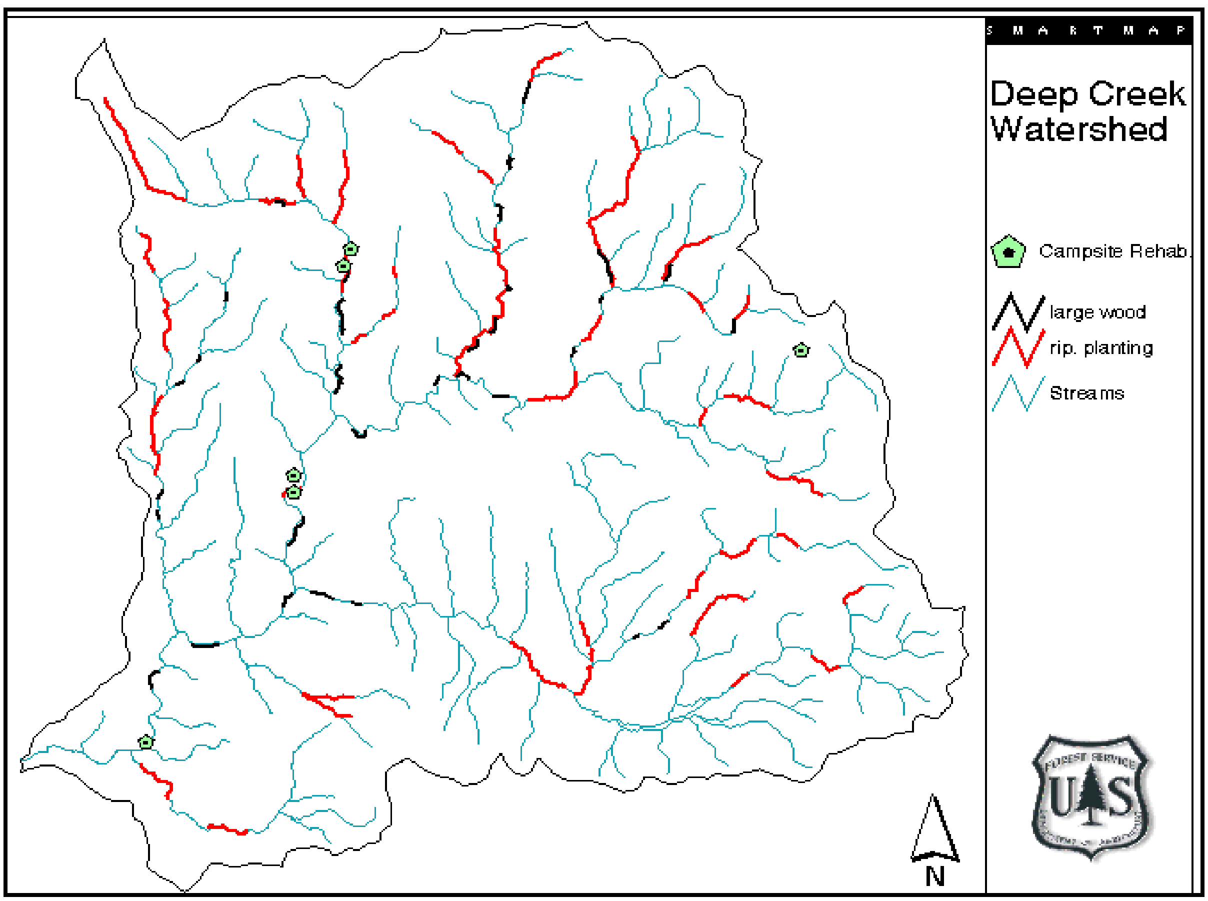
Channel stabilization projects, such as this one, decrease further channel erosion and prevent lowering of the existing water table (part of Objective 5). As described previously, channel incision has been shown to lower the existing water table and reduce and/or eliminate riparian vegetation. Hence, prevention of channel incision and restoration of channel form can facilitate healthy riparian vegetation (part of Objective 1) capable of providing shade for decreasing stream temperatures (Objectives 2 and 3). Restoration projects like Happy Camp Creek are prevalent throughout the watershed and will continue on an annual basis, as administered by the Paulina Ranger District.

Future stream restoration activities will involve a number of channel reconstructions, cutbank revetment, headcut stabilization, riparian fencing, and spring development projects. Channel reconstructions will have the objective of restoring reaches of G to E stream types (i.e. Happy Camp Creek) and D to C stream types (i.e. Jackson Creek). Cutbank revetment will involve constructing structures (rootwad revetment, boulder/log veins, etc.) that decrease or eliminate undesired bank erosion (i.e. Derr Creek, Haypress Creek, Happy Camp Creek, Double Corral Creek, and Jackson Creek). Headcut stabilization will usually involve constructing a boulder step pool configuration out of the "knick" point area (i.e. Derr Creek, Happy Camp Creek, and Thornton Creek). Riparian fencing will involve creating cattle exclosures (eliminate utilization) and/or riparian pastures (short duration grazing) with the objective of increasing stream bank stability and shade.

Channel stabilization and reconstruction will also include the placement of LWD. Eight miles of LWD placement on various streams will occur within the next 5 years and is included in the Deep EIS (Figure 11). LWD placement will improve fish habitat and water quality by increasing the frequency of pools and cover, improving width to depth ratios by stabilizing stream banks (part of Objective 5), and increasing shade (Objective 2, and indirectly part of Objective 3).

Highest priority for channel reconstruction will be given to those areas that are contributing the most toward water quality degradation, then to those that pose a risk to water quality. Other essential management considerations with regard to channel stabilization are livestock grazing, road crossings, and undersized culverts. These elements are discussed below.

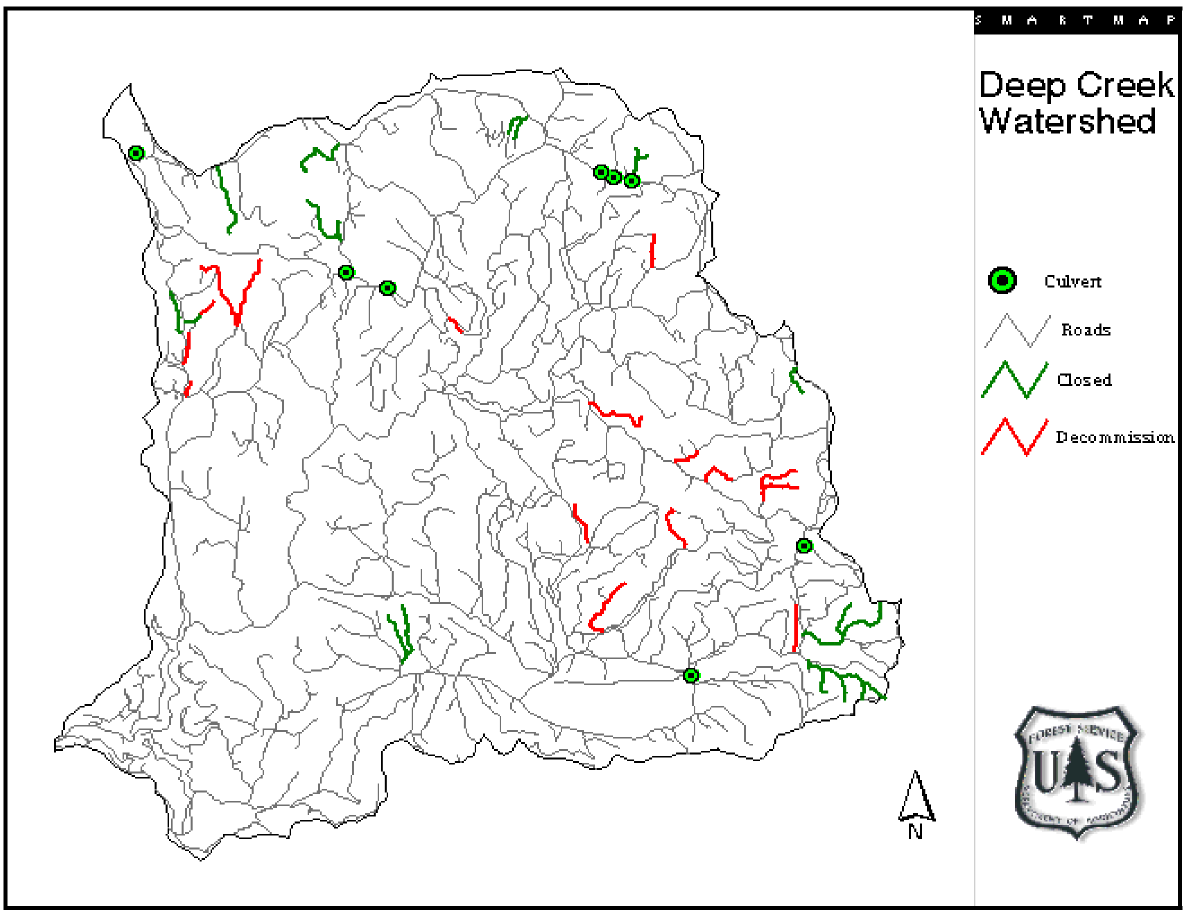
Figure 11. Locations where Riparian Plantings, Large Woody Debris Placement, and Campsite Rehabilitation will occur.



4. Road Crossings, Closures, and Culvert Replacements – There are over 260 existing and former road crossings on perennial and intermittent streams in the Deep Creek Watershed. Many crossings lack shade immediately upstream and downstream from the crossings due to road maintenance and safety practices. Pools below culvert outfalls are often not shaded, and obliterated crossings (where culverts have been removed) commonly have shallow channels with no bank vegetation. This plan proposes that road design, maintenance, and obliteration practices will include measures to establish shade on upstream and downstream areas and along banks when roads are closed (Objective 2, and part of Objectives 1 and 3), and restore channel form by connecting channel gradient from above and below replaced culverts (Objective 5). Restoration will occur where crossings have been removed and where new culverts are designed to accommodate 80 to 100-year flood events. Riparian hardwood shrubs will be favored.

This plan, along with the Deep EIS, plan to hydrologically close approximately 16.2 miles of road (Figure 12) to improve water quality. Hydrologic road closure will involve culvert removal, water barring, scarification, tank trapping, and organic coverage. The EIS also includes decommissioning 15.2 miles of road within the watershed (Figure 12). Decommissioning activities will involve removal of culverts and complete removal of the road prism from the system (usually done by recontouring). Eight culverts are scheduled for replacement under the Deep EIS. These culverts will provide fish passage and have proper hydrologic function at the road crossing (sized in order to move flood flows at an 80 year or greater magnitude).

Figure 12. Locations of Culvert Replacements and Closed/Decommissioned Roads within the Deep Creek Watershed.



5. Grazing/Allotment Management Measures – In 1999 the Ochoco National Forest initiated the mandatory Grazing Implementation Monitoring Module (GIMM) to gain compliance with the Endangered Species Act (ESA), INFISH, and Biological Opinions from NMFS and USFWS. The GIMM, as outlined in the 2001 Programmatic Biological Assessment (BA), incorporates the monitoring of stubble height, bank alteration, and riparian shrub use. As a result of administering these elements for the last two years, allotments have had reduced cattle numbers (10-20%) and all allotments have had shortened grazing seasons to remain within the standards. The practical effect of enforcing these standards is to reduce browsing on hardwoods during August and September.

In addition to GIMM and the Programmatic BA, revised AMPs are projected to decrease cattle numbers over the next 2 to 5 years in compliance with projected agreements between Paulina Ranger District and permittees. Most AMPs will have an objective of attaining 80% stream shade, or 100% of the potential where the potential is less than 80%, and to reduce stream erosion to not more than 20% of the total length. Currently the Paulina Ranger District has an allotment timeline and strategy in place that will be updated in the next two to three years. It is expected that the elements within this WQRP will be included in the revised AMPs.

All pastures within the Deep Creek Watershed will maintain certain stubble height requirements along green lines, as defined in the Programmatic BA. The grass communities will maintain stubble height of 4 inches at the end of the growing season, while the rush/sedge communities will maintain at least 6 inches at all times of the year. Pastures must not exceed 10% bank alteration (hoof shearing, post holing, bank sloughing, and any other livestock causal activity) in any monitored area. Incidence of riparian shrub/hardwood (alder, willow, aspen, cottonwood, etc.) utilization along streams will be less than 30%. The purpose of all three required elements in the Programmatic BA is to promote stream bank stability and increase the potential for bank building through establishment of vegetation (part of Objectives 1 and 5), increase riparian surface area coverage (shade) within the stream channel (Objective 2), promote lower stream temperatures (Objective 3), and to assess the AMPs (Objective 4).

All Annual Operating Plans that are based upon the 1990 and 1991 AMPs include the Forest Plan requirements to plan, apply, and monitor Best Management Practices, and encourage range improvements that disperse livestock away from riparian areas. With compliance to the Forest Plan, INFISH, GIMM, the Programmatic BA, and updated AMPs, the impacts to riparian areas and wetland features will lessen.

6. Timber Management Measures – In compliance with INFISH, all streams in the Deep Creek Watershed have designated Riparian Habitat Conservation Areas (RHCAs) on each streamside. The area of land to be managed as RHCAs is 6,332 acres, 11.4% of the Deep Creek Watershed. The width of each RHCA depends upon the type of stream present (Appendix A).

In addition to RHCA buffer width standard and guidelines, timber management and harvest practices will minimize the removal of shade from streams by protecting trees that shade channels between the solar hours of 0800 and 1600 (Objective 2, and indirectly part of Objective 3). This management approach is consistent with INFISH standards and guidelines and will meet the Riparian Management Objectives in Appendix A. Approximately 80% of the solar input into streams occurs between 0800 and 1600 hours (i.e. when the solar altitude is greater than 38 degrees) during the summer period of July 1 – August 15 (maximum water temperatures) (Brown and Brazier, 1972). The ability of a tree to shade a stream between 0800 and 1600 hours depends upon the height of the tree, the distance of the tree from the stream, and the canopy crown and density.

Table 9 was developed by as a guide for determining whether trees near or in riparian areas may be harvested without significantly reducing shade to the stream, or whether trees will attain increases in shade over the long term. The table was developed for the month of July and does not consider stream aspect. Table 9 was incorporated into the Deep EIS. Provisions of the EIS permit removal of shade trees for attainment of RMOs (i.e. increase hardwood vegetative composition in order to increase shade during summer months and increase bank stability).

Table 9. Matrix for Identifying Trees that Provide Shade to Streams*.

Distance from Stream (ft)	**Least Height (ft) of Trees that Provide Shade Between 0800 and 1600 Hours Solar Time** ***Slope Away from Stream, (%)***						
	0	**5**	**10**	**15**	**20**	**30**	**40**
1	0.8	0.75	0.70	0.65	0.60	0.50	0.40
5	4	3.8	3.5	3.3	3.0	2.5	2.0
10	8	7.5	7	6.5	6	5	4
25	20	19	17	16	15	12	10
50	40	37	35	32	30	25	20
75	60	56	52	40	45	37	30
100	80	75	70	65	60	50	40
120	100	94	87	81	75	62	50
150	117	110	102	94	87	72	57
200	156	147	135	126	116	96	90

* This table was produced by James Seymour, Hydrologist, Ochoco National Forest.

The Ochoco National Forest currently plans to reduce upland stand and canopy densities in the Deep Creek Watershed in order to achieve historical stand densities. Mechanical harvest and prescribed burning will be used to reduce vegetation density. In some cases, prescribed burning will occur within Riparian Habitat Conservation Areas, as long as Riparian Management Objectives are met and there are no short or long-term impacts on water quality. Impacts will be monitored for. A strong correlation between tree density and intense fires and disease indicates that existing stand densities pose a risk for damage and loss of resources.

Research by Troendle et al. (1998), Troendle and Olsen (1993), and Troendle and King (1987) found that when a watershed approaches 25-40% harvest, reductions in net evapotranspiration resulted in higher seasonal streamflows, and that the duration of higher, near bankfull, discharges were extended. Slight increases in base flow, due to stand reductions, will probably not extend into later summer months. Hence, decreases in summer stream temperatures due to increased base flow would not likely occur. There are many elements that will determine how upland harvest will affect stream temperature. All activities that may affect stream temperatures will be monitored for.

7. Other Management Measures - The Deep EIS has targeted six dispersed campsites for closure or rehabilitation (Figure 11). These sites have been identified as a source of compacted floodplains, bank erosion, and loss of riparian hardwoods (violating Objectives 1, 2, 3, and 5).

Margin of Safety:

A certain degree of precaution ("margin of safety") has been incorporated into all the above management activities. For management of shade producing vegetation in the riparian areas, it is apparent from research that the most effective zone for shade producing vegetation and for future supplies of large wood along streams is within 100 feet of streams (FEMAT, 1993; Beschta et. al, 1987). Minimum RHCA widths for the Deep Creek Watershed exceed this value for all listed streams (category 1 streams) by a minimum of 200 ft on each side. For category 2 and 3 streams, RHCA widths exceed the 100 ft by a minimum of 50 ft on each side. Category 4 streams require a minimum RHCA width of 50 ft on each side. The majority of the watershed (approximately 80%, including all water quality limited streams) has RHCA widths that exceed the 100 ft effective shade/LWD zone.

Additionally, all target load allocations from Tables 7 and 8 are based on the highest possible solar input value for locality (2445 btu/ft^2/day, from Table 5). Also, measured shade values represent conditions in the period of maximum loading. Both of these reinforce that reductions in solar loading are most likely overestimated.

For the development of potential shade and solar load values, topographic shade was not considered. Topographic shade varied dramatically throughout the watershed, therefore was factored out of the analysis. With the inclusion of topographic shade, most streams will likely achieve shade potential values at an earlier date than expected. Also, targeted shade and solar load values do not include possible small gains from projected increases in woody debris.

As discussed previously, riparian vegetation recovery is based on existing channel type and vegetation. Recovery is not based on natural channel recovery over time, which may take a century or more. This eliminates the error that may be associated with predicting changes, if any, that may occur in channel form, over many years. The rate of natural channel recovery is uncertain, therefore recovery timelines will be based on existing channel types and vegetation. If natural channel recovery occurs in the future, objectives will be achieved sooner than expected. Active channel recovery activities (channel reconstruction, head-cut stabilizations) will speed up the recovery process.

Discussed in Section 4, shade modeling only included the dominant vegetation type(s) for each Rosgen channel type. Hence, load reductions are most likely overestimated because shade from less dominant vegetation types was not modeled. In situations where there was a co-dominance of existing shade, two model simulations were performed.

SECTION 4 – TIMELINE FOR IMPLEMENTATION:

In the Land and Resource Management Plan of 1989, the Ochoco National Forest committed to long-term goals of restoring riparian areas, protecting stream temperatures, protecting and improving stream shade, and controlling channel erosion and instability. Subsequent planning documents and guidelines, including INFISH, broadened or strengthened the provisions of the Forest Plan. Riparian improvement projects, including channel stabilization and hardwood reforestation, have been completed in the past and are projected into the future. Specific activities designed to improve conditions on the ground will require analysis under the National Environmental Policy Act (NEPA). The timing and implementation of these activities will depend on the NEPA process (public scoping, revisions, etc.) and funding.

The following section establishes a timeline for implementation of management measures and achievement of milestones and goals/objectives.

1. Riparian Hardwood Restoration – Implementation has been ongoing for the past five years and will continue in the future. The Deep EIS stipulates that 40,000 riparian hardwoods will be planted within the next several years. Upstream reaches with degraded channel form and low riparian vegetation density will be top priority. Upstream reaches will serve as shade sources for downstream reaches. Recovery time for full achievement of riparian restoration will ultimately depend upon the recovery of shade. Therefore, riparian restoration will continue until existing shade has achieved site potential. Alder, willow, dogwood, cottonwood, and aspen will generally be the hardwood species to be planted. A combination of tubing, cages, fencing, and/or high density planting will help minimize the effects to new seedlings as a result of grazing.

Stream Segment Shade Model (SSSHADE) version 1.4, by Theurer et al (1984) and revised by Bartholow (1997), was used to assess whether or not site potential vegetation could produce predicted shade and solar load values. One or two model simulations were performed on each Rosgen channel type. All model parameter values were average values found in the Deep Creek Watershed for the Rosgen channel type of interest. Topographic shade was not modeled, as discussed previously.

For A-type stream channels, the recovery of shade producing vegetation should proceed rapidly where shade is lacking. Average height of existing vegetation along A-type channels is 90-110 feet and average existing shade for A-type channels in the Deep Creek Watershed is 48%. Kovalchik estimates that the 100-year site index for this vegetation composition (Ponderosa and Lodgepole Pine with Mountain Alder) is 120 to 130 feet tall. Furthermore, Kovalchik (1987) states that when cattle are stocked at 40% forage utilization, the vegetation can return to late seral or better ecological status in 10-20 years. It is presently projected that A-type channels will attain the predicted potential shade value (70-80%) within 15-20 years. In 5 and 10 years, shade values should approximate 58-60% and 68-70%, respectively. Milestone values are predominately based on the incremental increase of tree height over time.

From SSSHADE, it appears that the potential vegetation is capable of producing 70-80% shade, excluding topographic shading (Figure 13). This simulation takes into account only the dominant shade producing vegetation.

The existing average shade for B-type channels is 34%. Kovalchik (1987) gives a 100-year site index of 120 feet and states that two or three years of grazing rest will restore the vigor of surrounding shrubs, grasses, and forbs, and allow for recovery where needed. It is predicted that most B-type channels will attain their potential shade (65-75%) within 20 to 30 years. In 5 and 10 years, shade values should approximate 40-45% and 50-55%, respectively. At 15-20 years, shade values should approximate 63-66%. SSSHADE reinforces that this shade potential is achievable (Figure 14). The simulation is based on the dominant shade producing vegetation.

Figure 13. Potential Shade Prediction for Rosgen Type-A Channels in the DeepCreek Watershed.

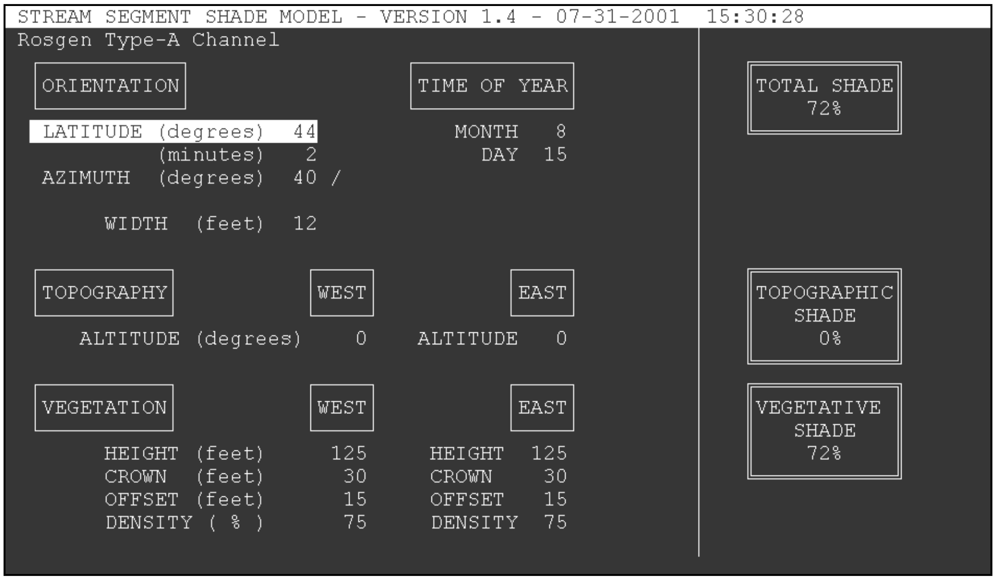
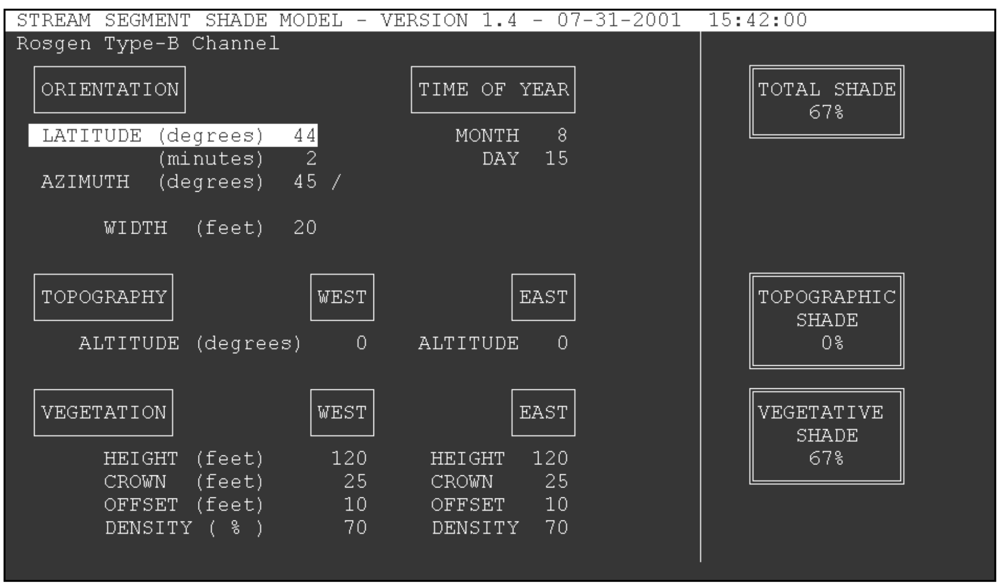


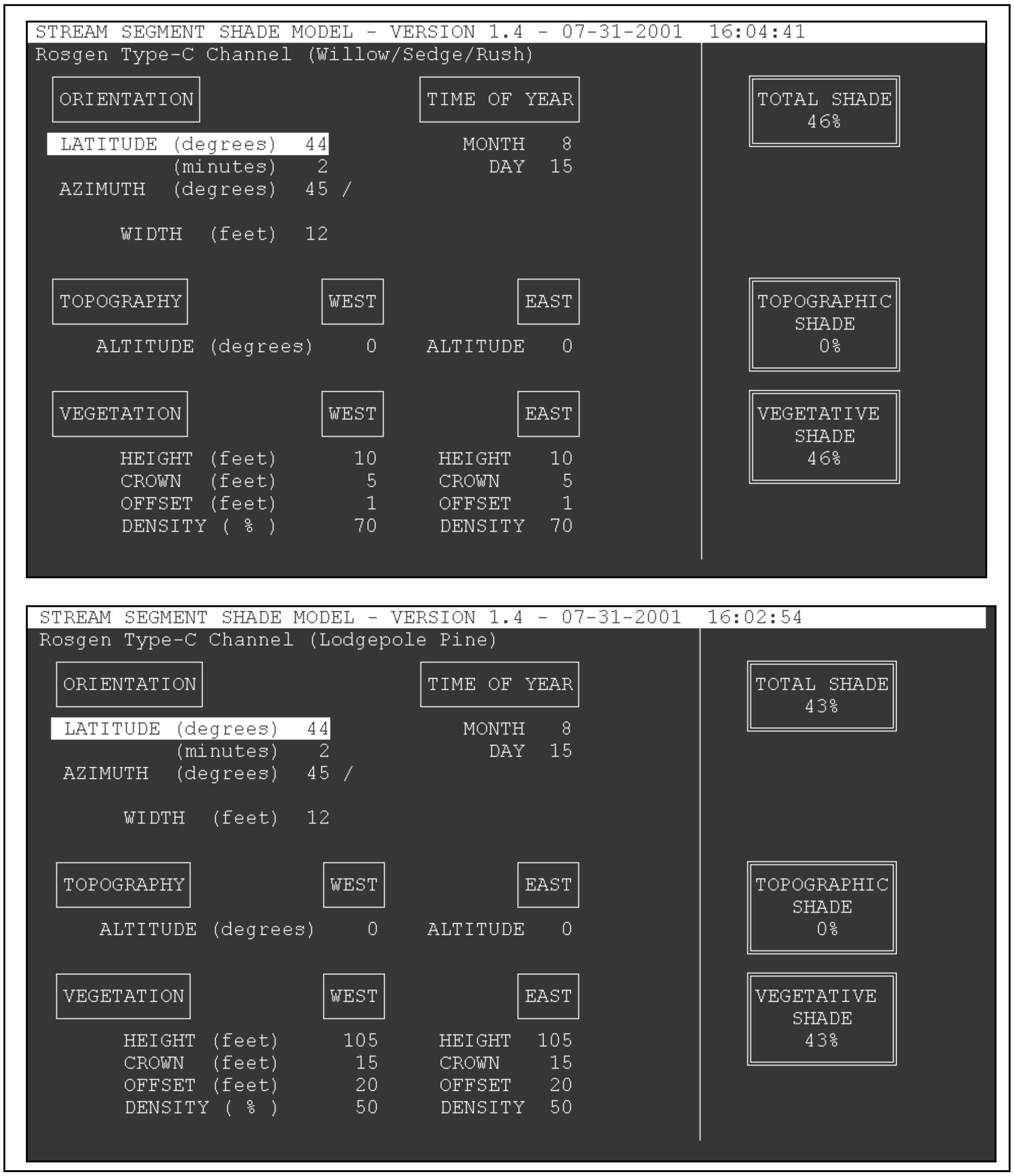
Figure 14. Potential Shade Prediction for Rosgen Type-B Channels in the Deep Creek Watershed.



The existing shade for C-type channels is 42%. Kovalchik (1987) estimates a 100-year site index of 105 feet for the Lodgepole pine and states that rest and late-season grazing is needed to allow grasses, sedges, rushes, and forbs a better ecological status. It is estimated that 15 to 20 years will be required to establish potential vegetative shade (60-65%) along these channels. Although this value may seem low, it is representative of potential shade on C-type channels in the Deep Creek Watershed, due to current grazing practices. This value does not include topographic shade. In 5 and 10 years, shade values should approximate 48-50% and 54-56%, respectively.

Due to model limitations and co-dominance of vegetation type, C-type channels were modeled twice. The first simulation was run with willow, sedge, and rush as the vegetative component and the second simulation was run with Lodgepole Pine as the vegetative component. Some combination of these two vegetation types should yield 60-65% shade (Figure 15).

Figure 15. Potential Shade Prediction for Rosgen Type-C Channels in the Deep Creek Watershed.



D-type channels have an average shade value of 13% in the Deep Creek Watershed. With an average width to depth ratio of greater than 40 within the Deep Creek Watershed, these channel types will require some sort of active restoration. Site potential height for the dominant existing vegetation is 120 ft. Site potential vegetation will not be adequate in providing enough shade in these channel types. Active channel restoration will accelerate the recovery process by reducing width to depth ratios. Restoration will include riparian planting and channel reconstruction. Shade values will immediately increase upon completion of restoration. D-type channels will be restored to C-type channels (some may be converted to B-type channels, depending on substrate, gradient, and valley type). Figures 16 and 17 demonstrate the changes that will take place when a D-type channel is converted to a C-type channel.

Figure 16. Changes Associated with Converting a D-Type to a C-Type Channel (Rosgen 1996).

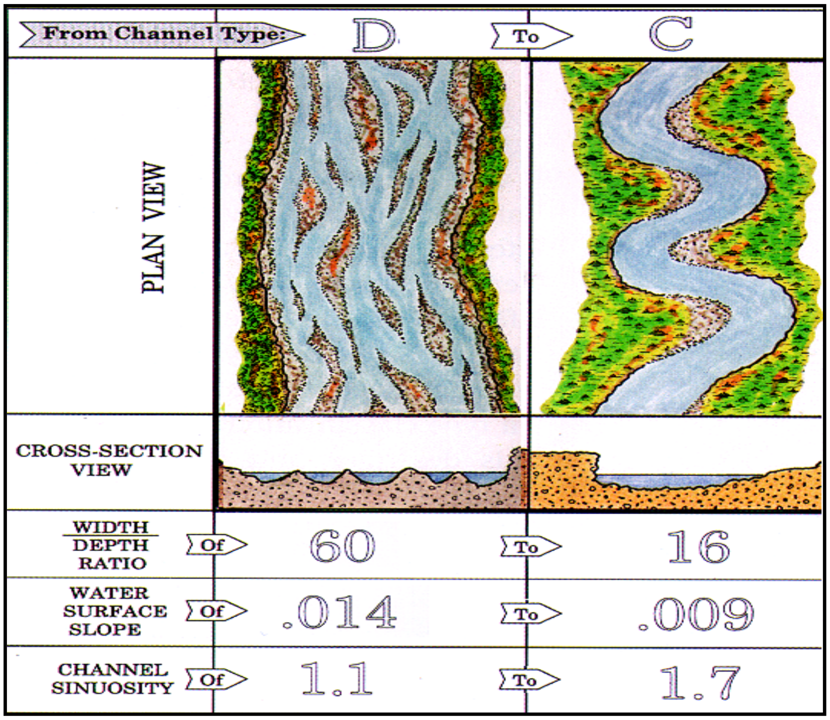


Figure 17 demonstrates how SSSHADE predicts shade to change by adjusting stream width from the average stream width of a D-type channel to the average width of a C-type channel. With active restoration (lowering width to depth ratios and planting riparian vegetation), it is assumed that these channels will attain potential shade values (60-65%) within 15-20 years. Figure 15 shows that C-type channels are capable of 60-65% shade.

Existing E-type channels have 45% shade and are projected to attain potential shade values (60-65%) within 10-15 years, with appropriate grazing and road crossing management. This value is representative of E-type channels in the Deep Creek Watershed, with current grazing practices. With low width to depth ratios, these streams will achieve shade potential much quicker than other stream types, especially where riparian plantings are done. In 3 to 4 years and 6 to 8 years it is expected that shade values will approximate 49-52% and 54-57%. In a pristine (or more of a historical) situation these channels will be heavily influenced by topographic and vegetative shade from overhanging banks, which may have raised potential shade to above 80%.

A co-dominance in vegetation type exists with E-type channels. Hence, two simulations were performed. The first simulation was performed with sedges and rushes as the dominant shade producing vegetation type, and the second with alder and willow (Figure 18). A combination of the vegetation types should yield 60-65% shade, with current grazing management.

Figure 17. The Predicted Change in Shade Associated with Changing Stream Width, as with Converting a D-Type to a C-Type Channel.

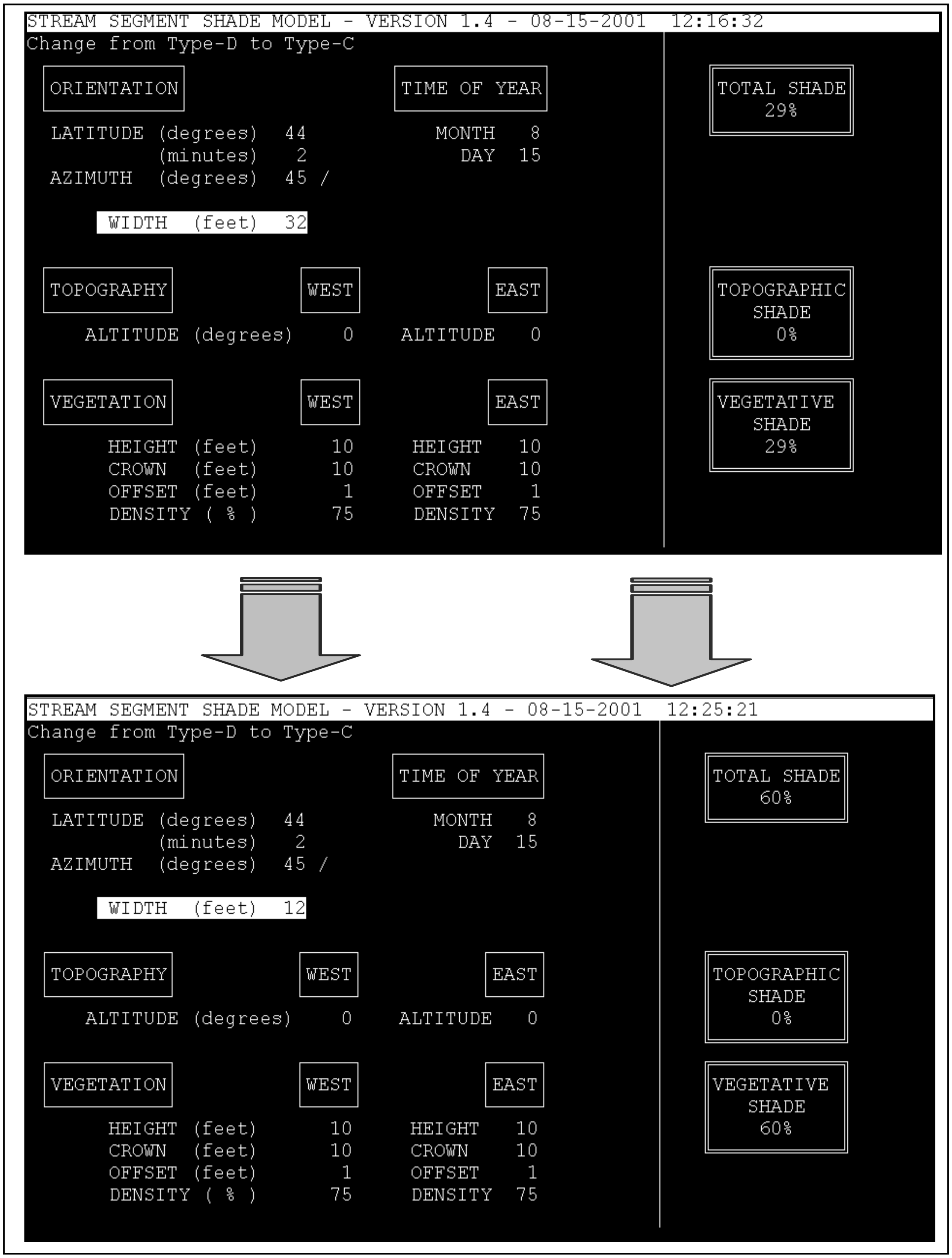
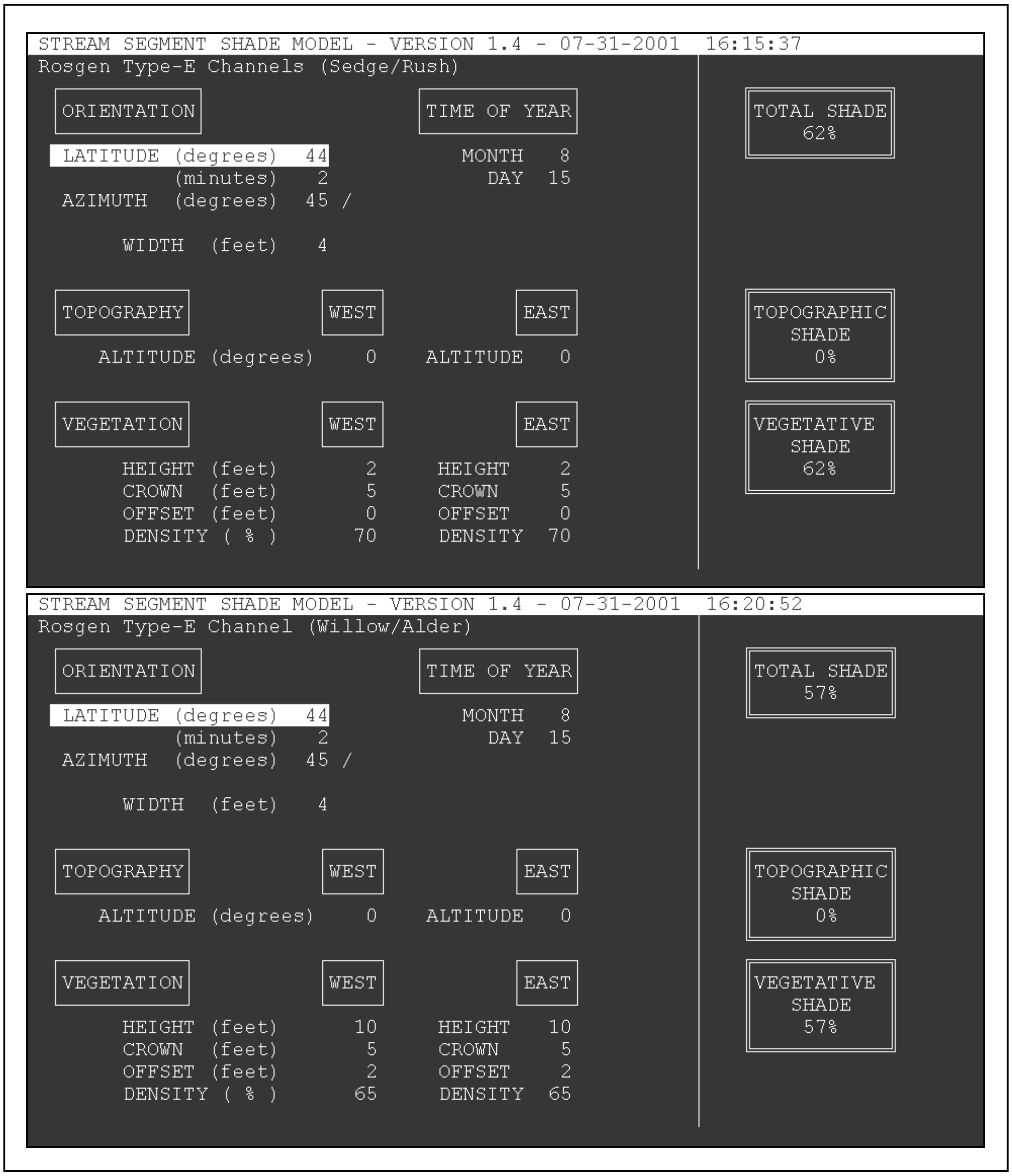


Figure 18. Potential Shade Prediction for Rosgen Type-E Channels in the Deep Creek Watershed.



Existing shade for G-type channels is 25%. These channels are high priority and will, at some time, require active restoration. Reestablishment of riparian vegetation will be difficult in areas where the water table has dropped below rooting depth, however active channel restoration projects will mitigate this concern by restoring channel floodplains and width to depth ratios typical of C and E-type streams. Exclusion of cattle, for some length of time, may be necessary to establish riparian vegetation. With active channel restoration, it is predicted that these channel types will reach shade potential (65-75%) in 20-25 years. Upon completion of restoration, shade values will immediately increase (due to riparian planting). Restoration will favor C and E-type channels. If left alone, G-type channels may not reach shade potential for a century or more.

2. Springs and Wetlands Protection/Development – Protective measures have been implemented in the past, and will continue in the future. Relocation of cattle watering tanks is projected to continue, and occur over the next several years to ensure protection of springs and wetlands. Cattle and wildlife exclosure fences will be implemented as needed and recommended by specialists. An estimated 7 to 10 spring development projects will occur throughout the Deep Creek Watershed. Spring development projects will provide off-channel watering opportunities for livestock and will decrease impacts cattle have to riparian areas.

3. Channel Stabilization and Fish Habitat Improvement – Implementation over the last several years has occurred, and will continue to occur in the future. Past stream restoration efforts have included headcut stabilizations, livestock exclosures, and creating riparian pastures.

Several head-cut stabilization projects (estimated number of 20 to 25) are projected to occur in the late summer to early fall of 2002 through 2007. Headcut restoration will deter channel incision and decrease the generation of sediment resulting from headcut advancement upstream. Restoration will generally involve constructing boulder step pool structures (defined by Rosgen 1996) that are designed for fish passage.

Large woody debris placement will occur within the next five years (8 to 12 miles) and will continue in the future in conjunction with channel reconstruction projects. Large woody debris placement will assist in bank stabilization, improving fish habitat and sediment storage, and slowing hydraulic gradients. Cutbank stabilization structures (designed to take discharge pressure off of eroding stream banks) utilizing large wood will occur in the form of rootwad bank revetment and log veins. Planting riparian vegetation will also assist in achieving bank stabilization and improving fish habitat.

Channel reconstruction will be utilized in an estimated 2 miles of stream reaches. Selective channel reaches will typically be converted from G to E and D to C stream types. Reconstruction activities will increase the streams ability to recover to the desired pattern, profile, and dimension.

4. Road Crossings, Closures, and Culvert Replacements – All road closures, decommissions, and culvert replacements will occur between 2002 and 2012. An estimated 40 miles of closure/decommissioning activities and 15 to 18 culvert replacements will occur within the Deep Creek Watershed. Hydrologic road closures will involve pulling culverts, constructing water bars, scarification, entry blockage, etc. Decommissioning will involve eliminating the road prism and all road crossings. Culvert replacements will allow streams to adequately pass flood flows and associated bedload.

5. Grazing/Allotment Management Measures – Implementation of monitoring stubble height, bank alteration, and riparian shrub is already in effect. This will continue at least three times a year (pre-stocking, post-stocking, and post-growing season. All AMP revisions are projected for completion within the next couple years (Table 10). Since the GIMM was implemented on the Paulina Ranger District in 1999, management trends have occurred for the improvement of riparian areas. Implementing GIMM

Table 10. Targeted Completion Dates for Revised AMPs in the Deep Creek Watershed.

Allotment	Targeted AMP Completion
Deep	2004
Happy	2004
Derr	2004
Little Summit	2004

standards have resulted in cattle removal from Deep Creek Watershed allotments an average of 15 days earlier than normal. Allotments or pastures that did not meet standards (i.e. 4 inches at the end of the growing season) were required to take reductions in cattle numbers (average of 10 percent) the following year, or rest the pasture. These management decisions in response to not meeting monitoring requirements are expected to continue in the future.

6. Timber Management Measures – Implementation is currently in effect and will continue in the future. Modification to timber management will occur over time with data collection (adaptive management). Currently conifer stand management practices involve implementing Riparian Habitat Conservation Area treatments based on Riparian Management Objectives (appendix A). Timber is currently managed for desired future vegetation conditions as discussed in the Forest Plan. Prescriptions such as thinning from below are utilized to restore historic conditions.

7. Other Management Measures – Six dispersed campsites will be closed or rehabilitated in the next two to three years. Campsite rehabilitation/closure will involve scarification, blockage, or other means necessary to de-compact floodplains and decrease fine sediment input to streams from these areas.

Implementation of most of these management activities is currently in effect. Those that aren't in affect will occur at the earliest time in the near future. It is understood that several decades may be necessary for recovery of riparian vegetation and compliance with water quality standards. Channel recovery and stabilization by natural processes will likely occur over time, yet it is very difficult to predict when such an event will occur, and to what degree the vegetative component will respond.

SECTION 5 – IDENTIFICATION OF RESPONSIBLE PARTIES:

The U.S. Forest Service is the predominant landowner in the watershed (98%). The U.S. Forest Service will implement all actions identified in the plan and will be responsible for restoration conditions. The District Ranger for the Paulina Ranger District is the responsible official for implementation of this plan on the National Forest.

In regard to grazing, the U.S. Forest Service will coordinate with all permittees and enforce regulations as described by all standards and guidelines. Private landowners (2% of watershed) are not required to follow the specific provisions contained in this plan, although they will be notified of, and encouraged to participate in management practices and restoration projects on both U.S. Forest Service and private lands.

The load allocations within this WQRP should become another building block towards acceptable water quality and healthy riparian areas. Efforts to implement this plan will be shared with Oregon state natural resource agencies, Federal agencies, local landowners, and the Crooked River Watershed Council. Other parties that may take volunteer partnership in this plan include Ochoco Trout Unlimited, Oregon Department of Fish and Wildlife (ODFW), Oregon Water Enhancement Board (OWEB), Deschutes Resources Conservancy (DRC), U.S. Fish and Wildlife Service, and National Fish and Wildlife Foundation. These partnerships will provide a very important tool to involving the public in this WQRP.

SECTION 6 – REASONABLE ASSURANCE OF IMPLEMENTATION:

The U.S. Forest Service is committed under the terms of INFISH, the GIMM, and the Programmatic BA to management of the aquatic resources in a manner that will produce water of acceptable quality. Furthermore, in the Land and Resource Management Plan of 1989, the Ochoco National Forest committed to long-term goals of restoring riparian areas, protecting stream temperatures, protecting and improving stream shade, and controlling channel erosion and instability.

Completion of AMPs will assure that management practices will be regulated to achieve desired riparian conditions. Annual monitoring will determine whether or not progress towards the goals contained in this plan is made. If not, the goals and activities will be revisited and changes made as necessary to the action plan to assure attainment of water quality standards. The GIMM protocol assures that implementation is done in a timely and efficient manner.

The Deschutes/Ochoco National Forest is planning a Restoration Environmental Analysis (EA) for the Deep Creek Watershed. The Restoration EA will supplement and elaborate on the restoration elements of this plan, and assure implementation.

SECTION 7 – MONITORING AND EVALUATION:

Monitoring will provide information as to whether standards and guidelines are being followed and if actions prescribed in the WQRP are achieving the desired results. All activities identified in this plan will be monitored in some form.

Fish habitat and geomorphic conditions, in the Deep Creek Watershed, have been monitored by methods or sources displayed in Figure 19. The objective of these monitoring methods is to collect data on potential project effects, changes in channel form, morphology, habitat, and shade. Outcomes from these surveys will indicate progress towards achievement of objectives and milestones.

Similar field investigations and monitoring will continue as part of planned forest monitoring and analysis. However, some techniques or methods may change due to refinements or adjustments in approaches used for specific resource concerns. In addition to collecting shade values in these surveys, attainment of average potential shade and targeted solar load values (Objective 2) will be monitored, with a solar pathfinder, at least once every five years.

The Ochoco National Forest will continue to monitor stream temperatures, throughout the Deep Creek Watershed, to track progress towards attainment of stream temperature compliance (Objective 3). The objectives are to monitor long term temperature recovery, better understand the natural temperature variability, and to track potential project effects.

Generally, stream temperatures will be monitored from June 1 to September 30 to ensure that critical high temperature periods are covered. Measurements will continue to be taken with thermistors programmed to record hourly samples. DEQ stream temperature collection protocol will be observed and utilized. Qualified personnel will review raw data and erroneous data will be deleted. Valid data will be processed to compute the 7-day average of the daily maximum temperatures at each site.

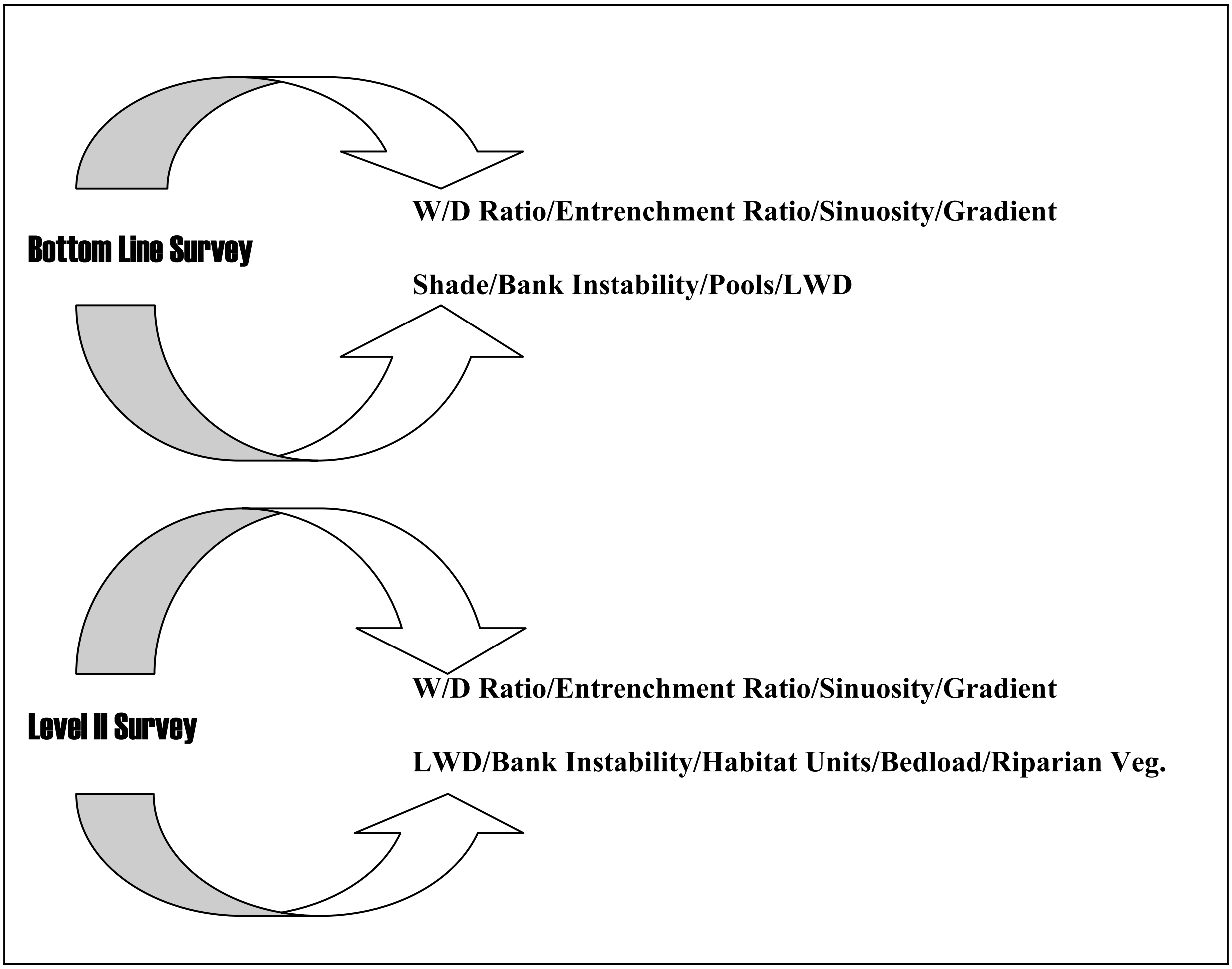
Every five years, the Deschutes/Ochoco National Forest will analyze the stream temperature data. Data will be used to assess whether active restoration activities have been effective, and if achievement of milestones and objectives are reasonable. At that time, the Deschutes/Ochoco National Forest will re-evaluate this plan and submit any proposed revisions to DEQ for consideration.

Data collected on stream temperature over the past few years indicates that temperatures vary slightly from year to year around high mean values with no apparent upward or downward trend. Trends in shade values and riparian conditions will not be substantiated until stream inventories are completed on identical reach scales in future years. This monitoring program is administered by the Paulina Ranger District and implemented by the District Fisheries Biologist.

Monitoring stubble height, bank alteration, and riparian shrub use is already in effect, in compliance with GIMM and the Programmatic BA. Monitoring will continue at least three times a year. In the 2001 Programmatic BA, the Ochoco National Forest has agreed to monitor 75% category 1 pastures and 20% in category 2 pastures (Appendix B). The Paulina Ranger District has chosen to monitor 100% of all category 1 and 2 pastures during grazing season. All acres within the Deep Creek Watershed reside in category 2 pastures. GIMM data is reported to the Region 6 Forest Service office and is incorporated into the Regional Effectiveness Monitoring Strategy.

All Annual Operating Plans for grazing allotments include the Forest Plan requirements to plan, apply, and monitor Best Management Practices, and encourage range improvements that disperse livestock away from riparian areas.

Figure 19. Stream Inventory Monitoring.



Obliterated roads, culvert replacements, and timber harvest activities will be monitored as currently outlined by Forest Standards and Guidelines and reported annually.

Future genetic studies to assess fish condition will occur. As discussed in Section 1, a redband trout study to assess population condition and migratory behavioral patterns was implemented throughout the Deep Creek Watershed in 1997, and is still ongoing (Grover and Hodgson 1999). Preliminary data analysis suggests redband migration to be very little. One of the current end results of this study was adjusting the harvest regulations in Deep Creek to better manage for larger size classes. In the spring of 2001 a screw trap was monitored in Deep Creek. Data collected from this trap showed high numbers of out-migration to the North Fork Crooked River by juvenile redband trout. A screw trap will be utilized in the future as a means of continued monitoring of out-migrating juveniles. Telemetry will be utilized to monitor adult migration within Deep Creek on a cycle that would reflect seasonal variation. An attempt will be made to correlate redband trout migration during different seasonal periods with local stream temperatures.

SECTION 8 – PUBLIC INVOLVEMENT:

Many elements contained in this plan are derived from existing land use planning documents such as the Ochoco National Forest Land and Resource Management Plan (1989), INFISH (1995), PACFISH (1994), GIMM (2000), and the Programmatic BA (2001). These documents received broad based public comment during "*scoping*" prior to development of alternatives and during public appeal. Currently the Paulina Ranger District has an Allotment Management Plan (AMP) timeline and strategy in place that will update the existing AMPs. Revision of the AMPs will incorporate public input and permittee cooperation.

The Paulina Ranger District has projected the start of a Restoration EA in 2002. It is expected that many elements within this WQMP will be included in this plan. Subject to the NEPA process, this plan will require public "*scoping*" and review. The Draft Deep EIS is also subject to public input and review. The U.S. Forest Service will provide support and participation in public outreach.

In addition to general public support, cooperation and assistance from Oregon state natural resource agencies, Federal agencies, local landowners, permittees, and the Crooked River Watershed Council will be necessary to attain desired future conditions. Forest Service funding, or volunteer labor partnerships may occur with Ochoco Trout Unlimited, Oregon Department of Fish and Wildlife (ODFW), Oregon Water Enhancement Board (OWEB), Deschutes Resources Conservancy (DRC), USFWS, and National Fish and Wildlife Foundation. Partnerships will provide a very important tool to involve the public in stream restoration.

SECTION 9 – MAINTENANCE OF EFFORT OVER TIME:

Some of the objectives of this plan are already enforced as previously mentioned. The remainder of the objectives will be incorporated into the updated Land and Resource Management Plan for the Deschutes/Ochoco National Forest, expected to occur within the next five years.

This WQRP will remain in effect until a new plan is formulated and approved or changes in laws or regulations remove the need of the Deschutes/Ochoco National Forest to implement the plan. As a land management oriented agency, the U.S. Forest Service will continue to implement activities on the landscape that favor watershed health and recovery.

Management and monitoring activities within this plan will continue to be enforced once goals and objectives are met.

SECTION 10 – DISCUSSION OF COST AND FUNDING:

Implementation of all aspects of this plan involves the collective efforts of personnel from several departments and funding from several programs within the Forest's total operations. Money for ongoing support of the plan is not likely to be allocated as a separate budget item but will continue to be multi-financed from many sources. It is important to note that many of the specific management practices contained in this plan represent mitigation of existing management activities such as timber harvest and grazing. These practices are not entirely dependant upon funds allocated for soil and water improvements.

With the exception of the stream temperature monitoring, stream surveys, and active restoration projects, most elements of this plan will be implemented through special emphasis within other programs such as vegetation management and monitoring, and regularly scheduled stream surveys. These activities have funding sources that are independent to this WQRP. Some sort of funding may come from partnerships with Ochoco Trout Unlimited, Oregon Department of Fish and Wildlife (ODFW), Oregon Water Enhancement Board (OWEB), Deschutes Resources Conservancy (DRC), and National Fish and Wildlife Foundation, Rocky Mountain Elk Foundation, and Crooked River Watershed Council.

The estimated annual cost for temperature monitoring for all locations established within the watershed is $3,000. Stream inventory activity costs are estimated at $5,000. Estimated costs for stream restoration projects range from $4,000 to $60,000.

REFERENCES:

Bartholow, J. 1997. Stream Segment Temperature Model. USGS, Fort Collins, CO, Program and documentation for microcomputers.

Beschta, R.L. and J. Weatherred. 1984. A Computer Model For Predicting Stream Temperatures Resulting From The Management Of Streamside Vegetation. USDA Forest Service, WSDG-AD-00009.

Beschta, R.L., R.E. Bilby, G.W. Brown, L.B. Holtby, and T.D. Hofstra. 1987. Stream Temperature and Aquatic Habitat: Fisheries and forestry interactions. In Streamside Management: forestry and fisheries interactions, Inst. of Forest Resources, University of Washington, Seattle WA, No. 57.

Boyd, M. and D. Sturdevant. 1997. The Scientific Basis For Oregon's Stream Temperature Standard: Common Questions And Straight Answers. Oregon Department of Environmental Quality, Technical Report, 6 pp.

Brown, Ervin C. and T. P. Thayer. 1966. Geologic Map of the Canyon City Quadrangle Northeastern Oregon. Oregon Department of Geology and Mineral Industries, USGS, Miscellaneous Geologic Investigations Map I-447

Brown, G.W. 1972. An Improved Temperature Model for Small Streams, Water Resources Research Institute Report 16, Oregon State University; Corvallis, OR.

Brown, G.W. 1984. Forestry And Water Quality. College Of Forestry, Oregon State University; Corvallis, OR.

Brown, G.W., and Brazier, J.R. 1972. Controlling Thermal Pollution In Small Streams. Environmental Protection Agency, Washington D.C. EPA-R2-72-083.

Burton, T., N. Bare, B. Ketcheson, H. Hudak, W. Little, W. Grow, T.M. Collins, A.H. Winward, D. Duff and H. Forsgren. 1992. Integrated Riparian Evaluation Guide, U.S. Dept. of Agriculture, Forest Service, Intermountain Region, Ogden, UT.

Crowe, E.A. and Clausnitzer, R.R. 1997. Mid-Montane Wetland Plant Associations of the Malheur, Umatilla and Wallowa-Whitman National Forest. U.S. Department of Agriculture, Forest Service, Pacific Northwest Region, Technical Paper R6-NR-ECOL-TP-22-97.

Currens, K.P. 1994. Genetic Variation in Crooked River Rainbow Trout. Oregon Cooperative Fishery Unit, Oregon State University, Corvallis, Oregon.

Forest Ecosystem Management Assessment Team. 1993. Forest Ecosystem Management: An Ecological, Economical, and Social Assessment.

Grover, D. and B. Hodgson. 1999. Deep Creek Redband Trout Study – 1999 Progress Report. Oregon Department of Fish and Wildlife, Prineville District.

Kovalchik, B.L. 1987. Riparian Zone Associations: Deschutes, Ochoco, Fremont, and Winema National Forests. U.S. Department of Agriculture, Forest Service, Pacific Northwest Region, R6-ECOL-TP-279-87.

La Marche. J, A. Dubin and D. Lettenmair. 1997. A 2-Layer Energy Balance Model For The Prediction Of Stream Temperature. Water Resources Research, July.

Maloney, S.B., A.R. Tiedemann, D.A. Higgins, T.M. Quigley, and D.B. Marx. 1999. Influence of Stream Characteristics and Grazing Intensity on Stream Temperatures in Eastern Oregon. General Technical Report PNW-GTR-459, USDA Forest Service, Pacific Northwest Research Station.

Padgett, W.G., A.P. Youngblood, and A.H. Winward. 1989. Riparian Community Type Classification of Utah and Southeastern Idaho. U.S. Dept. of Agriculture, Forest Service, Intermountain Region.

Phelps, S.R., S. Cierebiej, B. Baker, and K. Kostow. 1996. Genetic Relationships And Estimation of Hatchery Introgression In 28 Collections Of Redband Trout From The Upper Deschutes River, Crooked River, Malheur Lake Basin, And Goose Lake Basin, Oregon. Draft Report, Washington Department of Fish and Wildlife, Fish Management Program, Genetic Unit, Olympia, Washington.

Platts, W.S. 1991. Livestock Grazing. In: Meehan, W.R., ed. Influence of Forest and Rangeland on Salmonid Fisheries and their Habitats. AFS Special Publication 19. pp. 389-423.

Platts, W.S. 1990. Managing Fisheries and Wildlife on Rangelands Grazed by Livestock. Unpublished Report, Nevada Dept. of Wildlife.

Rosgen, D.L. 1996. Applied River Morphology. Wildland Hydrology, Pagosa Springs, CO.

Rosgen, D.L. 1994. Classification of Natural Rivers. Catena, Vol 22, No. 3; International Society Of Soil Science.

Simpson, M. 2001. Botanist/Ecologist.

Swanson, Donald A. 1969. Reconnaissance Geologic Map of the East Half of the Bend Quadrangle, Crook, Wheeler, Jefferson, Wasco and Deschutes Counties, Oregon. USGS, Misc. Geologic Investigations Map I-568.

Theurer, F.D., K.A. Voos, and W.J. Miller. 1984. Instream Water Temperature Model. Instream Flow Inf. Pap. 16 Coop., Instream Flow and Aquatic Systems Group, U.S. Fish and Wildlife Service, Fort Collins, CO.

Troendle, C.A., M.S. Wilcox, G.S. Bevenger, and L. Porth. 1998. The Coon Creek Water Yield Augmentation Project: Implementation of Research Technology.

Troendle, C.A and W.K. Olsen. 1993. Potential Effects of Timber Harvest and Water Management on Streamflow Dynamics and Sediment Transport. In: Sustainable Ecological Systems: Implementing an Ecological Approach to Land Management, July 12-15, 1993, Flagstaff, Arizona, pp. 34-41. USDA Forest Service, Rocky Mountain Forest and Range Experiment Station, General Technical Report RM-247.

Troendle, C.A. and R.M. King. 1987. The Effect of Partial and Clearcutting On Streamflow At Deadhorse Creek, Colorado. Journal of Hydrology. 90 (1987): 145-157.

U.S. Forest Service. 2000. Grazing Implementation Monitoring Module.

U.S. Forest Service. 1995. Inland Native Fish Strategy. Intermountain, Northern, and Pacific Northwest Regions.

U.S. Forest Service and U.S. Bureau of Land Management. 1994. Environmental Assessment for the Implementation of Interim Strategies for Managing Anadromous Fish-producing Watersheds in Eastern Oregon and Washington, Idaho, and Portions of California.

U.S. Forest Service, Ochoco National Forest. 1999. Deep Creek Watershed Analysis.

Walker, George W., 1990. Geology of the Blue Mountains Region of Oregon, Idaho and Washington: Cenozoic Geology of the Blue Mountains Region. USGS, Professional Paper 1437, 135 pg.

APPENDICES

APPENDIX A: Riparian Management Objectives and Designation of Riparian Habitat Conservation Areas from INFISH (1995).

RIPARIAN MANAGEMENT OBJECTIVES:

Habitat Feature	**Interim Objectives**
Pool Frequency (all systems)	Varies by channel width. See table below.
Water Temperature (all systems)	No measurable increase in maximum water temperature (7-day moving average of daily maximum temperature measured as the average of the maximum daily temperature of the warmest consecutive 7-day period). Maximum water temperatures below 59°F within adult holding habitat and below 48°F within spawning and rearing habitats.
Large Woody Debris (forested systems)	Coastal California, Oregon, and Washington: >80 pieces per mile; >24 inch diameter; >50 foot length. East of Cascade Crest in Oregon, Washington, Idaho: >20 pieces per mile; >12 inch diameter; >35 foot length.
Bank Stability (non-forested systems)	>80 percent stable.
Lower Bank Angle (non-forested systems)	>75 percent of banks with <90 degree angle (i.e. undercut).
Width/Depth Ratio (all systems)	<10, mean wetted width divided by mean depth.

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

RIPARIAN HABITAT CONSERVATION AREAS:

Riparian Habitat Conservation Areas (RHCAs) are portions of watersheds where riparian-dependent resources receive primary emphasis and management activities are subject to specific standards and guidelines. RHCAs 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 (INFISH 1995).

INFISH (1995) state that interim RHCA standard widths are based on the four categories of streams or water bodies. The standard widths apply where watershed analysis has not been completed. They are as follows:

Category 1 – Fish-bearing streams: Interim RHCAs consist of the stream and the area on either side of the stream extending from the edges of the active stream channel to the top of the inner gorge, or to the outer edges of the 100-year floodplain, or to the outer edges of riparian vegetation, or to a distance equal to the height of two sight-potential trees, or 300 feet slope distance (600 feet, including both sides of the stream channel), whichever is greatest.

Category 2 – Perennial non-fish-bearing streams: Interim RHCAs consist of the stream and the area on either side of the stream extending from the edges of the active stream channel to the top of the inner gorge, or to the outer edges of the 100-year floodplain, or to the outer edges of riparian vegetation, or to a distance equal to the height of one sight-potential tree, or 150 feet slope distance (300 feet, including both sides of the stream channel), whichever is greatest.

Category 3 – Ponds, lakes, reservoirs, and wetlands greater than 1 acre: Interim RHCAs consist of the body of water or wetland and the area to the outer edges of the riparian vegetation, or to the extent of the seasonally saturated soil, or to the extent of moderately and highly unstable areas, or to a distance equal to the height of one site-potential tree, or 150 feet slope distance from the edge of the maximum pool elevation of constructed ponds and reservoirs or from the edge of the wetland, pond or lake, whichever is greatest.

Category 4 – Seasonally flowing or intermittent stream, wetlands less than 1 acre, landslides, and landslide-prone areas: This category includes features with high variability in size and site-specific characteristics. At a minimum the interim RHCAs must include:

a. the extent of landslides and landslide-prone areas

b. the intermittent stream channel and the area to the top of the inner gorge

c. the intermittent stream channel or wetland and the area to the outer edges of the riparian vegetation.

d. for Priority Watersheds, the area from the edges of the stream channel, wetland, landslide, or landslide-prone area to a distance equal to the height of one site-potential tree, or 100 feet slope distance, whichever is greatest.

e. for watersheds not identified as Priority Watersheds, the area from the edges of the stream channel, wetland, landslide, or landslide-prone area to a distance equal to the height of one-half site-potential tree, or 50 feet slope distance, whichever is greatest.

In non-forested rangeland ecosystems, the interim RHCA width for permanently flowing streams in categories 1 and 2 is the extent of the 100-year flood plain.

APPENDIX B: Delineation of Pasture Category in Allotments (GIMM 2000).

Each pasture/use area in all allotments within the range of PACFISH and INFISH are assigned to one of the three categories:

Category I - All FS/BLM pasture/use areas within riparian areas that lie entirely or partially within a 6th-field subwatershed that have ESA-listed species (salmon, steelhead, or bull trout) or designated/proposed critical habitat.

Category II – All FS/BLM pasture/us areas with riparian areas that lie entirely or partially within a 6th-field subwatershed that do not contain ESA-listed fish species (salmon, steelhead, or bull trout) or designated/proposed critical habitat within the 6th-field subwatershed. (Within the range of PACFISH this applies to pasture/use areas on FS and BLM administered lands; within the range of INFISH this only includes FS-administered lands).

Category III – All FS/BLM pasture/use areas that do not have riparian areas. (Within the range of PACFISH this applies to pasture/use areas on FS and BLM administered lands; within the range of INFISH this only includes FS-administered lands).

Appendix E

The Smoke Management Program and Fuel Treatment Effects

A. Smoke Management Plan

The following information is provided to give additional background on consistency with the Interim Air Quality Policy on Wildland and Prescribed Fires. It was incorporated into the Final Environmental Impact statement (FEIS, September 2001) to respond to public comments to the Draft Environmental Impact Statement (DEIS) and has been included into this DSEIS. See Appendix C, page C-27.

The Interim Policy describes several elements of a smoke management program. This Appendix includes information on methods used in the Ochoco National Forest to be consistent with this policy.

These elements include:

1. A process to authorize burns.

    - Writing a burn plan prior to ignition and completing a Daily GO/NO GO Checklist prior to ignition completes this.

2. Requirements that land managers consider alternatives to burning to minimize air pollutant emissions.

    - During the EIS process, alternatives to burning were discussed that would minimize the amount of smoke produced from burning. Other methods of treatment include lop and scatter of residual fuels, piling of slash and burning piles, leaving some thinning slash as barriers along meadows and aspen stands, and utilization of all commercial valued biomass.

3. Requirements that burn plans include smoke management components.

    - Burns plans include prescription parameters to ensure that objectives of the burn would be met with as little smoke production as possible. Fuel moistures are monitored, and burns are timed to consume targeted fuels over a short period to reduce smoldering. Smoke columns are monitored visually to track direction of drift. Prevailing winds within the Deep Planning area are from the southwest to west direction. Daily notifications are given to the Oregon State Smoke Management department. Individuals or areas that could be potentially affected by smoke intrusions are notified 1-3 days in advance of ignition. During these notifications, objectives of the burn, duration of ignition, smoke dispersal predictions, weather conditions, and predicted duration of smoke impacts are discussed.

4. A public education and awareness program.

    - Public education and awareness are handled during the notification process and through the local media within the Central Oregon area. This includes newspaper articles, radio and television interviews, school programs and within the local community, by personal informal contacts with local residents.

5. A surveillance and enforcement program.

    - Surveillance and enforcement are conducted locally and at the Central Oregon area level under the direction of the Oregon Smoke Management Department. Daily reporting and contact with Smoke Management Forecasters help determine if conditions are conducive to burning within standards and guidelines.

Periodic review of its program for effectiveness.

- Yearly reviews are conducted at the state level to ensure that smoke management reporting is accurate. Within the Central Oregon area informal reviews of smoke management are conducted at least once a month during the spring and fall burning seasons, to ensure reporting and smoke management objectives are being met. Weekly conference calls are conducted during these same periods to coordinate burning programs, ensure management objectives are being met, and to determine if there are problems with intrusions into sensitive areas.

6. The Interim Policy also states that in order to evaluate the air quality and visibility impacts, the Forest Service through the NEPA process should:

a. Include historic (e.g. 10 years) and projected (life of the plan) annual or seasonal emissions from wildland and prescribed fires.

- Within the last 10 years wildland fire has produced a negligible amount of smoke from the Deep Planning Area. There have been no large wildland fires within this area.
- Projected emissions from prescribed burning for the life of the plan are:

	Summit Acres	Summit Emissions	Deep Acres	Deep Emissions	Emissions Per Year Over 5 Years	Percent of Yearly Forest Emissions
Alt. A	8,744	310	0	0	62	.6%
Alt. B	8,744	310	26,217	944	250	2.7%
Alt. C	8,744	310	15,898	572	177	1.9%
Alt. D	8,744	310	13,497	486	160	1.7%

- This information is found on page 4-27 of the EIS. Within the past 10 years emissions have been minimal from prescribed burning for this area. There have been no natural fuels burning conducted and only three activities units (approximately 170 acres) were burned. The district program has shifted from activities fuels treatments to naturals and, within the past 10 years, the natural fuel treatments have increased from 0 to 5,000 acres district-wide. Burning of the natural fuel units within Deep would become a part of the overall district program and would be completed over a minimum of a five-year period. The district program is expected to grow each successive year with a corresponding increase in smoke production (page 4-26). This increase is not expected to exceed standards and guidelines set either in the Land and Resource Management Plan (LRMP) or those in the State of Oregon's Smoke Management Plan.

b. When possible, analyze cumulative impacts of fires on regional and sub-regional air quality.

- Currently, this type of analysis is not available.

c. Identify applicable regulation, plans or policies (e.g. burn plans, authorization to burn, conformity, etc.

- Fire will be used as a tool to reach the "Desired Future Condition" temporarily increasing PM 10 emissions. Total Suspended Particulate (TSP) emissions for the planning area will be 3%, 2% and 1.5% of the yearly emissions stated in the Forest Plan for the forest for Alternative B, C, and D, respectively.

- Prescribed burning activities from this proposal would be incorporated into the overall Paulina Ranger District annual burning program. The district has been averaging approximately 3,000 to 5,000 acres of burning treatments per year. The amount of burning accomplished per year is not anticipated to increase dramatically due to the relatively short burning seasons (page 4-26)

d. Identify sensitive receptors.

- Alternative B would produce the highest amount of emissions from the treatment of all the commercial and natural fuel acres. Alternative D would produce the least. This would be accomplished over a period of no less than five years with the action alternatives. Due to local conditions, smoke would normally be transported by west/southwest winds in the early to late afternoon. Inversions in the area usually dissipate by mid-morning. Local communities that may be affected by smoke would be Dayville, John Day, Paulina, Mitchell, Prineville, and Bend, Oregon. The Black Canyon Wilderness, which is a Class II air shed, is located approximately 6 air miles (at the closest point) east of the planning area. Burning activities may affect the air quality within the Wilderness. Because of the prevailing winds, intrusion into the Wilderness should be kept to a minimum, and burning operations would be conducted to minimize the effects of smoke within it. With prevailing winds from the west/southwest, areas to the south, southwest, west and northwest have very little potential for smoke intrusions. Due to distances to the Class I air sheds to the northeast, smoke transportation will disperse concentration, minimizing impacts.

e. Include description of planned measures to reduce smoke impacts.

- The timing of burning is the key role in reducing smoke impacts. The burn plan would describe the prescription needed to meet resource objectives and minimize the impacts of smoke. Coordination with surrounding units, smoke management forecasters, and local knowledge of wind patterns would also help to mitigate adverse affects.

f. When possible, identify the potential for smoke intrusion into sensitive areas, and model air quality and visibility impacts.

- Smoke intrusions into Class I air sheds are possible, but due to prevailing winds and the distance to these air sheds (Strawberry Wilderness east 30+ miles, Baker City and Eagle Cap Wilderness northeast 120+ miles), concentrations would be minimal.
- Modeling air quality and visibility impacts have not been conducted due to the distance and location of Class I air sheds.

g. Describe ambient air monitoring plans where appropriate.

- Currently, we do not have the capability to monitor ambient air quality on site. Central Oregon has purchased equipment and is in the process of calibrating and setting up to perform on-site monitoring of sensitive areas. This equipment may be available during the life of this project but it is possible that it would never be set up on-site due to the remoteness of the Deep Planning area.

B. Fuel Treatments

The following information is presented to provide some detail to the potential effects of proposed fuel treatments on vegetation conditions, fuel conditions, and standing dead trees.
Several activities are proposed in Alternatives B, C, and D intended to address fuels and vegetation conditions. These activities are described in Chapter 2 of the EIS.

Underburning is proposed to reduce fuel loading which would reduce the potential intensity and effects of a subsequent wildfire. The proposed underburning would focus on reducing surface fuels less than 3 inches in diameter since they most influence the fire spread rate and intensity. Prescribed fire is also proposed to address juniper encroachment and to stimulate the growth and health of forage species for wildlife. As part of this activity larger juniper trees up to 10 inches in diameter may be mechanically cut prior to the prescribed fire.
Proposed fuels treatments are described for each alternative in the table and maps which follow.

Alternative A

No prescribed fire or fuels treatments are proposed under this alternative.

Alternative B

Prescribed Fire Unit Numbers	Estimated Acres	Objective
8,9,18,19,21,26,27	3456	Prescribed fire, underburn. Hazardous fuels reduction, reduce surface fuel loading to less than 5 tons per acre for <3” diameter fuels. Wildlife forage enhancement and juniper reduction. Remove 50 to 80% of juniper up to 2” diameter, and create a burned/unburned mosaic (60/40). Stimulate wildlife forage growth and health.
20,25	1323	Prescribed fire, underburn. Hazardous fuels reduction, reduce surface fuel loading to less than 5 tons per acre for <3” diameter fuels. Wildlife forage enhancement and juniper reduction. Remove 50 to 80% of juniper up to 2” diameter, and create a burned/unburned mosaic (60/40). Stimulate wildlife forage growth and health.
17	593	Prescribed fire, underburn. Hazardous fuels reduction, reduce surface fuel loading to less than 5 tons per acre for <3” diameter fuels.
13	455	Prescribed fire, underburn. Hazardous fuels reduction, reduce surface fuel loading to less than 5 tons per acre for <3” diameter fuels.
12	119	Prescribed fire, underburn. Hazardous fuels reduction, reduce surface fuel loading to less than 5 tons per acre for <3” diameter fuels.
4	1086	Prescribed fire, underburn. Hazardous fuels reduction, reduce surface fuel loading to less than 5 tons per acre for <3” diameter fuels.
2	671	Fuel break and jackpot burn. Reduce surface fuel loading to less than 5 tons per acre for <3” diameter fuels, reduce tree density, and increase the height to base of live crowns. Mechanical treatment (thinning the understory) would be done to reduce ladder fuels and potential for crown fire. Jackpot burning would be done to dispose of excess natural or created fuel concentrations.
22	329	Prescribed fire, underburn. Hazardous fuels reduction, reduce surface fuel loading to less than 5 tons per acre for <3” diameter fuels.
28	39	Prescribed fire, underburn. Hazardous fuels reduction, reduce surface fuel loading to less than 5 tons per acre for <3” diameter fuels.
5,6	1778	Prescribed fire, underburn. Hazardous fuels reduction, reduce surface fuel loading to less than 5 tons per acre for <3” diameter fuels.
7,10	3042	Prescribed fire, underburn. Hazardous fuels reduction, reduce surface fuel loading to less than 5 tons per acre for <3” diameter fuels.
14,15,16,23	3673	Prescribed fire, underburn. Hazardous fuels reduction, reduce surface fuel loading to less than 5 tons per acre for <3” diameter fuels. Wildlife forage enhancement and juniper reduction. Remove 50 to 80% of juniper up to 2” diameter, and create a burned/unburned mosaic (60/40). Stimulate wildlife forage growth and health.
11	1264	Wildlife forage enhancement and juniper reduction. Remove 50 to 80% of juniper up to 2” diameter, and create a burned/unburned mosaic (60/40). Stimulate wildlife forage growth and health.
3	2864	Wildlife forage enhancement and juniper reduction. Remove 50 to 80% of juniper up to 2” diameter, and create a burned/unburned mosaic (60/40). Stimulate wildlife forage growth and health.
Total	20692	

Alternative C

Prescribed Fire Unit Number	Estimated Acres	Objective
3,29	2343	Wildlife forage enhancement and juniper reduction. Remove 50 to 80% of juniper up to 2” diameter, and create a burned/unburned mosaic (60/40). Stimulate wildlife forage growth and health.
7	1066	Prescribed fire, underburn. Hazardous fuels reduction, reduce surface fuel loading to less than 5 tons per acre for <3” diameter fuels.
11	1121	Wildlife forage enhancement and juniper reduction. Remove 50 to 80% of juniper up to 2” diameter, and create a burned/unburned mosaic (60/40). Stimulate wildlife forage growth and health.
12	110	Prescribed fire, underburn. Hazardous fuels reduction, reduce surface fuel loading to less than 5 tons per acre for <3” diameter fuels.
14	683	Wildlife forage enhancement and juniper reduction. Remove 50 to 80% of juniper up to 2” diameter, and create a burned/unburned mosaic (60/40). Stimulate wildlife forage growth and health.
15	730	Wildlife forage enhancement and juniper reduction. Remove 50 to 80% of juniper up to 2” diameter, and create a burned/unburned mosaic (60/40). Stimulate wildlife forage growth and health.
17	589	Prescribed fire, underburn. Hazardous fuels reduction, reduce surface fuel loading to less than 5 tons per acre for <3” diameter fuels.
9,19	634	Prescribed fire, underburn. Hazardous fuels reduction, reduce surface fuel loading to less than 5 tons per acre for <3” diameter fuels.
20	755	Wildlife forage enhancement and juniper reduction. Remove 50 to 80% of juniper up to 2” diameter, and create a burned/unburned mosaic (60/40). Stimulate wildlife forage growth and health.
21	231	Prescribed fire, underburn. Hazardous fuels reduction, reduce surface fuel loading to less than 5 tons per acre for <3” diameter fuels.
22	305	Prescribed fire, underburn. Hazardous fuels reduction, reduce surface fuel loading to less than 5 tons per acre for <3” diameter fuels.
26	89	Prescribed fire, underburn. Hazardous fuels reduction, reduce surface fuel loading to less than 5 tons per acre for <3” diameter fuels.
27	50	Prescribed fire, underburn. Hazardous fuels reduction, reduce surface fuel loading to less than 5 tons per acre for <3” diameter fuels.
28	35	Prescribed fire, underburn. Hazardous fuels reduction, reduce surface fuel loading to less than 5 tons per acre for <3” diameter fuels.
Total	8741	

Alternative D

Prescribed Fire Unit Number	Estimated Acres	Objective
3,29	2343	Wildlife forage enhancement and juniper reduction. Remove 50 to 80% of juniper up to 2" diameter, and create a burned/unburned mosaic (60/40). Stimulate wildlife forage growth and health.
9	650	Wildlife forage enhancement and juniper reduction. Remove 50 to 80% of juniper up to 2" diameter, and create a burned/unburned mosaic (60/40). Stimulate wildlife forage growth and health.
11	1121	Wildlife forage enhancement and juniper reduction. Remove 50 to 80% of juniper up to 2" diameter, and create a burned/unburned mosaic (60/40). Stimulate wildlife forage growth and health.
12	110	Prescribed fire, underburn. Hazardous fuels reduction, reduce surface fuel loading to less than 5 tons per acre for <3" diameter fuels.
14	1230	Wildlife forage enhancement and juniper reduction. Remove 50 to 80% of juniper up to 2" diameter, and create a burned/unburned mosaic (60/40). Stimulate wildlife forage growth and health.
15	1125	Wildlife forage enhancement and juniper reduction. Remove 50 to 80% of juniper up to 2" diameter, and create a burned/unburned mosaic (60/40). Stimulate wildlife forage growth and health.
16	701	Prescribed fire, underburn. Hazardous fuels reduction, reduce surface fuel loading to less than 5 tons per acre for <3" diameter fuels.
17	589	Prescribed fire, underburn. Hazardous fuels reduction, reduce surface fuel loading to less than 5 tons per acre for <3" diameter fuels.
19	634	Prescribed fire, underburn. Hazardous fuels reduction, reduce surface fuel loading to less than 5 tons per acre for <3" diameter fuels.
20	755	Wildlife forage enhancement and juniper reduction. Remove 50 to 80% of juniper up to 2" diameter, and create a burned/unburned mosaic (60/40). Stimulate wildlife forage growth and health.
21	231	Prescribed fire, underburn. Hazardous fuels reduction, reduce surface fuel loading to less than 5 tons per acre for <3" diameter fuels.
22	206	Prescribed fire, underburn. Hazardous fuels reduction, reduce surface fuel loading to less than 5 tons per acre for <3" diameter fuels.
26	89	Prescribed fire, underburn. Hazardous fuels reduction, reduce surface fuel loading to less than 5 tons per acre for <3" diameter fuels.
27	50	Prescribed fire, underburn. Hazardous fuels reduction, reduce surface fuel loading to less than 5 tons per acre for <3" diameter fuels.
28	35	Prescribed fire, underburn. Hazardous fuels reduction, reduce surface fuel loading to less than 5 tons per acre for <3" diameter fuels.
Total	9868	

Effects of Fuel Treatment

Many of the units proposed for fuel treatments are similar in species composition, tree density, and fuel loading. The units are grouped for analysis of effects as displayed in the table below.

Group Number	Plant Community Composition	Alternative B Units	Alternative C Units	Alternative D Units
1	70% CPG222 – Ponderosa pine/elk sedge or CPG221 – Ponderosa pine/Pinegrass 30% SD9111 – Stiff sagebrush/sandburg's bluegrass	8,9,11,12,13,18, 19,21,26,27,28	9,11,12,19,21,28	9, 11, 12, 19, 21, 28
2	70% CDG112 – Douglas-fir/pinegrass 10% CWG113 – Grand Fir/pinegrass 20% SD9111 – Stiff sagebrush/sandburg's bluegrass	3,20,25	3,15,20,29	3, 15, 16, 17,29
3	60% CWG113 – Grand Fir/pinegrass 30% CDG112 – Douglas-fir/pinegrass 10% SD9111 – Stiff sagebrush/sandburg's bluegrass	2,4,5,6,7,10	7,26,27	26, 27
4	80% CPG222 – Ponderosa pine/elk sedge or CPG221 – Ponderosa pine/Pinegrass 20% CDG112 – Douglas-fir/pinegrass	17,22	17, 22	17, 22
5	20% CWG113 – Grand Fir/pinegrass 50% CDG112 – Douglas-fir/pinegrass 10% CPG222 – Ponderosa pine/elk sedge or CPG221 – Ponderosa pine/Pinegrass 20% SD9111 – Stiff sagebrush/sandburg's bluegrass	14,15,16,23	14	14

GROUP 1

Forest Vegetation

Existing Tree Composition – Per Acre Average for Units

Tree Diameter Class	Ponderosa Pine		Douglas-fir		Juniper		Total	
	TPA	BA	TPA	BA	TPA	BA	TPA	BA
<1 "	42	0	14	0	56	0	112	0
1 – 4.9"	87	3	17	1	28	1	132	4
5 – 8.9"	20	4	6	1	6	2	31	8
9 – 20.9"	19	18	7	6	4	4	29	27
>21"	3	15	0	0	1	2	4	17
Total	170	39	43	8	94	8	307	56

Post Burn Tree Composition – Per Acre Average for Units

Tree Diameter Class	Ponderosa Pine		Douglas-fir		Juniper		Total	
	TPA	BA	TPA	BA	TPA	BA	TPA	BA
<1 "	14	0	6	0	7	0	27	0
1 – 4.9"	42	1	7	1	11	1	60	3
5 – 8.9"	20	4	6	1	4	2	29	8
9 – 20.9"	19	18	6	5	4	4	29	27
>21"	3	15	0	0	1	2	4	17
Total	97	38	24	7	26	8	147	54

Group 1 units are typically dominated by ponderosa pine with Douglas-fir and western juniper also present. About 30 percent of the units are non-forested, shallow soil ridgetops which are dominated by stiff sage, and bunchgrasses. Understory vegetation is dominated by pinegrass and elk sedge. Idaho fescue and bromes are also present.

Activities proposed for Group 1 units may either be underburning or Juniper reduction followed by underburning. Some units may have both treatments applied. Though underburning is prescribed the effects are anticipated to be more similar to a jackpot burn, where concentrations of fuels are burned and other portions of the units are lightly burned or unburned. The non-forested areas have insufficient fuel continuity to carry a fire. The fire and fuels extension to the Forest Vegetation Simulator (FVS) was used to estimate the effects of treatment.

For Group 1 units the effects of the prescribed fire proposed in Alternatives B, C, and D would reduce trees per acre less than 5 inches dbh by about 64%, with western juniper being most affected. About 97% of trees larger than 5 inches dbh would be retained.

Fuels – Woody Material

Existing Fuel Loading – Per Acre Average for Units

Size Descriptors	Average Wt. (tons/acre)	Average Piece Count (Pieces/Acre)	Average Piece Length (ft)
< 3 inches diameter	4		
> 3 inches diameter	9		
3 – 11.9 inches diameter		891	4
12 – 19.9 inches diameter		0	0
> 20 inches diameter		4	30
Total	13	895	

Post Burn Fuel Loading – Per Acre Average for Units

Size Descriptors	Average Wt. (tons/acre)	Average Piece Count (Pieces/Acre)	Average Piece Length (ft)
< 3 inches diameter	3		
> 3 inches diameter	6		
3 – 11.9 inches diameter		115	4
12 – 19.9 inches diameter		0	0
> 20 inches diameter		3	21
Total	9	118	

Smoke production associated with this treatment in Group1units is estimated at .05 tons per acre for particulate matter <2.5 microns, and .07 tons per acre for particulate matter <10 microns.

Fuel treatments proposed in Alternatives B, C, and D would reduce the <3 inches diameter fuel category from an average of 4 tons per acre to 3 tons per acre. This would reduce potential fire spread rates and intensity. Estimated mineral soil exposure is 36 percent. Litter and duff amounts vary by stand and plant association, estimated effects of the fuel treatments on duff and litter are shown below.

Plant Association	Litter (tons per acre)		Duff (tons per acre)	
	Pre-burn	Post-burn	Pre-burn	Post-burn
CW (Mixed Conifer)	2.38	1.94	24.8	19.4
CD (Douglas-fir)	1.38	1.28	6.1	4.8
CP (Ponderosa pine)	1.50	1.37	6.1	4.8

Standing Dead Trees

Existing Snag Conditions – Per Acre Average for Units

Diameter Class	Hard Recently Dead	Hard Loose Bark	Hard No Bark	Soft Decayed	Soft Decomposed	Total All Snags
<12”	0	0	0	0	0	0
12 – 20”	0	.7	0	0	0	.7
>20”	0	0	.7	0	0	.7
Total	0	.7	0	0	0	1.4

Post Burn Snag Conditions – Per Acre Average for Units

Diameter Class	Hard Recently Dead	Hard Loose Bark	Hard No Bark	Soft Decayed	Soft Decomposed	Total All Snags
<12”	0	0	0	0	0	0
12 – 20”	0	.7	0	0	0	.7
>20”	1.12	0	0	0	0	1.12
Total	1.12	.7	0	0	0	1.82

Standing dead trees (snags) are estimated to increase from an average total of 1.4 to 1.82 snags per acre. Existing snags may be consumed by the prescribed fire while new snags would be created through the combined effects of the prescribed fire and insects or diseases.

Based on the plant association composition of units within Group 1 the desired snag ranges are shown in the table below.

Plant Association	Percent Composition	Snag Ranges <20" dbh	Snag Ranges >20" dbh	Aggregate Snag Range <20" dbh	Aggregate Snag Range >20" dbh
Dry Grand Fir (CW)	0	2- 6	.2 - 2	0 - 0	0 - 0
Douglas-fir (CD)	0	2 - 4	.2 - 2	0 - 0	0 - 0
Mesic Ponderosa Pine (CP)	70	2 - 4	.2 - 2	1.4 – 2.8	.14 – 1.4
Total Snag Range				1.4 – 2.8	.14 – 1.4

Existing snag conditions for units within Group 1 are slightly below the desired snag range, minimum would be 1.54 per acre (1.4 + .14) for total snags, and existing is 1.4. After the prescribed fire snag levels would be within desired ranges.

GROUP 2

Forest Vegetation

Existing Tree Composition – Per Acre Average for Units

Tree Diameter Class	Ponderosa Pine TPA	Ponderosa Pine BA	Douglas-fir TPA	Douglas-fir BA	Grand Fir TPA	Grand Fir BA	Juniper TPA	Juniper BA	Western Larch TPA	Western Larch BA	Total TPA	Total BA
<1 "	2	0	36	0	6	0	56	0	2	0	102	0
1 – 4.9"	20	1	8	1	17	1	84	2	0	0	129	5
5 – 8.9"	6	1	5	1	11	3	14	3	0	0	35	8
9 – 20.9"	12	15	2	3	5	5	1	1	0	0	20	25
>21"	3	19	1	2	0	0	1	4	0	0	5	25
Total	42	37	52	8	39	9	156	10	2	0	291	63

Post-Burn Tree Composition – Per Acre Average for Units

Tree Diameter Class	Ponderosa Pine TPA	Ponderosa Pine BA	Douglas-fir TPA	Douglas-fir BA	Grand Fir TPA	Grand Fir BA	Juniper TPA	Juniper BA	Western Larch TPA	Western Larch BA	Total TPA	Total BA
<1 "	1	0	17	0	2	0	14	0	2	0	35	0
1 – 4.9"	15	1	6	1	5	0	21	1	0	0	47	3
5 – 8.9"	5	1	5	1	8	2	4	1	0	0	21	6
9 – 20.9"	12	15	2	3	5	5	1	1	0	0	20	25
>21"	3	19	1	2	0	0	1	4	0	0	5	25
Total	36	37	31	8	19	7	41	7	2	0	128	59

Group 2 units are a mixture of species, but dominated by ponderosa pine with Douglas-fir, grand fir and western juniper also present. About 20 percent of the units are non-forested, shallow soil ridgetops which are dominated by stiff sage, and bunchgrasses. Understory vegetation is dominated by pinegrass and elk sedge. Idaho fescue and bromes are also present.

Activities proposed for Group 2 units may either be underburning or Juniper reduction followed by underburning. Some units may have both treatments applied. Though underburning is prescribed the effects are anticipated to be more similar to a jackpot burn, where concentrations of fuels are burned and other portions of the units are lightly burned or unburned. The non-forested areas have insufficient fuel continuity to carry a fire. The fire and fuels extension to the Forest Vegetation Simulator (FVS) was used to estimate the effects of treatment.

For Group 2 units the effects of the prescribed fire proposed in Alternatives B, C, and D would reduce trees per acre less than 5 inches dbh by about 64%, with western juniper being most affected. About 77% of trees larger than 5 inches dbh would be retained. For trees larger than 5 inches dbh, most of the loss occurs in western juniper 5 – 8.9 inches dbh.

Fuels – Woody Material

Existing Fuel Loading – Per Acre Average for Units

Size Descriptors	Average Wt. (tons/acre)	Average Piece Count (Pieces/Acre)	Average Piece Length (ft)
< 3 inches diameter	7		
> 3 inches diameter	7		
3 – 11.9 inches diameter		893	14
12 – 19.9 inches diameter		2	4
> 20 inches diameter		5	56
Total	14	900	

Post Burn Fuel Loading – Per Acre Average for Units

Size Descriptors	Average Wt. (tons/acre)	Average Piece Count (Pieces/Acre)	Average Piece Length (ft)
< 3 inches diameter	3		
> 3 inches diameter	5		
3 – 11.9 inches diameter		422	8
12 – 19.9 inches diameter		1	2
> 20 inches diameter		4	42
Total	8	427	

Smoke production associated with this treatment in Group 2 units is estimated at .06 tons per acre for particulate matter <2.5 microns, and .07 tons per acre for particulate matter <10 microns.

Fuel treatments proposed in Alternatives B, C, and D would reduce the <3 inches diameter fuel category from an average of 7 tons per acre to 3 tons per acre. This would reduce potential fire spread rates and intensity. Estimated mineral soil exposure is 36 percent. Litter and duff amounts vary by stand and plant association, estimated effects of the fuel treatments on duff and litter are shown below.

Plant Association	Litter (tons per acre)		Duff (tons per acre)	
	Pre-burn	Post-burn	Pre-burn	Post-burn
CW (Mixed Conifer)	2.38	1.94	24.8	19.4
CD (Douglas-fir)	1.38	1.28	6.1	4.8
CP (Ponderosa pine)	1.50	1.37	6.1	4.8

Standing Dead Trees

Existing Snag Conditions – Per Acre Average for Units

Diameter Class	Hard Recently Dead	Hard Loose Bark	Hard No Bark	Soft Decayed	Soft Decomposed	Total All Snags
<12”	0	0	0	0	0	0
12 – 20”	.2	.8	.7	.7	0	2.4
>20”	.7	.8	.7	0	.1	2.3
Total	.9	1.6	1.4	.7	.1	4.7

Post Burn Snag Conditions – Per Acre Average for Units

Diameter Class	Hard Recently Dead	Hard Loose Bark	Hard No Bark	Soft Decayed	Soft Decomposed	Total All Snags
<12”	0	0	0	0	0	0
12 – 20”	.78	0	0	.7	0	1.48
>20”	1.1	0	0	0	0	1.1
Total	1.88	0	0	.7	0	2.58

Standing dead trees (snags) are estimated to decrease from an average total of 4.7 to 2.58 snags per acre. Existing snags may be consumed by the prescribed fire while new snags would be created through the combined effects of the prescribed fire and insects or diseases.

Based on the plant association composition of units within Group 2 the desired snag ranges are shown in the table below.

Plant Association	Percent Composition	Snag Ranges <20" dbh	>20" dbh	Aggregate Snag Range <20" dbh	>20" dbh
Dry Grand Fir (CW)	10	2 - 6	.2 - 2	.2 - .6	.02 - .2
Douglas-fir (CD)	70	2 - 4	.2 - 2	1.4 – 4.2	.14 – 1.4
Mesic Ponderosa Pine (CP)	0	2 - 4	.2 - 2	0 – 0	0 – 0
Total Snag Range				1.9 – 5.4	.16 – 1.6

Existing snag conditions for units within Group 2 are within the desired snag range, minimum would be 2.24 per acre (1.9 + .34) for total snags, and existing is 4.7. After the prescribed fire snag levels would be reduced to about 2.58 per acre, still within the desired range.

GROUP 3

Forest Vegetation

Existing Tree Composition – Per Acre Average for Units

Tree Diameter	Ponderosa Pine		Douglas-fir		Grand Fir		Juniper		Western Larch		Total	
Class	TPA	BA	TPA	BA	TPA	BA	TPA	BA	TPA	BA	TPA	BA
<1 "	12	0	60	0	36	0	24	0	12	0	144	0
1 – 4.9"	8	1	17	1	103	5	36	1	0	0	164	7
5 – 8.9"	2	1	13	4	65	17	6	1	0	0	86	23
9 – 20.9"	5	7	11	13	28	30	0	0	1	1	45	50
>21"	1	8	1	3	1	4	1	2	0	0	4	17
Total	29	16	101	20	233	56	67	4	13	1	443	97

Post-Burn Tree Composition – Per Acre Average for Units

Tree Diameter	Ponderosa Pine		Douglas-fir		Grand Fir		Juniper		Western Larch		Total	
Class	TPA	BA	TPA	BA	TPA	BA	TPA	BA	TPA	BA	TPA	BA
<1 "	6	0	24	0	9	0	6	0	9	0	54	0
1 – 4.9"	7	1	11	1	30	2	9	0	0	0	56	4
5 – 8.9"	2	1	12	4	48	10	2	1	0	0	64	15
9 – 20.9"	5	7	11	13	27	30	0	0	1	1	44	50
>21"	1	8	1	3	1	4	1	2	0	0	4	17
Total	21	16	58	20	115	46	17	3	10	1	221	86

Group 3 units are cooler, wetter sites, and represent more productive sites than those in other groups. These units are dominated by grand fir with Douglas-fir, ponderosa pine, western larch and western juniper also present. About 10 percent of the units are non-forested, shallow soil ridgetops which are dominated by stiff sage, and bunchgrasses. Understory vegetation is dominated by pinegrass and elk sedge. Oregon grape and snowberry are also present.

Activities proposed for Group 3 units may either be underburning or Juniper reduction followed by underburning. Some units may have both treatments applied. Though underburning is prescribed the effects are anticipated to be more similar to a jackpot burn, where concentrations of fuels are burned and other portions of the units are lightly burned or unburned. The non-forested areas have insufficient fuel continuity to carry a fire in all but the most extreme conditions. The fire and fuels extension to the Forest Vegetation Simulator (FVS) was used to estimate the effects of treatment.

Included in Group 3 is Unit 18, which under Alternative B, would be proposed for a fuelbreak. A fuelbreak would involve removal of an increased amount of surface fuels, and thinning to remove ladder fuels to reduce the potential for crown fire.

For Group 3 units the effects of the prescribed fire proposed in Alternatives B, C, and D would reduce trees per acre less than 5 inches dbh by about 64%, grand fir, Douglas-fir and western juniper being most affected. About 83% of trees larger than 5 inches dbh would be retained.

Fuels – Woody Material

Existing Fuel Loading – Per Acre Average for Units

Size Descriptors	Average Wt. (tons/acre)	Average Piece Count (Pieces/Acre)	Average Piece Length (ft)
< 3 inches diameter	7		
> 3 inches diameter	9		
3 – 11.9 inches diameter		489	17
12 – 19.9 inches diameter		9	22
> 20 inches diameter		2	24
Total	16	500	

Post Burn Fuel Loading – Per Acre Average for Units

Size Descriptors	Average Wt. (tons/acre)	Average Piece Count (Pieces/Acre)	Average Piece Length (ft)
< 3 inches diameter	4		
> 3 inches diameter	7		
3 – 11.9 inches diameter		245	10
12 – 19.9 inches diameter		7	13
> 20 inches diameter		2	18
Total	11	254	

Smoke production associated with this treatment in Group 3 units is estimated at .06 tons per acre for particulate matter <2.5 microns, and .09 tons per acre for particulate matter <10 microns.

Fuel treatments proposed in Alternatives B, C, and D would reduce the <3 inches diameter fuel category from an average of 7 tons per acre to 4 tons per acre. This would reduce potential fire spread rates and intensity. Estimated mineral soil exposure is 36 percent. Litter and duff amounts vary by stand and plant association, estimated effects of the fuel treatments on duff and litter are shown below.

Plant Association	Litter (tons per acre)		Duff (tons per acre)	
	Pre-burn	Post-burn	Pre-burn	Post-burn
CW (Mixed Conifer)	2.38	1.94	24.8	19.4
CD (Douglas-fir)	1.38	1.28	6.1	4.8
CP (Ponderosa pine)	1.50	1.37	6.1	4.8

Standing Dead Trees

Existing Snag Conditions – Per Acre Average for Units

Diameter Class	Hard Recently Dead	Hard Loose Bark	Hard No Bark	Soft Decayed	Soft Decomposed	Total All Snags
<12”	0	0	0	0	0	0
12 – 20”	1.2	.9	.3	.3	0	2.7
>20”	.3	.9	.3	0	.6	2.1
Total	1.5	1.8	.6	.3	.6	4.8

Post Burn Snag Conditions – Per Acre Average for Units

Diameter Class	Hard Recently Dead	Hard Loose Bark	Hard No Bark	Soft Decayed	Soft Decomposed	Total All Snags
<12”	0	0	0	0	0	0
12 – 20”	1.95	0	.3	0	0	2.25
>20”	1.14	0	0	0	0	1.14
Total	3.09	0	.3	0	0	3.39

Standing dead trees (snags) are estimated to decrease from an average total of 4.8 to 3.39 snags per acre. Existing snags may be consumed by the prescribed fire while new snags would be created through the combined effects of the prescribed fire and insects or diseases.

Based on the plant association composition of units within Group 3 the desired snag ranges are shown in the table below.

Plant Association	Percent Composition	Snag Ranges <20" dbh	Snag Ranges >20" dbh	Aggregate Snag Range <20" dbh	Aggregate Snag Range >20" dbh
Dry Grand Fir (CW)	60	2 - 6	.2 - 2	1.2 – 3.6	.12 – 1.2
Douglas-fir (CD)	30	2 - 4	.2 - 2	.6 – 1.2	.06 - .6
Mesic Ponderosa Pine (CP)	0	2 - 4	.2 - 2	0 – 0	0 – 0
Total Snag Range				1.8 – 4.8	.18 – 1.8

Existing snag conditions for units within Group 3 are slightly below the desired snag range, minimum would be 4.86 per acre (3.6 + 1.26) for total snags, and existing is 4.8. After the prescribed fire snag levels would not meet desired ranges. Model projections indicate that the snag levels would increase to 4.9 per acre (within the desired range) about 15 years after prescribed fire treatment. Retention of existing snags may be increased through adjustment of lighting pattern, or clearing fuels around the base of snags. This would put the number of snags retained after the prescribed fire within the desired range.

GROUP 4

Forest Vegetation

Existing Tree Composition – Per Acre Average for Units

Tree Diameter Class	Ponderosa Pine TPA	Ponderosa Pine BA	Douglas-fir TPA	Douglas-fir BA	Grand Fir TPA	Grand Fir BA	Juniper TPA	Juniper BA	Western Larch TPA	Western Larch BA	Total TPA	Total BA
<1 "	48	0	24	0	0	0	80	0	0	0	152	0
1 – 4.9"	105	4	21	1	0	0	56	1	0	0	182	6
5 – 8.9"	24	5	7	2	0	0	10	3	0	0	42	10
9 – 20.9"	25	24	8	8	0	0	4	4	0	0	37	36
>21"	4	22	0	0	0	0	1	4	0	0	5	16
Total	206	55	60	11	0	0	152	12	0	0	418	78

Post-Burn Tree Composition – Per Acre Average for Units

Tree Diameter Class	Ponderosa Pine TPA	Ponderosa Pine BA	Douglas-fir TPA	Douglas-fir BA	Grand Fir TPA	Grand Fir BA	Juniper TPA	Juniper BA	Western Larch TPA	Western Larch BA	Total TPA	Total BA
<1 "	16	0	10	0	0	0	12	0	0	0	38	0
1 – 4.9"	52	2	9	1	0	0	18	1	0	0	80	4
5 – 8.9"	24	5	7	2	0	0	6	3	0	0	37	10
9 – 20.9"	25	24	8	8	0	0	4	4	0	0	37	36
>21"	4	22	0	0	0	0	1	4	0	0	5	26
Total	121	54	35	11	0	0	41	12	0	0	198	76

Group 4 units are dominated by ponderosa pine, with Douglas-fir and western juniper also present. Less than 10 percent of the units are non-forested, shallow soil ridgetops which are dominated by stiff sage, and bunchgrasses. Understory vegetation is dominated by pinegrass and elk sedge. Some mountain mahogany is also present in these units.

Activities proposed for Group 4 units may either be underburning or Juniper reduction followed by underburning. Some units may have both treatments applied. Though underburning is prescribed the effects are anticipated to be more similar to a jackpot burn, where concentrations of fuels are burned and other portions of the units are lightly burned or unburned. The non-forested areas have insufficient fuel continuity to carry a fire in all but the most extreme conditions. The fire and fuels extension to the Forest Vegetation Simulator (FVS) was used to estimate the effects of treatment.

For Group 4 units the effects of the prescribed fire proposed in Alternatives B, C, and D would reduce trees per acre less than 5 inches dbh by about 65%, grand fir, ponderosa pine and western juniper being most affected. About 94% of trees larger than 5 inches dbh would be retained.

Fuels – Woody Material
Existing Fuel Loading – Per Acre Average for Units

Size Descriptors	Average Wt. (tons/acre)	Average Piece Count (Pieces/Acre)	Average Piece Length (ft)
< 3 inches diameter	6		
> 3 inches diameter	12		
3 – 11.9 inches diameter		1268	7
12 – 19.9 inches diameter		0	0
> 20 inches diameter		6	51
Total	18	1274	

Post Burn Fuel Loading – Per Acre Average for Units

Size Descriptors	Average Wt. (tons/acre)	Average Piece Count (Pieces/Acre)	Average Piece Length (ft)
< 3 inches diameter	4		
> 3 inches diameter	8		
3 – 11.9 inches diameter		378	6
12 – 19.9 inches diameter		0	0
> 20 inches diameter		4	36
Total	11	382	

Smoke production associated with this treatment in Group 4 units is estimated at .06 tons per acre for particulate matter <2.5 microns, and .08 tons per acre for particulate matter <10 microns.

Fuel treatments proposed in Alternatives B, C, and D would reduce the <3 inches diameter fuel category from an average of 6 tons per acre to 4 tons per acre. This would reduce potential fire spread rates and intensity. Estimated mineral soil exposure is 36 percent. Litter and duff amounts vary by stand and plant association, estimated effects of the fuel treatments on duff and litter are shown below.

Plant Association	Litter (tons per acre)		Duff (tons per acre)	
	Pre-burn	Post-burn	Pre-burn	Post-burn
CW (Mixed Conifer)	2.38	1.94	24.8	19.4
CD (Douglas-fir)	1.38	1.28	6.1	4.8
CP (Ponderosa pine)	1.50	1.37	6.1	4.8

Standing Dead Trees
Existing Snag Conditions – Per Acre Average for Units

Diameter Class	Hard Recently Dead	Hard Loose Bark	Hard No Bark	Soft Decayed	Soft Decomposed	Total All Snags
<12”	0	0	0	0	0	0
12 – 20”	0	1	.2	.2	0	1.4
>20”	.2	.2	1	0	0	1.4
Total	.2	1.2	1.2	.2	0	2.8

Post Burn Snag Conditions – Per Acre Average for Units

Diameter Class	Hard Recently Dead	Hard Loose Bark	Hard No Bark	Soft Decayed	Soft Decomposed	Total All Snags
<12”	0	0	0	0	0	0
12 – 20”	.14	.8	0	.2	0	1.14
>20”	.28	1.28	0	0	0	1.56
Total	.42	2.08	0	.2	0	2.7

Standing dead trees (snags) are estimated to decrease slightly from an average total of 2.8 to 2.7 snags per acre. Existing snags may be consumed by the prescribed fire while new snags would be created through the combined effects of the prescribed fire and insects or diseases.

Based on the plant association composition of units within Group 4 the desired snag ranges are shown in the table below.

Plant Association	Percent Composition	Snag Ranges <20" dbh	Snag Ranges >20" dbh	Aggregate Snag Range <20" dbh	Aggregate Snag Range >20" dbh
Dry Grand Fir (CW)	0	2 - 6	.2 - 2	0 - 0	0 - 0
Douglas-fir (CD)	20	2 - 4	.2 - 2	.4 – .8	.04 - .4
Mesic Ponderosa Pine (CP)	80	2 - 4	.2 - 2	1.6 – 3.2	.16 – 1.6
Total Snag Range				2 – 4	.2 – 2.0

Existing snag conditions for units within Group 4 are within the desired snag range, minimum would be 2.2 per acre (2 + .2) for total snags, and existing is 2.8. After the prescribed fire snag levels would be within desired ranges at about 2.7 per acre.

GROUP 5

Forest Vegetation
Existing Tree Composition – Per Acre Average for Units

Tree Diameter Class	Ponderosa Pine TPA	Ponderosa Pine BA	Douglas-fir TPA	Douglas-fir BA	Grand Fir TPA	Grand Fir BA	Juniper TPA	Juniper BA	Western Larch TPA	Western Larch BA	Total TPA	Total BA
<1 "	10	0	38	0	12	0	48	0	4	0	112	0
1 – 4.9"	26	1	11	1	34	2	64	2	0	0	136	5
5 – 8.9"	7	2	7	2	22	6	11	2	0	0	46	11
9 – 20.9"	11	14	5	6	9	10	1	1	0	0	27	30
>21"	2	16	1	2	0	0	1	3	0	0	5	22
Total	57	32	62	11	78	18	125	8	4	0	325	70

Post-Burn Tree Composition – Per Acre Average for Units

Tree Diameter Class	Ponderosa Pine TPA	Ponderosa Pine BA	Douglas-fir TPA	Douglas-fir BA	Grand Fir TPA	Grand Fir BA	Juniper TPA	Juniper BA	Western Larch TPA	Western Larch BA	Total TPA	Total BA
<1 "	4	0	17	0	3	0	11	0	3	0	38	0
1 – 4.9"	17	1	7	1	10	1	17	1	0	0	51	3
5 – 8.9"	6	2	6	2	16	3	3	1	0	0	32	8
9 – 20.9"	11	14	5	6	9	10	1	1	0	0	26	30
>21"	2	16	1	2	0	0	1	3	0	0	5	22
Total	41	32	36	11	38	15	33	6	3	0	151	64

Group 5 units are a mixture of tree species dominated by ponderosa pine with Douglas-fir, grand fir, western larch and western juniper also present. About 20 percent of the units are non-forested, shallow soil ridgetops which are dominated by stiff sage, and bunchgrasses. Understory vegetation is dominated by pinegrass and elk sedge. Oregon grape, Idaho Fescue, and snowberry are also present.

Activities proposed for Group 5 units may either be underburning or Juniper reduction followed by underburning. Some units may have both treatments applied. Though underburning is prescribed the effects are anticipated to be more similar to a jackpot burn, where concentrations of fuels are burned and other portions of the units are lightly burned or unburned. The non-forested areas have insufficient fuel continuity to carry a fire in all but the most extreme conditions. The fire and fuels extension to the Forest Vegetation Simulator (FVS) was used to estimate the effects of treatment.

For Group 5 units the effects of the prescribed fire proposed in Alternatives B, C, and D would reduce trees per acre less than 5 inches dbh by about 64%, grand fir, Douglas-fir and western juniper being most affected. About 81% of trees larger than 5 inches dbh would be retained, most of the loss would be grand fir and western juniper 5 – 8.9 inches dbh.

Fuels – Woody Material

Existing Fuel Loading – Per Acre Average for Units

Size Descriptors	Average Wt. (tons/acre)	Average Piece Count (Pieces/Acre)	Average Piece Length (ft)
< 3 inches diameter	6		
> 3 inches diameter	8		
3 – 11.9 inches diameter		790	13
12 – 19.9 inches diameter		3	7
> 20 inches diameter		2	45
Total	14	795	

Post Burn Fuel Loading – Per Acre Average for Units

Size Descriptors	Average Wt. (tons/acre)	Average Piece Count (Pieces/Acre)	Average Piece Length (ft)
< 3 inches diameter	3		
> 3 inches diameter	6		
3 – 11.9 inches diameter		186	8
12 – 19.9 inches diameter		2	4
> 20 inches diameter		3	33
Total	9	191	

Smoke production associated with this treatment in Group 5 units is estimated at .06 tons per acre for particulate matter <2.5 microns, and .08 tons per acre for particulate matter <10 microns.

Fuel treatments proposed in Alternatives B, C and D would reduce the <3 inches diameter fuel category from an average of 6 tons per acre to 3 tons per acre. This would reduce potential fire spread rates and intensity. Estimated mineral soil exposure is 36 percent. Litter and duff amounts vary by stand and plant association, estimated effects of the fuel treatments on duff and litter are shown below.

Plant Association	Litter (tons per acre)		Duff (tons per acre)	
	Pre-burn	Post-burn	Pre-burn	Post-burn
CW (Mixed Conifer)	2.38	1.94	24.8	19.4
CD (Douglas-fir)	1.38	1.28	6.1	4.8
CP (Ponderosa pine)	1.50	1.37	6.1	4.8

Standing Dead Trees

Existing Snag Conditions – Per Acre Average for Units

Diameter Class	Hard Recently Dead	Hard Loose Bark	Hard No Bark	Soft Decayed	Soft Decomposed	Total All Snags
<12”	0	0	0	0	0	0
12 – 20”	.4	.8	.5	.5	0	2.2
>20”	.5	.7	.6	0	.2	2
Total	.9	1.5	1.1	.5	.2	4.2

Post Burn Snag Conditions – Per Acre Average for Units

Diameter Class	Hard Recently Dead	Hard Loose Bark	Hard No Bark	Soft Decayed	Soft Decomposed	Total All Snags
<12”	0	0	0	0	0	0
12 –20”	.93	.1	0	.5	0	1.53
>20”	.94	.16	0	0	0	1.1
Total	1.87	.26	0	.5	0	2.63

Standing dead trees (snags) are estimated to decrease from an average total of 4.2 to 2.63 snags per acre. Existing snags may be consumed by the prescribed fire while new snags would be created through the combined effects of the prescribed fire and insects or diseases.

Based on the plant association composition of units within Group 5 the desired snag ranges are shown in the table below.

Plant Association	Percent Composition	Snag Ranges		Aggregate Snag Range	
		<20" dbh	>20" dbh	<20" dbh	>20" dbh
Dry Grand Fir (CW)	20	2 - 6	.2 - 2	1 – 1.2	.04 – .4
Douglas-fir (CD)	50	2 - 4	.2 - 2	1 - 2	.1 - 1
Mesic Ponderosa Pine (CP)	10	2 - 4	.2 - 2	.2 – .4	.02 – .2
Total Snag Range				1.6 – 3.8	.16 – 1.6

Existing snag conditions for units within Group 5 are within the desired snag range, minimum would be 2.72 per acre (2.2 + .52) for total snags, and existing is 4.2. After the prescribed fire snag levels would be reduced to about 2.63 per acre, slightly below the desired range. Retention of existing snags may be increased through adjustment of lighting pattern, or clearing fuels around the base of snags. This would put the number of snags retained after the prescribed fire within the desired range.

Table F-3 ~ Alternative D Commercial Treatment Summary

Unit #	Acres	RX	Post	Fuel Treatment	Logging System	MBF Acre	RHCA Treatment
107	29	HIM	SPC/WHIP	Under Burn	Tractor	2	None
115	10	HIM	SPC/WHIP	Jackpot Burn	Tractor	2	None
116	20	HIM	SPC/WHIP	Jackpot Burn	Tractor	2	None
117	35	HTH	SPC/WHIP	Grapple Pile	Tractor	2	None
120	6	HIM	SPC/WHIP	Under Burn	Tractor	2	None
124	31	HIM	WHIPFALL	Jackpot Burn	Tractor	2.5	None
125	14	HIM	WHIPFALL	Jackpot Burn	Tractor	2.5	None
127	28	HIM	WHIPFALL	Jackpot Burn	Tractor	2.5	None
128	12	HCR w/reserv	WHIPFALL	Broadcast Burn	Tractor	7.5	None
129	24	HTH	SPC/WHIP	Jackpot Burn	Tractor	2.5	None
130	34	HIM	SPC/WHIP	Jackpot Burn	Tractor	2	None
131	28	HIM	SPC/WHIP	Grapple Pile	Tractor	2	None
133	27	HIM	SPC	Jackpot Burn	Tractor	2	None
134	69	HIM	SPC/WHIP	Under Burn	Tractor	2	None
140	41	HIM	SPC/WHIP	Grapple Pile	Tractor	4	None
142	100	HIM	SPC/WHIP	Grapple Pile	Tractor	4	None
143	23	HIM	SPC/WHIP	Grapple Pile	Tractor	4	None
144	19	HIM	SPC/WHIP	Grapple Pile	Tractor	4	None
145	44	HIM	SPC/WHIP	Under Burn	Tractor	2.5	None
146	15	HIM	SPC/WHIP	Grapple Pile	Tractor	4	None
149	23	HIM	SPC/WHIP	Grapple Pile	Tractor	4	None
151	24	HCR w/reserves/HIM	WHIPFALL	Broadcast Burn	Tractor	7.5	None
156	17	HIM	SPC/WHIP	Jackpot Burn	Tractor	2	None
157	15	HIM	SPC/WHIP	Jackpot Burn	Tractor	2	None
159	35	HIM	SPC/WHIP	Under Burn	Tractor	1.7	None
161	21	HIM	SPC/WHIP	Under Burn	Tractor	2	None
162	31	HIM	SPC/WHIP	Under Burn	Tractor	2	None
163	24	HIM	SPC/WHIP	Under Burn	Tractor	7.5	None
166	23	HIM	SPC/WHIP	Under Burn	Tractor	2	None
168	44	HIM	SPC/WHIP	Broadcast Burn	Tractor	7.5	None
169	42	HIM	SPC/WHIP	Broadcast Burn	Tractor	7.5	None
170	26	HIM	SPC/WHIP	Broadcast Burn	Tractor	7.5	None
175	24	HIM	SPC/WHIP	Jackpot Burn	Tractor	2	None
176	23	HIM	SPC/WHIP	Jackpot Burn	Tractor/Winter	2	None
178	26	HIM	SPC/WHIP	Jackpot Burn	Helicopter	2	None
181	7	HIM	SPC/WHIP	Under Burn	Helicopter	1.7	None
182	37	HIM	SPC/WHIP	Under Burn	Tractor	1.7	None
183	22	HTH	SPC	Under Burn	Helicopter	1.5	None
186	9	HIM	SPC/WHIP	Under Burn	Helicopter	1.5	None
187	5	HIM	SPC/WHIP	Under Burn	Helicopter	1.5	None
188	23	HIM	SPC/WHIP	Under Burn	Helicopter	1.5	None
189	28	HIM	SPC/WHIP	Under Burn	Helicopter	1.5	None
190	11	HTH	SPC	Under Burn	Helicopter	1.5	None
192	6	HSL	SPC	Under Burn	Helicopter	1.5	None
193	6	HTH	SPC	Under Burn	Helicopter	1.5	None
194	43	HTH	SPC	Under Burn	Helicopter	1.5	None
195	10	HIM	SPC/WHIP	Under Burn	Helicopter	1.5	None
196	9	HIM	SPC/WHIP	Under Burn	Helicopter	1.5	None
197	13	HIM	SPC/WHIP	Under Burn	Helicopter	1.5	None
198	7	HIM	SPC/WHIP	Under Burn	Helicopter	1.5	None
199	8	HIM	SPC/WHIP	Under Burn	Helicopter	1.7	None
204	22	HIM	SPC/WHIP	Under Burn	Helicopter	1.5	None
205	25	HTH	SPC	Under Burn	Helicopter	1.5	None
206	21	HIM	SPC/WHIP	Under Burn	Tractor	1.5	None

*** Acres presented are gross acres. Actual treatment acres in HSG units will be approximately 25% of those listed.**

Table F-3 ~ Alternative D Commercial Treatment Summary

Unit #	Acres	RX	Post	Fuel Treatment	Logging System	CCF Acre	RHCA Treatment
208	23	HIM	SPC/WHIP	Under Burn	Tractor	1.5	None
210	37	HIM	SPC/WHIP	Jackpot Burn	Tractor	1.5	None
211	23	HIM	SPC/WHIP	Broadcast Burn	Tractor	7.5	None
213	16	HIM	SPC/WHIP	Under Burn	Tractor	1.5	None
214	28	HIM	SPC/WHIP	Under Burn	Tractor	1.5	None
214a	27	HIM	SPC/WHIP	Under Burn	Helicopter	1.5	None
215	62	HIM	SPC/WHIP	Jackpot Burn	Tractor	1.5	None
216	15	HIM	SPC/WHIP	Jackpot Burn	Helicopter	1.5	None
217	7	HIM	SPC/WHIP	Jackpot Burn	Helicopter	1.5	None
220	54	HIM	SPC/WHIP	Jackpot Burn	Helicopter	1.5	None
221	11	HIM	SPC/WHIP	Jackpot Burn	Tractor	1.5	None
222	42	HIM	SPC/WHIP	Under Burn	Helicopter	1.5	None
223	98	HIM	SPC/WHIP	Broadcast Burn	Tractor	7.5	None
223a	4	HSG	SPC/WHIP	Broadcast Burn	Helicopter	7.5	None
224	21	HIM	SPC/WHIP	Broadcast Burn	Tractor	7.5	None
226	62	HIM	SPC/WHIP	Jackpot Burn	Helicopter	2.5	None
227	22	HIM	SPC/WHIP	Jackpot Burn	Tractor	1.5	None
229	7	HIM	SPC/WHIP	Broadcast Burn	Tractor	7.5	None
230	70	HIM	SPC/WHIP	Jackpot Burn	Tractor	1.5	None
232	24	HSG	SPC/WHIP	Broadcast Burn	Tractor	7.5	None
233	14	HIM	SPC/WHIP	Broadcast Burn	Tractor	7.5	None
234	7	HIM	SPC/WHIP	Broadcast Burn	Tractor	7.5	None
235	68	HSG	WHIPFALL	Broadcast Burn	Tractor	7.5	None
237	110	HSG	WHIPFALL	Broadcast Burn	Helicopter	7.5	None
238	20	HSG	WHIPFALL	Broadcast Burn	Tractor	7.5	None
245	16	HIM	SPC/WHIP	Under Burn	Tractor	2.5	None
246	14	HIM	SPC/WHIP	Under Burn	Tractor	2.5	None
247	34	HSG	SPC/WHIP	Broadcast Burn	Tractor	7.5	None
252	16	HIM	SPC/WHIP	Jackpot Burn	Tractor	2.5	None
253	50	HIM	SPC/WHIP	Under Burn	Tractor	2.5	None
254	7	HIM	SPC/WHIP	Broadcast Burn	Tractor	7.5	None
255	33	HIM	SPC/WHIP	Under Burn	Tractor	2.5	None
257	44	HIM	SPC/WHIP	Under Burn	Tractor	2.5	None
258	21	HIM	SPC/WHIP	Broadcast Burn	Tractor	2.5	None
261	18	HIM	SPC/WHIP	Grapple Pile	Tractor	2.5	None
3	112	HIM	SPC/WHIP	Grapple Pile	Tractor	2	None
310	113	HIM	SPC/WHIP	Under Burn	Tractor/Winter	1.7	None
314	47	HTH	SPC/WHIP	Under Burn	Tractor/Winter	1.7	None
315	28	HTH	SPC/WHIP	Under Burn	Helicopter	1.7	None
316	24	HTH	SPC/WHIP	Under Burn	Helicopter	1.7	None
317	28	HTH	SPC/WHIP	Under Burn	Tractor/Winter	1.7	None
317a	24	HTH	SPC/WHIP	Under Burn	Helicopter	1.7	None
326	73	HIM	SPC/WHIP	Under Burn	Tractor/Winter	1.7	None
327	21	HIM	SPC/WHIP	Under Burn	Tractor/Winter	1.7	None
341	14	HIM	SPC/WHIP	Jackpot Burn	Helicopter	1.7	None
343	21	HIM	SPC/WHIP	Jackpot Burn	Helicopter	2	None
351	23	HIM	SPC/WHIP	Under Burn	Tractor/Winter	2.5	None
352	24	HIM	SPC/WHIP	Under Burn	Tractor/Winter	2.5	None
353	127	HIM	SPC/WHIP	Under Burn	Tractor/Winter	2.5	None
354	79	HIM	SPC/WHIP	Under Burn	Tractor	2.5	None
356	31	HIM	SPC/WHIP	Jackpot Burn	Tractor	2.5	None
360	46	HIM	SPC/WHIP	Under Burn	Tractor/Winter	2.5	None
367	14	HIM	SPC/WHIP	Under Burn	Helicopter	1.7	None
37	7	HIM	SPC/WHIP	Jackpot Burn	Tractor	1.5	None

*** Acres presented are gross acres. Actual treatment acres in HSG units will be approximately 25% of those listed.**

Table F-3 ~ Alternative D Commercial Treatment Summary

Unit #	Acres	RX	Post	Fuel Treatment	Logging System	CCF Acre	RHCA Treatment
371	65	HIM	SPC/WHIP	Under Burn	Tractor	1.7	None
372	20	HIM	SPC/WHIP	Jackpot Burn	Tractor	2	None
375	28	HIM	SPC/WHIP	Under Burn	Helicopter	2	None
377	11	HIM	SPC/WHIP	Under Burn	Tractor	1.7	None
378	11	HIM	SPC/WHIP	Under Burn	Tractor	1.7	None
379	23	HIM	SPC/WHIP	Jackpot Burn	H	2	None
38	55	HIM	SPC	Jackpot Burn	Tractor	1.5	None
381	28	HIM	SPC/WHIP	Jackpot Burn	Tractor	2	None
387	83	HIM	SPC/WHIP	Under Burn	Tractor	2.5	None
388	275	HTH	SPC/WHIP	Under Burn	Tractor	2.5	None
39	102	HIM	SPC/WHIP	Under Burn	Tractor	2	None
397	59	HIM	SPC/WHIP	Under Burn	H	1.7	None
4	9	HTH	WHIPFALL	Jackpot Burn	Tractor	2.5	None
40	37	HIM	SPC/WHIP	Jackpot Burn	Tractor	2.5	None
401	24	HIM	SPC/WHIP	Under Burn	Tractor	1.7	None
416	22	HIM	SPC/WHIP	Under Burn	Tractor	2.5	None
42	90	HSG	SPC/WHIP	Broadcast Burn	Tractor	7.5	None
425	12	HIM	SPC/WHIP	Jackpot Burn	Tractor	2.5	None
426	19	HIM	SPC/WHIP	Under Burn	Tractor	2.5	None
436	56	HIM	SPC/WHIP	Under Burn	Tractor	2.5	None
443	24	HIM	SPC/WHIP	Under Burn	Tractor	2	None
446	34	HIM	SPC/WHIP	Under Burn	Tractor	2	None
447	47	HIM	SPC/WHIP	Jackpot Burn	Tractor	1.7	None
453	37	HIM	SPC/WHIP	Jackpot Burn	Helicopter	2.5	None
454	25	HTH	SPC	Under Burn	Tractor	2	None
455	54	HIM	SPC/WHIP	Under Burn	Tractor	2	None
455a	7	HIM	SPC/WHIP	Under Burn	Helicopter	2	None
456	16	HIM	SPC/WHIP	Under Burn	Tractor	2	None
466	13	HIM	SPC/WHIP	Jackpot Burn	Tractor/Winter	2.5	None
472	45	HTH	SPC	Under Burn	Tractor	2.5	None
477	20	HIM	SPC/WHIP	Under Burn	Tractor	1.7	None
478	8	HIM	SPC/WHIP	Under Burn	Tractor	1.7	None
482	37	HIM	SPC/WHIP	Grapple Pile	Tractor	2.5	None
485	30	HIM	SPC/WHIP	Under Burn	Tractor/Winter	2.5	None
488	77	HIM	SPC/WHIP	Jackpot Burn	Tractor/Winter	2.5	None
494	23	HIM	SPC/WHIP	Grapple Pile	Tractor/Winter	2.5	None
495	29	HIM	SPC/WHIP	Under Burn	Tractor/Winter	2.5	None
496	34	HTH	SPC	Under Burn	Tractor/Winter	2.5	None
499	20	HTH	SPC	Grapple Pile	Tractor/Winter	2.5	None
50	38	HIM	SPC/WHIP	Jackpot Burn	Helicopter	2.5	None
500	14	HSH	WHIPFALL	Broadcast Burn	Tractor/Winter	7.5	None
506	30	HIM	SPC/WHIP	Under Burn	Tractor	2.5	None
506a	15	HIM	SPC/WHIP	Grapple Pile	Tractor	2.5	None
507	33	HIM	SPC/WHIP	Under Burn	Tractor	2.5	None
508	9	HIM	SPC/WHIP	Jackpot Burn	Tractor	2.5	None
509	39	HIM	SPC/WHIP	Jackpot Burn	Tractor/Winter	2.5	None
51	47	HIM	SPC/WHIP	Jackpot Burn	Helicopter	2	None
513	30	HIM	SPC/WHIP	Under Burn	Tractor/Winter	2.5	None
516	16	HIM	SPC/WHIP	Jackpot Burn	Tractor/Winter	2.5	None
518	12	HIM	SPC/WHIP	Under Burn	Tractor/Winter	2.5	None
52	50	HIM	SPC/WHIP	Under Burn	Tractor	2	None
520	5	HIM	SPC/WHIP	Under Burn	Tractor/Winter	2.5	None
524	48	HIM	SPC/WHIP	Under Burn	Tractor/Winter	2.5	None
526	40	HTH	SPC	Grapple Pile	Tractor/Winter	2.5	None

* Acres presented are gross acres. Actual treatment acres in HSG units will be approximately 25% of those listed.

Table F-3 ~ Alternative D Commercial Treatment Summary

Unit #	Acres	RX	Post	Fuel Treatment	Logging System	CCF Acre	RHCA Treatment
528	33	HIM	SPC/WHIP	Under Burn	Tractor/Winter	2.5	None
53	41	HIM	SPC/WHIP	Under Burn	Tractor	2	None
534	44	HIM	SPC/WHIP	Grapple Pile	Tractor/Winter	2.5	None
55	11	HIM	SPC/WHIP	Under Burn	Helicopter	2.5	None
57	11	HIM	SPC/WHIP	Under Burn	Tractor	2	None
59a	29	HIM	WHIPFALL	Grapple Pile	Tractor	2.5	None
60	14	HTH		Jackpot Burn	Tractor	2.5	None
61	23	HCR	WHIPFALL	Broadcast Burn	Tractor	7.5	None
68	11	HSV	WHIPFALL	Under Burn	Tractor	2.5	None
69	12	HIM	WHIPFALL	Jackpot Burn	Tractor	2	None
75	21	HIM	SPC/WHIP	Jackpot Burn	Tractor	2.5	None
76	10	HIM	SPC/WHIP	LTGrapple Pile	Tractor	4	None
78	47	HSG	WHIPFALL	Broadcast Burn	Tractor	7.5	None
80	6	HIM	SPC/WHIP	Jackpot Burn	Tractor	4	None
81	18	HIM	SPC/WHIP	Grapple Pile	Tractor	4	None
85	25	HIM	SPC/WHIP	Grapple Pile	Tractor	4	None
90	25	HIM	SPC/WHIP	Broadcast Burn	Tractor	7.5	None

*** Acres presented are gross acres. Actual treatment acres in HSG units will be approximately 25% of those listed.**

Appendix G

Commercial Harvest Soils Summary

Commercial Harvest Soils Summary
Alternative B

Unit	Logging System	Acres	Existing Soil Disturbance	% of Area Tillable	% Slope	Acres of Soil Rehab	Post Trmt Soil Disturbance	REMARKS
1	T	13	11-20%	50	0-15	0.7	11-20%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
2	H	4	0-10%	50	15-30	0	0-10%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
3	T	113	41-50%	50	0-15	5.7	41-50%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
4	T	9	31-40%	0	0-15	0	31-40%	Design skid trails/landings to use existing disturbance. No net increase of detrimental soil conditions.
37	T	7	0-10%	50	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
38	T	128	0-10%	50	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
39	T	102	31-40%	75	0-15	5.1	31-40%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
40	T	37	31-40%	25	0-15	0	31-40%	Design skid trails/landings to use existing disturbance. No net increase of detrimental soil conditions.
42	T	108	51-60%	75	0-15	5.4	51-60%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
50	H	38	21-30%	50	0-15	0	21-30%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
51	H	47	31-40%	100	0-15	0	31-40%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
52	T	72	21-30%	50	0-15	3.6	21-30%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
53	T	41	21-30%	75	0-15	2.1	21-30%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
54	S	14	0-10%	75	0-15	0	11-20%	Design will meet S&Gs
55	S	11	11-20%	50	15-30	0	11-20%	Design will meet S&Gs
57	T	23	21-30%	75	0-15	1.2	21-30%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
58	T	29	21-30%	50	0-15	1.5	21-30%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
59	T	10	11-20%	0	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
60	T	14	21-30%	0	0-15	0	21-30%	Design skid trails/landings to use existing disturbance. No net increase of detrimental soil conditions.
61	T	10	0-10%	0	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
68	T	11	21-30%	50	0-15	0.6	21-30%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
69	T	35	21-30%	25	0-15	0	21-30%	Design skid trails/landings to use existing disturbance. No net increase of detrimental soil conditions.
75	T	36	21-30%	75	0-15	1.8	21-30%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
76	T	10	11-20%	0	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
78	T	92	0-10%	50	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
79	T	11	0-10%	100	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.

Commercial Harvest Soils Summary
Alternative B

Unit	Logging System	Acres	Existing Soil Disturbance	% of Area Tillable	% Slope	Acres of Soil Rehab	Post Trmt Soil Disturbance	REMARKS
80	T	6	0-10%	100	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
81	T	30	0-10%	75	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
82	T	49	0-10%	75	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
83	T	125	0-10%	50	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
85	T	30	21-30%	75	0-15	1.5	21-30%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
90	T	83	0-10%	75	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
95	T	16	0-10%	100	15-30	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
107	T	29	21-30%	25	0-15	0	21-30%	Design skid trails/landings to use existing disturbance. No net increase of detrimental soil conditions.
109	T	11	11-20%	100	0-15	0.6	11-20%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
110	T	28	11-20%	25	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
115	T	10	21-30%	50	0-15	0.5	21-30%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
116	T	22	11-20%	25	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
117	T	55	11-20%	25	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
120	T	6	11-20%	0	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
121	T	9	31-40%	0	0-15	0	31-40%	Design skid trails/landings to use existing disturbance. No net increase of detrimental soil conditions.
123	T	38	0-10%	50	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
124	T	31	0-10%	25	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
125	T	14	0-10%	100	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
126	T	24	11-20%	75	0-15	1.2	11-20%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
127	T	36	21-30%	50	0-15	1.8	21-30%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
128	T	22	11-20%	75	0-15	1.1	11-20%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
129	T	24	31-40%	25	0-15	0	31-40%	Design skid trails/landings to use existing disturbance. No net increase of detrimental soil conditions.
130	T	34	41-50%	25	0-15	0	41-50%	Design skid trails/landings to use existing disturbance. No net increase of detrimental soil conditions.
131	T	28	0-10%	50	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
133	T	27	0-10%	50	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
134	T	43	21-30%	75	0-15	2.2	21-30%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
140	T	41	21-30%	50	0-15	2.1	21-30%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.

Commercial Harvest Soils Summary
Alternative B

Unit	Logging System	Acres	Existing Soil Disturbance	% of Area Tillable	% Slope	Acres of Soil Rehab	Post Trmt Soil Disturbance	REMARKS
142	T	100	41-50%	50	0-15	5.0	41-50%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
143	T	35	41-50%	75	0-15	1.8	41-50%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
144	T	37	11-20%	75	0-15	1.9	11-20%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
145	T	44	11-20%	25	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
146	T	39	21-30%	50	0-15	2.0	21-30%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
149	T	43	31-40%	50	0-15	2.2	31-40%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
151	T	26	31-40%	75	0-15	1.3	31-40%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
156	T	17	21-30%	50	0-15	0.9	21-30%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
157	T	15	21-30%	50	0-15	0.8	21-30%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
159	T	35	31-40%	25	0-15	0	31-40%	Design skid trails/landings to use existing disturbance. No net increase of detrimental soil conditions.
161	T	53	0-10%	50	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
163	T	59	31-40%	50	0-15	3.0	31-40%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
166	T	27	21-30%	50	0-15	1.4	21-30%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
168	T	44	0-10%	50	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
169	T	56	0-10%	50	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
170	T	39	11-20%	0	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
175	T	24	31-40%	0	0-15	0	31-40%	Design skid trails/landings to use existing disturbance. No net increase of detrimental soil conditions.
176	T/WL	30	21-30%	50	0-15	2.3	21-30%	Log under winter conditions (design element) to meet S&Gs. Re-hab landings.
178	H	26	11-20%	0	15-30	0	11-20%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
181	T	7	11-20%	0	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
182	T	37	0-10%	0	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
183	H	22	21-30%	75	0-15	0	21-30%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
186	H	9	0-10%	0	15-30	0	11-20%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
187	T	5	0-10%	0	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
188	H	23	11-20%	0	30-50	0	11-20%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
189	H	49	11-20%	75	0-15	0	11-20%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
190	H	11	11-20%	0	15-30	0	11-20%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.

Commercial Harvest Soils Summary
Alternative B

Unit	Logging System	Acres	Existing Soil Disturbance	% of Area Tillable	% Slope	Acres of Soil Rehab	Post Trmt Soil Disturbance	REMARKS
192	H	9	11-20%	0	0-15	0	11-20%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
193	H	6	11-20%	0	0-15	0	11-20%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
194	H	43	11-20%	0	0-15	0	11-20%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
195	H	10	11-20%	0	0-15	0	11-20%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
196	H	9	21-30%	0	0-15	0	21-30%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
197	H	14	11-20%	50	0-15	0	11-20%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
198	H	7	11-20%	0	0-15	0	11-20%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
199	H	8	11-20%	0	0-5	0	11-20%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
200	H	25	11-20%	0	15-30	0	11-20%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
201	H	27	11-20%	0	0-15	0	11-20%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
203	H	22	11-20%	0	0-15	0	11-20%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
204	H	22	11-20%	0	0-15	0	11-20%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
205	T	25	11-20%	50	0-15	1.3	11-20%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
205a	H	10	11-20%	0	0-15	0	11-20%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
206	T	21	21-30%	100	0-15	1.1	21-30%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
207	T	14	0-10%	25	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
207a	H	14	0-10%	0	15-30	0	0-10%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
208	T	23	11-20%	100	0-15	1.2	11-20%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
210	T	37	21-30%	100	0-15	1.9	21-30%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
211	T	23	21-30%	75	0-15	1.2	21-30%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
212	T	9	11-20%	50	0-15	0.5	11-20%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
213	T	16	0-10%	50	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
213a	H	12	0-10%	0	0-15	0	0-10%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
214	T	30	0-10%	25	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
214a	H	26	0-10%	0	0-15	0	0-10%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
215	T	48	0-10%	25	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
215a	H	12	0-10%	0	0-15	0	0-10%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.

Commercial Harvest Soils Summary
Alternative B

Unit	Logging System	Acres	Existing Soil Disturbance	% of Area Tillable	% Slope	Acres of Soil Rehab	Post Trmt Soil Disturbance	REMARKS
216	H	15	31-40%	50	0-15	0	31-40%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
217	H	7	21-30%	50	0-15	0	21-30%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
219	H	11	0-10%	0	15-30	0	0-10%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
220	H	60	11-20%	50	0-15	0	11-20%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
221	T	11	0-10%	50	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
222	H	42	11-20%	0	0-15	0	11-20%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
223	T	127	0-10%	50	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
223a	H	5	0-10%	50	0-15	0	0-10%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
224	H	35	11-20%	25	0-15	0	11-20%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
225	H	18	11-20%	25	0-15	0	11-20%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
226	H	62	31-40%	50	0-15	0	31-40%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
227	T	22	11-20%	50	0-15	1.1	11-20%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
228	T	10	0-10%	50	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
229	T	8	11-20%	0	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
230	T	71	31-40%	0	0-15	0	31-40%	Design skid trails/landings to use existing disturbance. No net increase of detrimental soil conditions.
231	T	14	11-20%	100	0-15	0.7	11-20%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
232	T	24	31-40%	0	0-15	0	31-40%	Design skid trails/landings to use existing disturbance. No net increase of detrimental soil conditions.
233	T	14	11-20%	50	0-15	0.7	11-20%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
234	T	7	11-20%	100	0-15	0.4	11-20%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
235	T	77	0-10%	50	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
237	H	110	31-40%	25	0-15	0	31-40%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
238	T	20	21-30%	75	0-15	1.0	21-30%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
243	T	52	0-10%	100	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
244	T	5	0-10%	0	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
245	T	16	21-30%	75	0-15	0.8	21-30%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
246	T	22	31-40%	0	0-15	0	31-40%	Design skid trails/landings to use existing disturbance. No net increase of detrimental soil conditions.
247	T	74	0-10%	100	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.

Commercial Harvest Soils Summary
Alternative B

Unit	Logging System	Acres	Existing Soil Disturbance	% of Area Tillable	% Slope	Acres of Soil Rehab	Post Trmt Soil Disturbance	REMARKS
252	T	16	11-20%	100	0-15	0.8	11-20%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
253	T	50	11-20%	75	0-15	2.5	11-20%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
254	T	30	11-20%	75	0-15	1.5	11-20%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
255	T	33	21-30%	50	0-15	1.7	21-30%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
257	T	44	21-30%	25	0-15	0	21-30%	Design skid trails/landings to use existing disturbance. No net increase of detrimental soil conditions.
258	T	21	31-40%	50	0-15	1.1	31-40%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
261	T	18	21-30%	100	0-15	0.9	21-30%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
310	T/WL	138	11-20%	0	0-15	0	11-20%	Log under winter conditions (design element) to meet S&Gs. Re-use existing landings to stay below 20%.
313	T/WL	74	21-30%	25	0-15	0	21-30%	Log under winter conditions (design element) to meet S&Gs. Re-use existing landings.
314	T/WL	42	21-30%	25	0-15	0	21-30%	Log under winter conditions (design element) to meet S&Gs. Re-use existing landings.
315	S	28	21-30%	0	50	0	21-30%	No net increase of detrimental disturbance to occur. Use existing trails,landings,roads.
316	S	25	21-30%	0	50	0	21-30%	No net increase of detrimental disturbance to occur. Use existing trails,landings,roads.
317	T	2	31-40%	0	0-15	0	31-40%	Design skid trails/landings to use existing disturbance. No net increase of detrimental soil conditions.
317a	S	56	21-30%	0	15-30	0	21-30%	No net increase of detrimental disturbance to occur. Use existing trails,landings,roads.
318	T/WL	71	21-30%	0	0-15	0	21-30%	Log under winter conditions (design element) to meet S&Gs. Re-use existing landings.
326	T/WL	74	21-30%	0	0-15	0	21-30%	Log under winter conditions (design element) to meet S&Gs. Re-use existing landings.
327	T/WL	23	21-30%	0	0-15	0	21-30%	Log under winter conditions (design element) to meet S&Gs. Re-use existing landings.
334	T/WL	75	11-20%	0	0-15	0	11-20%	Log under winter conditions (design element) to meet S&Gs. Re-use existing landings to stay below 20%.
338	S	47	0-10%	75	15-30	0	11-20%	Design will meet S&Gs
341	H	14	0-10%	0	15-30	0	0-10%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
342	H	4	0-10%	0	50	0	0-10%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
343	H	24	0-10%	0	50	0	0-10%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
344	H	2	0-10%	50	50	0	0-10%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
345	H	23	0-10%	50	50	0	0-10%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
351	T/WL	25	31-40%	50	15-30	1.9	31-40%	Log under winter conditions (design element) to meet S&Gs. Re-hab landings.
352	T/WL	27	21-30%	100	0-15	2.0	21-30%	Log under winter conditions (design element) to meet S&Gs. Re-hab landings.
353	T/WL	128	31-40%	75	0-15	9.6	31-40%	Log under winter conditions (design element) to meet S&Gs. Re-hab landings.

Commercial Harvest Soils Summary
Alternative B

Unit	Logging System	Acres	Existing Soil Disturbance	% of Area Tillable	% Slope	Acres of Soil Rehab	Post Trmt Soil Disturbance	REMARKS
354	T	79	21-30%	75	0-15	4.0	21-30%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
356	T	31	21-30%	100	0-15	1.6	21-30%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
357	T	13	21-30%	0	0-15	0	21-30%	Design skid trails/landings to use existing disturbance. No net increase of detrimental soil conditions.
360	T	46	21-30%	0	0-15	0	21-30%	Design skid trails/landings to use existing disturbance. No net increase of detrimental soil conditions.
367	S	14	11-20%	0	0-15	0	11-20%	Design will meet S&Gs
371	T	65	0-10%	50	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
372	T	20	0-10%	75	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
373	H	5	0-10%	100	50	0	0-10%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
374	H	8	0-10%	100	15-30	0	0-10%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
375	H	28	0-10%	0	15-30	0	0-10%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
377	T	11	11-20%	25	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
378	T	11	11-20%	100	0-15	0.6	11-20%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
379	H	23	0-10%	25	15-30	0	0-10%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
381	T	28	11-20%	100	0-15	1.4	11-20%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
387	T	83	31-40%	75	0-15	4.2	31-40%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
388	T	277	31-40%	75	0-15	13.9	31-40%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
397	S	59	0-10%	75	0-15	0	11-20%	Design will meet S&Gs.
400	T	9	21-30%	0	0-15	0	21-30%	Design skid trails/landings to use existing disturbance. No net increase of detrimental soil conditions.
401	T	24	11-20%	0	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
416	T	36	21-30%	100	0-15	1.8	21-30%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
420	T	21	0-10%	75	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
424	T	25	11-20%	75	0-15	1.3	11-20%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
425	T	32	0-10%	50	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
426	T	19	0-10%	0	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
436	T	114	11-20%	75	15-30	5.7	11-20%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
443	T	27	0-10%	75	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
445	H	14	11-20%	100	15-30	0	11-20%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.

Commercial Harvest Soils Summary
Alternative B

Unit	Logging System	Acres	Existing Soil Disturbance	% of Area Tillable	% Slope	Acres of Soil Rehab	Post Trmt Soil Disturbance	REMARKS
446	T	43	0-10%	75	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
447	T	47	0-10%	25	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
453	H	37	21-30%	75	0-15	0	21-30%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
454	T	33	31-40%	0	0-15	0	31-40%	Design skid trails/landings to use existing disturbance. No net increase of detrimental soil conditions.
454a	H	68	31-40%	25	0-15	0	31-40%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
455	T	54	0-10%	50	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
455a	H	13	31-40%	100	0-15	0	31-40%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
456	T	16	0-10%	0	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
461	T	44	11-20%	100	0-15	2.2	11-20%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
463	T/WL	28	31-40%	0	0-15	0	31-40%	Log under winter conditions (design element) to meet S&Gs. Re-use existing landings.
465	T/WL	85	31-40%	75	0-15	6.4	31-40%	Log under winter conditions (design element) to meet S&Gs. Re-hab landings.
466	T/WL	21	31-40%	100	0-15	1.6	31-40%	Log under winter conditions (design element) to meet S&Gs. Re-hab landings.
466a	T/WL	3	11-20%	0	0-15	0	11-20%	Log under winter conditions (design element) to meet S&Gs. Re-use existing landings to stay below 20%.
467	T/WL	8	11-20%	0	0-15	0	11-20%	Log under winter conditions (design element) to meet S&Gs. Re-use existing landings to stay below 20%.
472	T/WL	52	41-50%	75	0-15	3.9	41-50%	Log under winter conditions (design element) to meet S&Gs. Re-hab landings.
473	H	23	11-20%	75	15-30	0	11-20%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
477	T	20	0-10%	100	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
478	T	8	0-10%	100	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
478a	H	7	11-20%	100	0-15	0	11-20%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
479	T	22	11-20%	50	0-15	1.1	11-20%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
482	T	47	31-40%	50	0-15	2.4	31-40%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
484	T	23	31-40%	50	0-15	1.2	31-40%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
485	T/WL	22	41-50%	0	0-15	0	41-50%	Log under winter conditions (design element) to meet S&Gs. Re-use existing landings.
488	T/WL	66	31-40%	50	0-15	5.0	31-40%	Log under winter conditions (design element) to meet S&Gs. Re-hab landings.
491	T/WL	51	31-40%	100	15-30	3.8	31-40%	Log under winter conditions (design element) to meet S&Gs. Re-hab landings.
494	T/WL	14	11-20%	100	0-15	1.1	11-20%	Log under winter conditions (design element) to meet S&Gs. Re-hab landings.
495	T/WL	29	31-40%	100	0-15	2.2	31-40%	Log under winter conditions (design element) to meet S&Gs. Re-hab landings.

Commercial Harvest Soils Summary
Alternative B

Unit	Logging System	Acres	Existing Soil Disturbance	% of Area Tillable	% Slope	Acres of Soil Rehab	Post Trmt Soil Disturbance	REMARKS
496	T/WL	39	31-40%	100	0-15	2.9	31-40%	Log under winter conditions (design element) to meet S&Gs. Re-hab landings.
499	T/WL	66	31-40%	100	0-15	5.0	31-40%	Log under winter conditions (design element) to meet S&Gs. Re-hab landings.
500	T/WL	14	11-20%	100	0-15	1.1	11-20%	Log under winter conditions (design element) to meet S&Gs. Re-hab landings.
501	T/WL	12	21-30%	25	0-15	0	21-30%	Log under winter conditions (design element) to meet S&Gs. Re-use existing landings.
502	T/WL	40	21-30%	75	0-15	3.0	21-30%	Log under winter conditions (design element) to meet S&Gs. Re-hab landings.
503	T/WL	10	21-30%	100	0-15	0.8	21-30%	Log under winter conditions (design element) to meet S&Gs. Re-hab landings.
504	T/WL	4	11-20%	0	0-15	0	11-20%	Log under winter conditions (design element) to meet S&Gs. Re-use existing landings to stay below 20%.
506	T	30	11-20%	75	0-15	1.5	11-20%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
506a	T	15	0-10%	0	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
507	T	33	11-20%	75	0-15	1.7	11-20%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
508	T	9	21-30%	0	0-15	0	21-30%	Design skid trails/landings to use existing disturbance. No net increase of detrimental soil conditions.
509	T/WL	47	41-50%	25	0-15	0	41-50%	Log under winter conditions (design element) to meet S&Gs. Re-use existing landings.
513	T/WL	30	41-50%	100	0-15	2.3	41-50%	Log under winter conditions (design element) to meet S&Gs. Re-hab landings.
516	T/WL	5	31-40%	100	0-15	0.4	31-40%	Log under winter conditions (design element) to meet S&Gs. Re-hab landings.
518	T/WL	12	11-20%	100	0-15	0.9	11-20%	Log under winter conditions (design element) to meet S&Gs. Re-hab landings.
520	T/WL	27	31-40%	75	0-15	2.0	31-40%	Log under winter conditions (design element) to meet S&Gs. Re-hab landings.
522	T/WL	22	21-30%	50	0-15	1.7	31-30%	Log under winter conditions (design element) to meet S&Gs. Re-hab landings.
524	T/WL	48	41-50%	75	0-15	3.6	41-50%	Log under winter conditions (design element) to meet S&Gs. Re-hab landings.
526	T/WL	45	31-40%	50	15-30	3.4	31-40%	Log under winter conditions (design element) to meet S&Gs. Re-hab landings.
528	T/WL	39	21-30%	75	0-15	2.9	21-30%	Log under winter conditions (design element) to meet S&Gs. Re-hab landings.
529	T/WL	12	31-40%	0	0-15	0	31-40%	Log under winter conditions (design element) to meet S&Gs. Re-use existing landings.
534	T/WL	44	41-50%	25	0-15	0	41-50%	Log under winter conditions (design element) to meet S&Gs. Re-use existing landings.
600	T	41	11-20%	50	0-15	2.1	11-20%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
601	T	11	11-20%	50	15-30	0.6	11-20%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
602	T	51	0-10%	100	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.

Commercial Harvest Soils Summary
Alternative C

Unit	Logging System	Acres	Existing Soil Disturbance	% of Area Tillable	% Slope	Acres of Soil Rehab	Post Trtmnt Soil Disturbance	REMARKS
1	T	10	11-20%	50	0-15	0.5	11-20%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
3	T	112	41-50%	50	0-15	5.6	41-50%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
4	T	9	31-40%	0	0-15	0	31-40%	Design skid trails/landings to use existing disturbance. No net increase of detrimental soil conditions.
38	T	128	21-30%	50	0-15	6.4	21-30%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
39	T	102	31-40%	75	0-15	5.1	31-40%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
40	T	37	31-40%	25	0-15	0	31-40%	Design skid trails/landings to use existing disturbance. No net increase of detrimental soil conditions.
42	T	56	51-60%	75	0-15	2.8	51-60%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
50	H	38	21-30%	50	0-15	0	21-30%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
51	H	47	31-40%	100	0-15	0	31-40%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
52	T	50	21-30%	50	0-15	2.5	21-30%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
53	T	41	21-30%	75	0-15	2.1	21-30%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
55	H	11	11-20%	50	15-30	0	11-20%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
57	T	11	21-30%	75	0-15	0.6	21-30%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
59	T	7	11-20%	0	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
59a	T	29	11-20%	50	0-15	1.5	11-20%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
60	T	14	21-30%	0	0-15	0	21-30%	Design skid trails/landings to use existing disturbance. No net increase of detrimental soil conditions.
61	T	23	0-10%	0	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
68	T	11	21-30%	50	0-15	0.6	21-30%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
69	T	12	21-30%	25	0-15	0	21-30%	Design skid trails/landings to use existing disturbance. No net increase of detrimental soil conditions.
75	T	39	21-30%	75	0-15	2.0	21-30%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
76	T	10	11-20%	0	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
78a	T	21	0-10%	50	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
78b	T	7	0-10%	50	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
78c	T	7	0-10%	50	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
79	T	7	0-10%	100	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
80	T	6	0-10%	100	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
81	T	18	0-10%	75	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.

Commercial Harvest Soils Summary
Alternative C

Unit	Logging System	Acres	Existing Soil Disturbance	% of Area Tillable	% Slope	Acres of Soil Rehab	Post Trtmnt Soil Disturbance	REMARKS
85	T	25	21-30%	75	0-15	1.3	21-30%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
107	T	29	21-30%	25	0-15	0	21-30%	Design skid trails/landings to use existing disturbance. No net increase of detrimental soil conditions.
115	T	10	21-30%	50	0-15	0.5	21-30%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
116	T	20	11-20%	25	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
120	T	6	11-20%	0	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
123	T	39	0-10%	50	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
124	T	31	0-10%	25	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
125	T	14	0-10%	100	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
126	T	24	11-20%	75	0-15	1.2	11-20%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
127	T	36	21-30%	50	0-15	1.8	21-30%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
128	T	12	11-20%	75	0-15	0.6	11-20%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
129	T	24	31-40%	25	0-15	0	31-40%	Design skid trails/landings to use existing disturbance. No net increase of detrimental soil conditions.
130	T	34	41-50%	25	0-15	0	41-50%	Design skid trails/landings to use existing disturbance. No net increase of detrimental soil conditions.
131	T	28	0-10%	50	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
133	T	27	0-10%	50	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
134	T	69	21-30%	75	0-15	3.5	21-30%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
140	T	41	21-30%	50	0-15	2.1	21-30%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
142	T	100	41-50%	50	0-15	5.0	41-50%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
143	T	35	41-50%	75	0-15	1.8	41-50%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
144	T	19	11-20%	75	0-15	1.0	11-20%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
145	T	44	11-20%	25	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
146	T	53	21-30%	50	0-15	2.7	21-30%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
149	T	23	31-40%	50	0-15	1.2	31-40%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
151a	T	14	31-40%	75	0-15	0.7	31-40%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
151b	T	17	31-40%	75	0-15	0.9	31-40%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
156	T	17	21-30%	50	0-15	0.9	21-30%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
157	T	15	21-30%	50	0-15	0.8	21-30%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
159	T	35	31-40%	25	0-15	0	31-40%	Design skid trails/landings to use existing disturbance. No net increase of detrimental soil conditions.

Commercial Harvest Soils Summary
Alternative C

Unit	Logging System	Acres	Existing Soil Disturbance	% of Area Tillable	% Slope	Acres of Soil Rehab	Post Trtmnt Soil Disturbance	REMARKS
161	T	21	0-10%	50	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
162	T	66	0-10%	50	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
166	T	23	21-30%	50	0-15	1.2	21-30%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
168	T	44	0-10%	50	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
169	T	50	0-10%	50	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
170	T	26	11-20%	0	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
175	T	24	31-40%	0	0-15	0	31-40%	Design skid trails/landings to use existing disturbance. No net increase of detrimental soil conditions.
176	T/WL	23	21-30%	50	0-15	1.7	21-30%	Log under winter conditions (design element) to meet S&Gs. Re-hab landings.
178	H	26	11-20%	0	15-30	0	11-20%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
181	H	7	11-20%	0	0-15	0	11-20%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
182	T	37	0-10%	0	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
183	H	22	21-30%	75	15-30	0	21-30%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
186	H	9	0-10%	0	15-30	0	0-10%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
187	H	5	0-10%	0	0-15	0	0-10%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
188	H	23	11-20%	0	30-50	0	11-20%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
189	H	49	11-20%	75	15-30	0	11-20%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
190	H	11	11-20%	0	15-30	0	11-20%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
192	H	6	11-20%	0	0-15	0	11-20%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
193	H	6	11-20%	0	0-15	0	11-20%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
194	H	43	11-20%	0	0-15	0	11-20%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
195	H	10	11-20%	0	0-15	0	11-20%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
196	H	9	21-30%	0	0-15	0	21-30%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
197	H	13	11-20%	50	0-15	0	11-20%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
198	H	7	11-20%	0	0-15	0	11-20%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
199	H	8	11-20%	0	0-15	0	11-20%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
200	H	25	11-20%	0	15-30	0	11-20%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
201	H	27	11-20%	0	0-15	0	11-20%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
204	H	22	11-20%	0	0-15	0	11-20%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.

Commercial Harvest Soils Summary
Alternative C

Unit	Logging System	Acres	Existing Soil Disturbance	% of Area Tillable	% Slope	Acres of Soil Rehab	Post Trtmnt Soil Disturbance	REMARKS
205	T	25	11-20%	50	0-15	1.3	11-30%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
205a	H	10	11-20%	0	0-15	0	11-20%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
206	T	21	21-30%	100	0-15	1.1	21-30%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
207	T	12	0-10%	25	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
208	T	23	11-20%	100	0-15	1.2	11-20%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
210	T	37	21-30%	100	0-15	1.9	21-30%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
211	T	23	21-30%	75	0-15	1.2	21-30%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
212	T	9	11-20%	50	0-15	0.5	11-20%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
213	T	16	0-10%	50	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
213a	H	12	0-10%	0	0-15	0	0-10%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
214	T	29	0-10%	25	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
214a	H	27	0-10%	0	0-15	0	0-10%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
215	H	62	0-10%	25	0-15	0	0-10%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
216	H	15	31-40%	50	0-15	0	31-40%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
217	H	7	21-30%	50	0-15	0	21-30%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
220	H	54	11-20%	50	15-30	0	11-20%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
221	T	11	0-10%	50	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
222	H	42	11-20%	0	0-15	0	11-20%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
223	T	22	0-10%	50	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
223a	H	5	0-10%	50	0-15	0	0-10%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
223b	T	59	0-10%	50	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
224	T	27	11-20%	25	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
224a	H	8	11-20%	25	0-15	0	11-20%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
225	H	18	11-20%	25	0-15	0	11-20%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
226	H	62	31-40%	50	0-15	0	31-40%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
227	T	22	11-20%	50	0-15	1.1	11-20%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
228	T	10	0-10%	50	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
229	T	7	11-20%	0	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.

Commercial Harvest Soils Summary
Alternative C

Unit	Logging System	Acres	Existing Soil Disturbance	% of Area Tillable	% Slope	Acres of Soil Rehab	Post Trtmnt Soil Disturbance	REMARKS
230	T	70	31-40%	0	0-15	0	31-40%	Design skid trails/landings to use existing disturbance. No net increase of detrimental soil conditions.
233	T	14	11-20%	50	0-15	0.7	11-20%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
235a	H	44	0-10%	50	0-15	0	0-10%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
235b	H	8	0-10%	50	0-15	0	0-10%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
237a	H	14	31-40%	25	0-15	0	31-40%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
237b	H	13	31-40%	25	0-15	0	31-40%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
238	T	20	21-30%	75	0-15	1.0	21-30%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
245	T	16	21-30%	75	0-15	0.8	21-30%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
246	T	14	31-40%	0	0-15	0	31-40%	Design skid trails/landings to use existing disturbance. No net increase of detrimental soil conditions.
252	T	16	11-20%	100	0-15	0.8	11-20%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
253	T	50	11-20%	75	0-15	2.5	11-20%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
254	T	7	11-20%	75	0-15	0.4	11-20%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
255	T	33	21-30%	50	0-15	1.7	21-30%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
257	T	44	21-30%	25	0-15	0	21-30%	Design skid trails/landings to use existing disturbance. No net increase of detrimental soil conditions.
258	T	21	31-40%	50	0-15	1.1	31-40%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
261	T	18	21-30%	100	0-15	0.9	21-30%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
310	T/WL	138	11-20%	0	0-15	0	11-20%	Log under winter conditions (design element) to meet S&Gs. Re-use existing landings.
314	T/WL	47	21-30%	25	0-15	0	21-30%	Log under winter conditions (design element) to meet S&Gs. Re-use existing landings.
315	H	28	21-30%	0	15-30	0	21-30%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
316	H	24	21-30%	0	30-50	0	21-30%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
317	T/WL	28	31-40%	0	51-30	0	31-40%	Log under winter conditions (design element) to meet S&Gs. Re-use existing landings.
317a	H	18	21-30%	0	15-30	0	21-30%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
317c	H	6	21-30%	0	30-50	0	21-30%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
318	T/WL	13	21-30%	0	0-15	0	21-30%	Log under winter conditions (design element) to meet S&Gs. Re-use existing landings.
318a	H	57	21-30%	0	0-15	0	21-30%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
326	T/WL	73	21-30%	0	0-15	0	21-30%	Log under winter conditions (design element) to meet S&Gs. Re-use existing landings.
327	T/WL	21	21-30%	0	0-15	0	21-30%	Log under winter conditions (design element) to meet S&Gs. Re-use existing landings
334	T/WL	70	11-20%	0	0-15	0	11-20%	Log under winter conditions (design element) to meet S&Gs. Re-use existing landings

Commercial Harvest Soils Summary
Alternative C

Unit	Logging System	Acres	Existing Soil Disturbance	% of Area Tillable	% Slope	Acres of Soil Rehab	Post Trtmnt Soil Disturbance	REMARKS
338	H	33	0-10%	75	15-30	0	0-10%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
341	H	14	0-10%	0	15-30	0	0-10%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
343	H	21	0-10%	0	15-30	0	0-10%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
351	T/WL	23	31-40%	50	15-30	1.7	31-40%	Log under winter conditions (design element) to meet S&Gs. Re-hab landings.
352	T/WL	24	21-30%	100	0-15	1.8	21-30%	Log under winter conditions (design element) to meet S&Gs. Re-hab landings.
353	T/WL	127	31-40%	75	15-30	9.5	31-40%	Log under winter conditions (design element) to meet S&Gs. Re-hab landings.
354	T	79	21-30%	75	0-15	4.0	21-30%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
356	T	31	21-30%	100	0-15	1.6	21-30%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
357	T/WL	13	21-30%	0	0-15	0	21-30%	Log under winter conditions (design element) to meet S&Gs. Re-use existing landings.
360	T/WL	46	21-30%	0	0-15	0	21-30%	Log under winter conditions (design element) to meet S&Gs. Re-use existing landings.
371	T	65	0-10%	50	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
372	T	20	0-10%	75	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
373	H	5	0-10%	100	15-30	0	0-10%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
374	H	8	0-10%	100	15-30	0	0-10%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
375	H	28	0-10%	0	15-30	0	0-10%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
377	T	11	11-20%	25	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
378	T	11	11-20%	100	0-15	0.6	11-20%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
379	H	23	0-10%	25	15-30	0	0-10%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
381	T	28	11-20%	100	0-15	1.4	11-20%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
387	T	83	31-40%	75	0-15	4.2	31-40%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
388	T	275	31-40%	75	0-15	13.8	31-40%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
397	H	59	0-10%	75	0-15	0	0-10%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
400	T	9	21-30%	0	0-15	0	21-30%	Design skid trails/landings to use existing disturbance. No net increase of detrimental soil conditions.
401	T	24	11-20%	0	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
416	T	22	21-30%	100	0-15	1.1	21-30%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
420	T	17	0-10%	75	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
425	T	12	0-10%	50	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
426	T	19	0-10%	0	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.

Commercial Harvest Soils Summary
Alternative C

Unit	Logging System	Acres	Existing Soil Disturbance	% of Area Tillable	% Slope	Acres of Soil Rehab	Post Trtmnt Soil Disturbance	REMARKS
436	T	56	11-20%	75	15-30	2.8	11-20%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
443	T	24	0-10%	75	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
445	H	14	11-20%	100	15-30	0	11-20%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
446	T	34	0-10%	75	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
447	T	47	0-10%	25	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
453	H	37	21-30%	75	0-15	0	21-30%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
454	T	33	31-40%	0	0-15	0	31-40%	Design skid trails/landings to use existing disturbance. No net increase of detrimental soil conditions.
454a	H	67	31-40%	25	0-15	0	31-40%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
455	T	54	0-10%	50	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
455a	H	2	31-40%	100	0-15	0	31-40%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
455b	H	5	31-40%	100	0-15	0	31-40%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
456	T	16	0-10%	0	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
461	T	38	11-20%	100	15-30	1.9	11-20%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
465	T/WL	74	31-40%	75	0-15	5.6	31-40%	Log under winter conditions (design element) to meet S&Gs. Re-hab landings.
466	T/WL	13	31-40%	100	0-15	1.0	31-40%	Log under winter conditions (design element) to meet S&Gs. Re-hab landings.
472	T/WL	45	41-50%	75	0-15	3.4	41-50%	Log under winter conditions (design element) to meet S&Gs. Re-hab landings.
473	H	23	11-20%	75	15-30	0	11-20%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
477	T	20	0-10%	100	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
478	T	8	0-10%	100	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
478a	H	6	11-20%	100	0-15	0	11-20%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
482	T	46	31-40%	50	0-15	2.3	31-40%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
484	T	23	31-40%	50	0-15	1.2	31-40%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
485	T/WL	22	41-50%	0	0-15	0	41-50%	Log under winter conditions (design element) to meet S&Gs. Re-use existing landings.
488	T/WL	77	31-40%	50	0-15	5.8	31-40%	Log under winter conditions (design element) to meet S&Gs. Re-hab landings.
494	T/WL	23	11-20%	100	0-15	1.7	11-20%	Log under winter conditions (design element) to meet S&Gs. Re-hab landings.
495	T/WL	29	31-40%	100	0-15	2.2	31-40%	Log under winter conditions (design element) to meet S&Gs. Re-hab landings.
496	T/WL	34	31-40%	100	0-15	2.6	31-40%	Log under winter conditions (design element) to meet S&Gs. Re-hab landings.
499	T	66	21-30%	50	0-15	3.3	21-30%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.

Commercial Harvest Soils Summary
Alternative C

Unit	Logging System	Acres	Existing Soil Disturbance	% of Area Tillable	% Slope	Acres of Soil Rehab	Post Trtmnt Soil Disturbance	REMARKS
500	T/WL	14	11-20%	100	0-15	1.1	11-20%	Log under winter conditions (design element) to meet S&Gs. Re-hab landings.
501	T/WL	12	21-30%	25	0-15	0	21-30%	Log under winter conditions (design element) to meet S&Gs. Re-use existing landings.
502	T/WL	40	21-30%	75	0-15	3.0	21-30%	Log under winter conditions (design element) to meet S&Gs. Re-hab landings.
503	T/WL	10	21-30%	100	0-15	0.8	21-30%	Log under winter conditions (design element) to meet S&Gs. Re-hab landings.
506	T	30	11-20%	75	0-15	1.5	11-20%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
506a	T	15	0-10%	0	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
507	T	33	11-20%	75	0-15	1.7	11-20%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
508	T	9	21-30%	0	0-15	0	21-30%	Design skid trails/landings to use existing disturbance. No net increase of detrimental soil conditions.
509	T/WL	47	41-50%	25	0-15	3.5	41-50%	Log under winter conditions (design element) to meet S&Gs. Re-hab landings.
513	T/WL	30	41-50%	100	0-15	2.3	41-50%	Log under winter conditions (design element) to meet S&Gs. Re-hab landings.
516	T/WL	16	31-40%	100	0-15	1.2	31-40%	Log under winter conditions (design element) to meet S&Gs. Re-hab landings.
518	T/WL	12	11-20%	100	0-15	0.9	11-20%	Log under winter conditions (design element) to meet S&Gs. Re-hab landings.
520	T/WL	5	31-40%	75	0-15	0.4	31-40%	Log under winter conditions (design element) to meet S&Gs. Re-hab landings.
524	T/WL	48	41-50%	75	0-15	3.6	41-50%	Log under winter conditions (design element) to meet S&Gs. Re-hab landings.
526	T/WL	45	31-40%	50	15-30	3.4	31-40%	Log under winter conditions (design element) to meet S&Gs. Re-hab landings.
528	T/WL	33	21-30%	75	0-15	2.5	21-30%	Log under winter conditions (design element) to meet S&Gs. Re-hab landings.
529	T/WL	12	31-40%	0	0-15	0	31-40%	Log under winter conditions (design element) to meet S&Gs. Re-use existing landings.
534	T/WL	44	41-50%	25	0-15	3.3	41-50%	Log under winter conditions (design element) to meet S&Gs. Re-hab landings.
600	T	40	11-20%	50	0-15	2.0	11-20%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
602	T	58	0-10%	100	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.

Commercial Harvest Soils Summary
Alternative D

Unit	Logging System	Acres	Existing Soil Disturbance	% of Area Tillable	% Slope	Acres of Soil Rehab	Post Trtmt Soil Disturbance	REMARKS
3	T	112	41-50%	50	0-15	5.6	41-50%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
4	T	9	31-40%	0	0-15	0	31-40%	Design skid trails/landings to use existing disturbance. No net increase of detrimental soil conditions.
37	T	7	0-10%	50	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
38	T	55	0-10%	50	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
39	T	102	31-40%	75	0-15	5.1	31-40%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
40	T	37	31-40%	25	0-15	0	31-40%	Design skid trails/landings to use existing disturbance. No net increase of detrimental soil conditions.
42	T	90	51-60%	75	0-15	4.5	51-60%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
50	H	38	21-30%	50	0-15	0	21-30%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
51	H	47	31-40%	100	0-15	0	31-40%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
52	T	50	21-30%	50	0-15	2.5	21-30%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
53	T	41	21-30%	75	0-15	2.1	21-30%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
55	H	11	11-20%	50	15-30	0	11-20%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
57	T	11	21-30%	75	0-15	0.6	21-30%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
59a	T	29	11-20%	50	0-15	1.5	11-20%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
60	T	14	21-30%	0	0-15	0	21-30%	Design skid trails/landings to use existing disturbance. No net increase of detrimental soil conditions.
61	T	23	0-10%	0	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
68	T	11	21-30%	50	0-15	0.6	21-30%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
69	T	12	21-30%	25	0-15	0	21-30%	Design skid trails/landings to use existing disturbance. No net increase of detrimental soil conditions.
75	T	21	21-30%	75	0-15	1.1	21-30%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
76	T	10	11-20%	0	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
78	T	47	0-10%	50	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
80	T	6	0-10%	100	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
81	T	18	0-10%	75	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
85	T	25	21-30%	75	0-15	1.3	21-30%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
90	T	25	0-10%	75	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
107	T	29	21-30%	25	0-15	0	21-30%	Design skid trails/landings to use existing disturbance. No net increase of detrimental soil conditions.
115	T	10	21-30%	50	0-15	0.5	21-30%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.

Commercial Harvest Soils Summary
Alternative D

Unit	Logging System	Acres	Existing Soil Disturbance	% of Area Tillable	% Slope	Acres of Soil Rehab	Post Trtmt Soil Disturbance	REMARKS
116	T	20	11-20%	25	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
117	T	35	11-20%	25	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
120	T	6	11-20%	0	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
124	T	31	0-10%	25	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
125	T	14	0-10%	100	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
127	T	28	21-30%	50	0-15	1.4	21-30%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
128	T	12	11-20%	75	0-15	0.6	11-20%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
129	T	24	31-40%	25	0-15	0	31-40%	Design skid trails/landings to use existing disturbance. No net increase of detrimental soil conditions.
130	T	34	41-50%	25	0-15	0	41-50%	Design skid trails/landings to use existing disturbance. No net increase of detrimental soil conditions.
131	T	28	0-10%	50	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
133	T	27	0-10%	50	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
134	T	69	21-30%	75	0-15	3.5	21-30%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
140	T	41	21-30%	50	0-15	2.1	21-30%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
142	T	100	41-50%	50	0-15	5.0	41-50%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
143	T	23	41-50%	75	0-15	1.2	41-50%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
144	T	19	11-20%	75	0-15	1.0	11-20%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
145	T	44	11-20%	25	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
146	T	15	21-30%	50	0-15	0.8	21-30%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
149	T	23	31-40%	50	0-15	1.2	31-40%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
151	T	24	31-40%	75	0-15	1.2	31-40%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
156	T	17	21-30%	50	0-15	0.9	21-30%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
157	T	15	21-30%	50	0-15	0.8	21-30%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
159	T	35	31-40%	25	0-15	0	31-40%	Design skid trails/landings to use existing disturbance. No net increase of detrimental soil conditions.
161	T	21	0-10%	50	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
162	T	31	0-10%	50	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
163	T	24	31-40%	50	0-15	1.2	31-40%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
166	T	23	21-30%	50	0-15	1.2	21-30%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.

Commercial Harvest Soils Summary
Alternative D

Unit	Logging System	Acres	Existing Soil Disturbance	% of Area Tillable	% Slope	Acres of Soil Rehab	Post Trtmt Soil Disturbance	REMARKS
168	T	44	0-10%	50	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
169	T	42	0-10%	50	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
170	T	26	11-20%	0	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
175	T	24	31-40%	0	0-15	0	31-40%	Design skid trails/landings to use existing disturbance. No net increase of detrimental soil conditions.
176	T/WL	23	21-30%	50	0-15	1.7	21-30%	Log under winter conditions (design element) to meet S&Gs. Re-hab landings.
178	H	26	11-20%	0	15-30		11-20%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
181	H	7	11-20%	0	0-15	0	11-20%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
182	T	37	0-10%	0	0-51	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
183	H	22	21-30%	75	15-30	0	21-30%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
186	H	9	0-10%	0	15-30	0	0-10%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
187	H	5	0-10%	0	0-15	0	0-10%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
188	H	23	11-20%	0	30-50	0	11-20%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
189	H	28	11-20%	75	0-15	0	11-20%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
190	H	11	11-20%	0	0-15	0	11-20%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
192	H	6	11-20%	0	0-15	0	11-20%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
193	H	6	11-20%	0	0-15	0	11-20%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
194	H	43	11-20%	0	0-15	0	11-20%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
195	H	10	11-20%	0	0-15	0	11-20%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
196	H	9	21-30%	0	0-15	0	21-30%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
197	H	13	11-20%	50	0-15	0	11-20%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
198	H	7	11-20%	0	0-15	0	11-20%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
199	H	8	11-20%	0	0-15	0	11-20%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
204	H	22	11-20%	0	0-15	0	11-20%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
205	H	25	11-20%	50	0-15	0	11-20%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
206	T	21	21-30%	100	0-15	1.1	21-30%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
208	T	23	11-20%	100	0-15	1.2	11-20%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
210	T	37	21-30%	100	0-15	1.9	21-30%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.

Commercial Harvest Soils Summary
Alternative D

Unit	Logging System	Acres	Existing Soil Disturbance	% of Area Tillable	% Slope	Acres of Soil Rehab	Post Trtmt Soil Disturbance	REMARKS
211	T	23	21-30%	75	0-15	1.2	21-30%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
213	T	16	0-10%	50	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
214	T	28	0-10%	25	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
214a	H	27	0-10%	0	0-15	0	0-10%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
215	T	62	0-10%	25	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
216	H	15	31-40%	50	0-15	0	31-40%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
217	H	7	21-30%	50	0-15	0	21-30%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
220	H	54	11-20%	50	15-30	0	11-20%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
221	T	11	0-10%	50	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
222	H	42	11-20%	0	0-15	0	11-20%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
223	T	98	0-10%	50	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
223a	H	4	0-10%	50	0-15	0	11-20%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
224	T	21	11-20%	25	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
226	H	62	31-40%	50	0-15	0	31-40%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
227	T	22	11-20%	50	0-15	1.1	11-20%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
229	T	7	11-20%	0	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
230	T	70	31-40%	0	0-15	0	31-40%	Design skid trails/landings to use existing disturbance. No net increase of detrimental soil conditions.
232	T	24	31-40%	0	0-15	0	31-40%	Design skid trails/landings to use existing disturbance. No net increase of detrimental soil conditions.
233	T	14	11-20%	50	0-15	0.7	11-20%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
234	T	7	11-20%	100	0-15	0.4	11-20%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
235	T	68	0-10%	50	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
237	H	110	31-40%	25	0-15	0	31-40%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
238	T	20	21-30%	75	0-15	1.0	21-30%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
245	T	16	21-30%	75	0-15	0.8	21-30%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
246	T	14	31-40%	0	0-15	0	31-40%	Design skid trails/landings to use existing disturbance. No net increase of detrimental soil conditions.
247	T	34	0-10%	100	0-15	0	11-21%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
252	T	16	11-20%	100	0-15	0.8	11-20%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.

Commercial Harvest Soils Summary
Alternative D

Unit	Logging System	Acres	Existing Soil Disturbance	% of Area Tillable	% Slope	Acres of Soil Rehab	Post Trtmt Soil Disturbance	REMARKS
253	T	50	11-20%	75	0-15	2.5	11-20%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
254	T	7	11-20%	75	0-15	0.4	11-20%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
255	T	33	21-30%	50	0-15	1.7	21-30%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
257	T	44	21-30%	25	0-15	0	21-30%	Design skid trails/landings to use existing disturbance. No net increase of detrimental soil conditions.
258	T	21	31-40%	50	0-15	1.1	31-40%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
261	T	18	21-30%	100	0-15	0.9	21-30%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
310	T/WL	113	11-20%	0	0-15	0	11-20%	Log under winter conditions (design element) to meet S&Gs. Re-use existing landings.
314	T/WL	47	21-30%	25	0-15	0	21-30%	Log under winter conditions (design element) to meet S&Gs. Re-use existing landings.
315	H	28	21-30%	0	30-50	0	21-30%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
316	H	24	21-30%	0	30-50	0	21-30%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
317	T/WL	28	31-40%	0	15-30	0	31-40%	Log under winter conditions (design element) to meet S&Gs. Re-use existing landings.
317a	H	24	21-30%	0	15-30	0	21-30%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
326	T/WL	73	21-30%	0	0-15	0	21-30%	Log under winter conditions (design element) to meet S&Gs. Re-use existing landings.
327	T/WL	21	21-30%	0	0-15	0	21-30%	Log under winter conditions (design element) to meet S&Gs. Re-use existing landings.
341	H	14	0-10%	0	15-30	0	0-10%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
343	H	21	0-10%	0	15-30	0	0-10%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
351	T/WL	23	31-40%	50	15-30	1.7	31-40%	Log under winter conditions (design element) to meet S&Gs. Re-hab landings.
352	T/WL	24	21-30%	100	0-15	1.8	21-30%	Log under winter conditions (design element) to meet S&Gs. Re-hab landings.
353	T/WL	127	31-40%	75	15-30	9.5	31-40%	Log under winter conditions (design element) to meet S&Gs. Re-hab landings.
354	T	79	21-30%	75	0-15	4.0	21-30%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
356	T	31	21-30%	100	0-15	1.6	21-30%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
360	T/WL	46	21-30%	0	0-15	0	21-30%	Log under winter conditions (design element) to meet S&Gs. Re-use existing landings.
367	H	14	11-20%	0	0-15	0	11-20%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
371	T	65	0-10%	50	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
372	T	20	0-10%	75	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
375	H	28	0-10%	0	15-30	0	0-10%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
377	T	11	11-20%	25	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.

Commercial Harvest Soils Summary
Alternative D

Unit	Logging System	Acres	Existing Soil Disturbance	% of Area Tillable	% Slope	Acres of Soil Rehab	Post Trtmt Soil Disturbance	REMARKS
378	T	11	11-20%	100	0-15	0.6	11-20%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
379	H	23	0-10%	25	15-30	0	0-10%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
381	T	28	11-20%	100	0-15	1.4	11-20%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
387	T	83	31-40%	75	0-15	4.2	31-40%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
388	T	275	31-40%	75	0-15	13.8	31-40%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
397	H	59	0-10%	75	0-15	0	0-10%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
401	T	24	11-20%	0	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
416	T	22	21-30%	100	0-15	1.1	21-30%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
425	T	12	0-10%	50	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
426	T	19	0-10%	0	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
436	T	56	11-20%	75	15-30	2.8	11-20%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
443	T	24	0-10%	75	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
446	T	34	0-10%	75	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
447	T	47	0-10%	25	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
453	H	37	21-30%	75	0-15	0	21-30%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
454	T	25	31-40%	0	0-15	0	31-40%	Design skid trails/landings to use existing disturbance. No net increase of detrimental soil conditions.
455	T	54	0-10%	50	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
455a	H	7	31-40%	100	0-15	0	31-40%	No additional detrimental disturbance expected. Land on previously disturbed areas. Meets S&Gs.
456	T	16	0-10%	0	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
466	T/WL	13	31-40%	100	0-15	1.0	31-40%	Log under winter conditions (design element) to meet S&Gs. Re-hab landings.
472	T	45	41-50%	75	0-15	2.3	41-50%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
477	T	20	0-10%	100	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
478	T	8	0-10%	100	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
482	T	37	31-40%	50	0-15	1.9	31-40%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
485	T/WL	30	41-50%	0	0-15	0	41-50%	Log under winter conditions (design element) to meet S&Gs. Re-use existing landings.
488	T/WL	77	31-40%	50	0-15	5.8	31-40%	Log under winter conditions (design element) to meet S&Gs. Re-hab landings.
494	T/WL	23	11-20%	100	0-15	1.7	11-20%	Log under winter conditions (design element) to meet S&Gs. Re-hab landings.

Commercial Harvest Soils Summary
Alternative D

Unit	Logging System	Acres	Existing Soil Disturbance	% of Area Tillable	% Slope	Acres of Soil Rehab	Post Trtmt Soil Disturbance	REMARKS
495	T/WL	29	31-40%	100	0-15	2.2	31-40%	Log under winter conditions (design element) to meet S&Gs. Re-hab landings.
496	T/WL	34	31-40%	100	0-15	2.6	31-40%	Log under winter conditions (design element) to meet S&Gs. Re-hab landings.
499	T/WL	20	31-40%	100	0-15	1.5	31-40%	Log under winter conditions (design element) to meet S&Gs. Re-hab landings.
500	T/WL	14	11-20%	100	0-15	1.1	11-20%	Log under winter conditions (design element) to meet S&Gs. Re-hab landings.
506	T	30	11-20%	75	0-15	1.5	11-20%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
506a	T	15	0-10%	0	0-15	0	11-20%	Skid trail/landing layout will keep area below 20% detrimental soil conditions and meet S&Gs.
507	T	33	11-20%	75	0-15	1.7	11-20%	Limit new disturbance to <5%, Mitigate effects with scarification/tilling to meet S&Gs.
508	T	9	21-30%	0	0-15	0	21-30%	Design skid trails/landings to use existing disturbance. No net increase of detrimental soil conditions.
509	T/WL	39	41-50%	25	0-15	0	41-50%	Log under winter conditions (design element) to meet S&Gs. Re-use existing landings.
513	T/WL	30	41-50%	100	0-15	2.3	41-50%	Log under winter conditions (design element) to meet S&Gs. Re-hab landings.
516	T/WL	16	31-40%	100	0-15	1.2	31-40%	Log under winter conditions (design element) to meet S&Gs. Re-hab landings.
518	T/WL	12	11-20%	100	0-15	0.9	11-20%	Log under winter conditions (design element) to meet S&Gs. Re-hab landings.
520	T/WL	5	31-40%	75	0-15	0.4	31-40%	Log under winter conditions (design element) to meet S&Gs. Re-hab landings.
524	T/WL	48	41-50%	75	0-15	3.6	41-50%	Log under winter conditions (design element) to meet S&Gs. Re-hab landings.
526	T/WL	40	31-40%	50	15-30	3.0	31-40%	Log under winter conditions (design element) to meet S&Gs. Re-hab landings.
528	T/WL	33	21-30%	75	0-15	2.5	21-30%	Log under winter conditions (design element) to meet S&Gs. Re-hab landings.
534	T/WL	44	41-50%	25	0-15	0	41-50%	Log under winter conditions (design element) to meet S&Gs. Re-use existing landings.

Appendix H.

Aspen, Willow, and Meadows

ASPEN STANDS

UNIT NO.	ACRES	PRESCRIP TION	LOGGING SYSTEM	FUELS TREATMENT	PROTECTION
2	7	CT/PCT	Helicopter	Jackpot burn	Fence
3	4	CT/PCT	Helicopter	Jackpot burn	Fence
4	**0.3**	**PCT**	**N/A**	**Jackpot burn**	**Slash barrier**
5	**0.3**	**PCT**	**N/A**	**Handpile**	**Fence**
6	**0.5**	**PCT**	**N/A**	**Handpile**	**Fence**
11	1	CT/PCT	Tractor	Lop & scatter	Fence
12	3	CT	Winter log	No treatment	Fence
14	3	CT/PCT	Helicopter	No treatment	Fence
15	3	CT/PCT	Helicopter	No treatment	Fence
16	1	PCT	N/A	Handpile	Fence
17	4	PCT	N/A	Handpile	Fence
18	2	PCT	N/A	Handpile	Fence
19	3	PCT	N/A	Handpile	Fence
20 *	8	PCT	N/A	Jackpot burn	Fence
37	9	CT/PCT	Winter log	No treatment	Fence
39	3	PCT	N/A	Handpile	Monitor/cages
47	1	PCT	N/A	Jackpot burn	Slash barrier
49	6	CT/PCT	Winter log	No treatment	Fence
53	2	CT/PCT	Tractor	Jackpot burn	3-way enclosure
55	2	HTH	Tractor	Handpile	Slash barrier
59	1	CT/PCT	Winter log	No treatment	Monitor/cages
64	1	PCT	N/A	Jackpot burn	Cages
65	5	CT/PCT	Helicopter	Jackpot burn	No treatment
66	2	PCT	N/A	Jackpot burn	Fence
73	3	CT/PCT	Winter log	Lop & scatter	Existing fence
74	**1**	**PCT**	**N/A**	**Handpile**	**Fence**
75	2	CT/PCT	Winter log	No treatment	Cattle fence
80	**1**	**PCT**	**N/A**	**Handpile**	**Fence**
84	2	Cut aspen	N/A	Handpile	Monitor/cages

Additional stands for Alternative C are in bold.

WILLOW STANDS

UNIT NO.	ACRES	PRESCRIPTION	LOGGING SYSTEM	FUELS TREATMENT	PROTECTION
7	2	PCT	N/A	Jackpot burn	Fence
9	3	PLANTING	N/A	N/A	Fence

***** This stand also includes cottonwood treatment.
CT – Commercial thinning harvest.
PCT – Precommercial thinning of conifers, this varies from cutting trees 1' tall to < 9" to < 12" dbh, depending on the stand structure.

Meadows

Meadow Name	Location	Acres	Elevation	Slope	Aspect	Soil Origin
Happy Camp Spring	T13S, R23E, S18	66	5600-5800'	0.1%	South	Alluvial terrace
Happy Camp West	T13S, R22E, S24	40	5640'	5-10%	East	Loess and residuum
Happy Camp East	T13S, R22E, S24	7	5480'	0-5%	Southeast	Mix of loess & colluvium
4270	T14S, R22E, S22	32	5080'	0%	North	Loess and residuum
Big Springs	T14S, R23E, S29	75	5000'	5-10%	Northwest	Ash, loess & residuum
Jackson Creek	T13S, R23E, S26	31	5480'	0.05%	South	Alluvial terrace
Double Corral	T13S, R23E, S22, 26	120	5400-5680'	5-10%	Southeast	Alluvium; loess, residuum
2630 #1	T13S, R23E, S9, 15	69	5720'	5-10%	Southeast	Loess and residuum
2630 #2	T13S, R23E, S10	72	5720'	0-2%	South	Loess and residuum
2630 #3	T13S, R23E, S10, 11	69	5760'	0.05%	Southwest	Alluvial terrace
Derr	T13S, R23E, S14	61	5700'	0-5%	South	Alluvial terrace
Toggle	T13S, R23E, S35	60	5440'	0-5%	Northwest	Alluvial terrace
Dicer North	T14S, R24E, S6	25	5480'	0-2%	Northwest	Alluvial terrace
Dicer South	T14S, R24E, S6	17	5520'	0-2%	Northwest	Alluvial terrace
Round	T14S, R24E, S7	15	5400'	0-2%	West	Alluvial terrace
Thornton	T14S, R23E, S14	10	5160'	0-5%	Southwest	Loess and residuum
2630-800	T13S, R23E, S17	32	5800'	0-5%	Southeast	Alluvial; loess & residuum
Haypress	T13S, R23E, S17	21	5600'	0.05%	East	Ash, loess & residuum
12-350	T14S, R24E, S5	15	5760'	0-2%	North	Alluvial terrace

Stand Number	Harvest Treatment	Post-Sale Treatment	PAG	Before Treatment Structure	After Treatment Structure
001	HIM	SPC/WHIP	2	M5b	M5b
002	HIM	SPC/WHIP	2	M5a	M5b
107	HIM	SPC/WHIP	2	M4b	M4b
109	HIM	SPC/WHIP	2	M5b	M5b
110	HIM	SPC/WHIP	2	E3b	E4b
115	HIM	SPC/WHIP	2	M5a	M5b
116	HIM	SPC/WHIP	2	M5a	M5b
117	HTH	SPC/WHIP	2	M5a	M5b
120	HIM	SPC/WHIP	2	M4b	M4b
121	HIM	SPC/WHIP	2	M4b	M4b
123	HCR w/reserves	WHIPFALL	2	M4a	E1
124	HIM	WHIPFALL	2	L4a	M4b
125	HIM	WHIPFALL	2	L4a	M4b
126	HTH	WHIPFALL	2	M4a	E4b
127	HIM	WHIPFALL	2	L4a	M4b
128	HCR w/reserves	WHIPFALL	2	L4a	E1
129	HTH	SPC/WHIP	2	L4a	L4b
130	HIM	SPC/WHIP	2	L4a	M4b
131	HIM	SPC/WHIP	2	M5a	M5b
133	HIM	SPC	2	E4a	E4b
134	HIM	SPC/WHIP	2	M5a	M5b
140	HIM	SPC/WHIP	2	M5a	M5b
142	HIM	SPC/WHIP	2	M4a	M4b
143	HIM	SPC/WHIP	2	M3	E3b
144	HIM	SPC/WHIP	2	M5a	M5b
145	HIM	SPC/WHIP	2	M4b	M4b
146	HIM	SPC/WHIP	2	L4a	M4b
149	HIM	SPC/WHIP	3	M3	M4b
151	HIM	WHIPFALL	2	M3	E4b
156	HIM	SPC/WHIP	2	M5a	M5b
157	HIM	SPC/WHIP	2	M4a	M4b
159	HIM	SPC/WHIP	3	M5b	M5b
161	HIM	SPC/WHIP	2	M5a	M5b
163	HIM	SPC/WHIP	2	M5a	M5b
166	HIM	SPC/WHIP	2	M5a	M5b
168	HIM	SPC/WHIP	2	M5a	M5b

169	HIM	SPC/WHIP	2	M5a	M5b
170	HIM	SPC/WHIP	2	M5a	M5b
175	HIM	SPC/WHIP	2	M5a	M5b
176	HIM	SPC/WHIP	2	M5a	M5b
178	HIM	SPC/WHIP	2	E2	E3b
181	HIM	SPC/WHIP	4	L4b	L4b
182	HIM	SPC/WHIP	4	L4b	L4b
183	HTH	SPC	3	M3	M4b
186	HIM	SPC/WHIP	3	E4a	E4b
187	HIM	SPC/WHIP	3	M4b	M4b
188	HIM	SPC/WHIP	3	M4a	M4b
189	HIM	SPC/WHIP	3	M5a	M5b
190	HTH	SPC/WHIP	3	M5b	M5b
192	HSL	SPC	3	M4b	M4b
193	HTH	SPC	3	M5b	M5b
194	HTH	SPC	2	M5b	E5b
195	HIM	SPC/WHIP	4	L5a	L5b
196	HIM	SPC/WHIP	3	M3	M4b
197	HIM	SPC/WHIP	3	M5a	M5b
198	HIM	SPC/WHIP	4	L3b	L3b
199	HIM	SPC/WHIP	3	M4b	M4b
200	HIM	SPC/WHIP	3	M5b	M5b
201	HIM	SPC/WHIP	4	M4a	M4b
203	HIM	SPC/WHIP	2	E4b	E4b
204	HIM	SPC/WHIP	2	M5b	M5b
205	HTH	SPC	2	E5a	E5b
205a	HTH	SPC	2	E5a	E5b
206	HIM	SPC/WHIP	2	E3b	E4b
207	HIM	SPC/WHIP	2	M5a	M5b
207a	HIM	SPC/WHIP	2	M5a	M5b
208	HIM	SPC/WHIP	4	E5a	M5b
210	HIM	SPC/WHIP	2	E4b	E4b
211	HIM	SPC/WHIP	2	M5a	M5b
212	HIM	SPC/WHIP	2	M5b	M5b
213	HIM	SPC/WHIP	2	M4a	M4b
213a	HIM	SPC/WHIP	2	M5a	M5b
214	HIM	SPC/WHIP	2	E5a	E5b

214a	HIM	SPC/WHIP	2	M4b	M4b
215	HIM	SPC/WHIP	2	M5a	M5b
215a	HIM	SPC/WHIP	2	M5b	M5b
216	HIM	SPC/WHIP	2	M4b	M4b
217	HIM	SPC/WHIP	2	M5b	M5b
219	HIM	SPC/WHIP	2	E5a	E5b
220	HIM	SPC/WHIP	2	L5a	M5b
221	HIM	SPC/WHIP	2	M4b	M4b
222	HIM	SPC/WHIP	3	M4b	M4b
223	HIM	SPC/WHIP	2	M5a	M5b
223a	HSG	SPC/WHIP	4	L3b	E1
224	HIM	SPC/WHIP	2	M5a	M5b
225	HIM	SPC/WHIP	2	M4b	M4b
226	HIM	SPC/WHIP	2	M5b	M5b
227	HIM	SPC/WHIP	2	M4b	M4b
228	HIM	SPC/WHIP	2	M5a	M5b
229	HIM	SPC/WHIP	2	M5a	M5b
230	HIM	SPC/WHIP	2	M5a	M5b
231	HSG	SPC/WHIP	2	M3	E1
232	HSG	SPC/WHIP	2	M3	E1
233	HIM	SPC/WHIP	2	M5a	M5b
234	HIM	SPC/WHIP	2	L5a	L5b
235	HSG	WHIP	2	L5a	L5b
237	HSG	WHIP	2	M5a	M5b
238	HSG	WHIP	1	L3	E1
243	HSG	WHIP	2	L4a	E1
244	HIM	SPC/WHIP	2	M4b	M4b
245	HIM	SPC/WHIP	2	M4b	M4b
246	HIM	SPC/WHIP	2	L4a	M4b
247	HSG	WHIP	2	L4a	E1
252	HIM	SPC/WHIP	2	M4a	M4b
253	HIM	SPC/WHIP	2	M4b	M4b
254	HIM	SPC/WHIP	2	M5a	M5b
255	HIM	SPC/WHIP	2	M4b	M4b
257	HIM	SPC/WHIP	2	M4b	M4b
258	HIM	SPC/WHIP	2	M5a	M5b
261	HIM	SPC/WHIP	2	E2	E3b

3	HIM	SPC/WHIP	2	M4b	M4b
310	HIM	SPC/WHIP	4	M4a	M4b
313	HIM	SPC/WHIP	4	M4a	M4b
314	HTH	SPC/WHIP	4	M3	M3b
315	HTH	SPC/WHIP	3	M5b	M5b
316	HTH	SPC/WHIP	3	M5a	M5b
317	HTH	SPC/WHIP	4	L5a	L5b
317a	HTH	SPC/WHIP	3	M5a	M5b
318	HTH	SPC/WHIP	4	M5a	M5b
326	HIM	SPC/WHIP	4	M3	M3b
327	HIM	SPC/WHIP	4	M4a	M4b
334	HIM	SPC/WHIP	4	M5a	M5b
338	HIM	SPC/WHIP	2	M5a	M5b
341	HIM	SPC/WHIP	3	M4b	M4b
342	HIM	SPC/WHIP	3	M4a	M4b
343	HIM	SPC/WHIP	2	M5a	M5b
344	HIM	SPC/WHIP	2	M5a	M5b
345	HIM	SPC/WHIP	2	M5a	M5b
351	HIM	SPC/WHIP	2	M5a	M5b
352	HIM	SPC/WHIP	4	L3b	L3b
353	HIM	SPC/WHIP	4	L3b	L3b
354	HIM	SPC/WHIP	2	E5a	E5b
356	HIM	SPC/WHIP	2	E5a	E5b
357	HIM	SPC/WHIP	4	L5a	L5b
360	HIM	SPC/WHIP	2	E5b	E5b
367	HIM	SPC/WHIP	4	M3	M3b
37	HIM	SPC/WHIP	2	M3	E3b
371	HIM	SPC/WHIP	4	M5a	M5b
372	HIM	SPC/WHIP	2	M5a	M5b
373	HIM	SPC/WHIP	2	M5a	M5b
374	HIM	SPC/WHIP	2	M5a	M5b
375	HIM	SPC/WHIP	2	M3	E3b
377	HIM	SPC/WHIP	4	M3	M3b
378	HIM	SPC/WHIP	4	M5a	M5b
379	HIM	SPC/WHIP	2	M5a	M5b
38	HIM	SPC	2	L5	M5b
381	HIM	SPC/WHIP	2	M5a	M5b

387	HIM	SPC/WHIP	2	E3a	E3b
388	HIM	SPC/WHIP	2	M4b	M4b
39	HIM	SPC/WHIP	2	E4b	E4b
397	HIM	SPC/WHIP	4	M5a	M5b
4	HTH	SPC	2	M4a	E4b
40	HIM	SPC/WHIP	2	M4a	M4b
400	HIM	SPC/WHIP	4	M4a	M4b
401	HIM	SPC/WHIP	3	M5b	M5b
416	HIM	SPC/WHIP	2	E5a	E5b
42	HSG	SPC/WHIP	2	M4b	E1
420	HIM	SPC/WHIP	2	E5b	E5b
424	HIM	SPC/WHIP	4	M5a	M5b
425	HIM	SPC/WHIP	2	M5a	M5b
426	HIM	SPC/WHIP	2	E5a	E5b
436	HIM	SPC/WHIP	2	E5a	E5b
443	HIM	SPC/WHIP	2	E4a	E4b
445	HIM	SPC/WHIP	4	L3b	L3b
446	HIM	SPC/WHIP	2	M5a	M5b
447	HIM	SPC/WHIP	3	M3	M4b
453	HIM	SPC/WHIP	2	M4b	M4b
454	HTH	SPC	2	E5b	E5b
454a	HTH	SPC	2	M5b	E5b
455	HIM	SPC/WHIP	2	M5a	M5b
455a	HIM	SPC/WHIP	2	M5a	M5b
456	HIM	SPC/WHIP	2	M4b	M4b
461	HIM	SPC/WHIP	2	M5a	M5b
463	HIM	SPC/WHIP	4	L3b	L3b
465	HIM	SPC/WHIP	2	M4b	M4b
466	HIM	SPC/WHIP	2	M5a	M5b
466a	HIM	SPC/WHIP	2	M3	E3b
467	HIM	SPC/WHIP	4	L4b	L4b
472	HTH	SPC	2	E3b	E3b
473	HIM	SPC/WHIP	2	M4b	M4b
477	HIM	SPC/WHIP	3	M4b	M4b
478	HIM	SPC/WHIP	3	M5a	M5b
478a	HIM	SPC/WHIP	2	M5a	M5b
479	HIM	SPC/WHIP	2	M5a	M5b

482	HIM	SPC/WHIP	2	M5a	M5b
484	HIM	SPC/WHIP	2	M5a	M5b
485	HIM	SPC/WHIP	2	M4b	M4b
488	HIM	SPC/WHIP	2	M5a	M5b
491	HIM	SPC/WHIP	4	M3	E3b
494	HIM	SPC/WHIP	4	M3	M3b
495	HIM	SPC/WHIP	2	M4b	M4b
496	HTH	SPC	2	M4b	E4b
499	HTH	SPC	2	M5a	M5b
50	HIM	SPC/WHIP	2	M5a	M5b
500	HSH	WHIP	2	L4a	E1
501	HIM	SPC/WHIP	2	M4a	M4b
502	HIM	SPC/WHIP	2	M5b	M5b
503	HIM	SPC/WHIP	2	M5b	M5b
504	HIM	SPC/WHIP	2	M5b	M5b
506	HIM	SPC/WHIP	2	M5a	M5b
506a	HIM	SPC/WHIP	2	M3	E3b
507	HIM	SPC/WHIP	2	M5a	M5b
508	HIM	SPC/WHIP	2	M4a	M4b
509	HIM	SPC/WHIP	2	M4b	M4b
51	HIM	SPC/WHIP	2	E2	E3b
513	HIM	SPC/WHIP	2	M4a	M4b
516	HIM	SPC/WHIP	2	M5a	M5b
518	HIM	SPC/WHIP	2	E5a	E5b
52	HIM	SPC/WHIP	2	M5a	M5b
520	HIM	SPC/WHIP	1	M5b	M5b
522	HIM	SPC/WHIP	2	M5a	M5b
524	HIM	SPC/WHIP	2	M5b	M5b
526	HTH	SPC	2	M4b	E4b
528	HIM	SPC/WHIP	2	M5b	M5b
529	HIM	SPC/WHIP	2	M4b	M4b
53	HIM	SPC/WHIP	2	M5b	M5b
534	HIM	SPC/WHIP	2	M3	E3b
54	HIM	SPC/WHIP	3	M5a	M5b
55	HIM	SPC/WHIP	2	M3	E3b
57	HIM	SPC/WHIP	2	M5a	M5b
58	HIM	SPC/WHIP	2	M5a	M5b

59	HIM	WHIPFALL	2	M4a	M4b
60	HTH		2	M5a	M5b
600	HIM	SPC/WHIP	2	M5a	M5b
601	HIM	SPC/WHIP	2	M5a	M5b
602	HIM	SPC/WHIP	2	L4a	M4b
61	HIM	WHIPFALL	2	M4a	M4b
68	HSV	WHIPFALL	2	M5a	M5b
69	HIM	WHIPFALL	2	M4a	M4b
71	HCR w/reserves	WHIPFALL	2	L4a	
75	HIM	SPC/WHIP	2	M5a	M5b
76	HIM	SPC/WHIP	2	M5a	M5b
78	HSG	WHIPFALL	2	L4a	E1
79	HSG	SPC	2	L4a	E1
80	HIM	SPC/WHIP	2	M5a	M5b
81	HIM	SPC	2	L4a	M4b
82	HSG	WHIPFALL	2	L4a	E1
83	HSG	WHIP	2	L4a	E1
85	HIM	SPC/WHIP	2	M5a	M5b
90	HIM	SPC/WHIP	2	M5a	M5b
95	HIM	SPC/WHIP	2	M5a	M5b

Stand Number	Harvest Treatment	Post-Sale Treatment	PAG	Before Treatment Structure	After Treatment Structure
001	HIM	SPC/WHIP	2	E5b	E5b
107	HIM	SPC/WHIP	2	M4b	M4b
115	HIM	SPC/WHIP	2	M5a	M5b
116	HIM	SPC/WHIP	2	M5a	M5b
120	HIM	SPC/WHIP	2	M4a	M4b
123	HIM	SPC/WHIP	2	M4a	E1
124	HIM	WHIPFALL	2	L4a	M4b
125	HIM	WHIPFALL	2	L4a	M4b
126	HTH	WHIPFALL	2	M4a	E4b
127	HIM	WHIPFALL	2	L4a	M4b
128	HCR w/reserves	WHIPFALL	2	L4a	E1
129	HTH	SPC/WHIP	2	L4a	L4b
130	HIM	SPC/WHIP	2	L4a	M4b
131	HIM	SPC/WHIP	2	M5a	M5b
133	HIM	SPC	2	E4a	E4b
134	HIM	SPC/WHIP	2	M5a	M5b
140	HIM	SPC/WHIP	2	M5a	M5b
140	HIM	SPC/WHIP	2	M5a	M5b
142	HIM	SPC/WHIP	2	M4a	M4b
143	HIM	SPC/WHIP	2	M3	E3b
144	HIM	SPC/WHIP	2	M5a	M5b
145	HIM	SPC/WHIP	2	M4b	M4b
146	HIM	SPC/WHIP	2	L4a	M4b
149	HIM	SPC/WHIP	3	M3	M4b
156	HIM	SPC/WHIP	2	M5a	M5b
157	HIM	SPC/WHIP	2	M4a	M4b
159	HIM	SPC/WHIP	3	M5b	M5b
161	HIM	SPC/WHIP	2	M4b	E4b
162	HIM	SPC/WHIP	2	M5b	E5b
166	HIM	SPC/WHIP	2	M5a	M5b
168	HIM	SPC/WHIP	2	M5a	M5b
169	HIM	SPC/WHIP	2	M5a	M5b
170	HIM	SPC/WHIP	2	M5a	M5b
175	HIM	SPC/WHIP	2	M5a	M5b
176	HIM	SPC/WHIP	2	M5a	M5b
178	HIM	SPC/WHIP	2	E2	E3b

181	HIM	SPC/WHIP	4	L4b	L4b
182	HIM	SPC/WHIP	4	L4b	L4b
183	HTH	SPC	3	M3	M4b
186	HIM	SPC/WHIP	3	E4a	E4b
187	HIM	SPC/WHIP	3	M4b	M4b
188	HIM	SPC/WHIP	3	M4a	M4b
188	HIM	SPC/WHIP	3	M4a	M4b
189	HIM	SPC/WHIP	3	M5a	M5b
190	HTH	SPC	3	M5b	M5b
192	HSL	SPC	3	M4b	M4b
193	HTH	SPC	3	M5b	M5b
194	HTH	SPC	2	M5b	E5b
194	HTH	SPC	2	M5b	E5b
195	HIM	SPC/WHIP	4	L5a	L5b
196	HIM	SPC/WHIP	3	M3	M4b
197	HIM	SPC/WHIP	3	M5a	M5b
198	HIM	SPC/WHIP	4	L3b	L3b
199	HIM	SPC/WHIP	3	M4b	M4b
200	HIM	SPC/WHIP	3	M5b	M5b
201	HIM	SPC/WHIP	4	M4a	M4b
204	HIM	SPC/WHIP	2	M5b	M5b
205	HTH	SPC	2	E5a	E5b
205a	HTH	SPC	2	E5a	E5b
206	HIM	SPC/WHIP	2	E3b	E4b
207	HIM	SPC/WHIP	2	M5a	M5b
208	HIM	SPC/WHIP	4	E5a	M5b
210	HIM	SPC/WHIP	2	E4b	E4b
211	HIM	SPC/WHIP	2	M5a	M5b
212	HIM	SPC/WHIP	2	M5b	M5b
213	HIM	SPC/WHIP	2	M4a	M4b
213a	HIM	SPC/WHIP	2	M5a	M5b
214	HIM	SPC/WHIP	2	E5a	E5b
214a	HIM	SPC/WHIP	2	M4b	M4b
215	HIM	SPC/WHIP	2	M5b	E5b
216	HIM	SPC/WHIP	2	M4b	M4b
217	HIM	SPC/WHIP	2	M5b	M5b
220	HIM	SPC/WHIP	2	L5a	M5b

220	HIM	SPC/WHIP	2	L5a	M5b
220	HIM	SPC/WHIP	2	L5a	M5b
221	HIM	SPC/WHIP	2	M4b	M4b
222	HIM	SPC/WHIP	3	M4b	M4b
223	HIM	SPC/WHIP	2	M5a	M5b
223a	HIM	SPC/WHIP	4	L3b	E1
223b	HIM	SPC/WHIP	2	M5b	M5b
224	HIM	SPC/WHIP	2	M5a	M5b
224a	HIM	SPC/WHIP	2	M4a	E4b
225	HIM	SPC/WHIP	2	M4b	M4b
226	HIM	SPC/WHIP	2	M5b	M5b
227	HIM	SPC/WHIP	2	M4b	M4b
228	HIM	SPC/WHIP	2	M5a	M5b
229	HIM	SPC/WHIP	2	M5a	M5b
230	HIM	SPC/WHIP	2	M5a	M5b
233	HIM	SPC/WHIP	2	M5a	M5b
238	HSG	SPC/WHIP	1	L3	E1
245	HIM	SPC/WHIP	2	M4b	M4b
246	HIM	SPC/WHIP	2	L4a	M4b
252	HIM	SPC/WHIP	2	M4a	M4b
253	HIM	SPC/WHIP	2	M4b	M4b
254	HIM	SPC/WHIP	2	M5b	M5b
255	HIM	SPC/WHIP	2	M4b	M4b
257	HIM	SPC/WHIP	2	M4b	M4b
258	HIM	SPC/WHIP	2	M5a	M5b
261	HIM	SPC/WHIP	2	E2	E3b
3	HIM	SPC/WHIP	2	M4b	M4b
310	HIM	SPC/WHIP	4	M4a	M4b
314	HTH	SPC/WHIP	4	M3	M3b
314	HTH	SPC/WHIP	4	M3	M3b
315	HTH	SPC/WHIP	3	M5b	M5b
315	HTH	SPC/WHIP	3	M5b	M5b
316	HTH	SPC/WHIP	3	M5a	M5b
317	HTH	SPC/WHIP	4	L5a	L5b
317a	HTH	SPC/WHIP	3	M5a	M5b
317c	HTH	SPC/WHIP	4	L5b	L5b
318	HIM	SPC/WHIP	4	M5a	M5b

318a	HIM	SPC/WHIP	4	M5a	M5b
326	HIM	SPC/WHIP	4	M3	M3b
327	HIM	SPC/WHIP	4	M4a	M4b
334	HIM	SPC/WHIP	4	M5a	M5b
338	HIM	SPC/WHIP	2	M3	M4b
341	HIM	SPC/WHIP	3	M4b	M4b
343	HIM	SPC/WHIP	2	M5a	M5b
351	HIM	SPC/WHIP	2	M5a	M5b
352	HIM	SPC/WHIP	4	L3b	L3b
353	HIM	SPC/WHIP	4	L3b	L3b
354	HIM	SPC/WHIP	2	E5a	E5b
356	HIM	SPC/WHIP	2	E5a	E5b
357	HIM	SPC/WHIP	4	L5a	L5b
360	HIM	SPC/WHIP	2	E5b	E5b
37	HIM	SPC/WHIP	2	M3	E3b
371	HIM	SPC/WHIP	4	M5a	M5b
372	HIM	SPC/WHIP	2	M5a	M5b
373	HIM	SPC/WHIP	2	M5a	M5b
374	HIM	SPC/WHIP	2	M5a	M5b
375	HIM	SPC/WHIP	2	M3	E3b
377	HIM	SPC/WHIP	4	M3	M3b
378	HIM	SPC/WHIP	4	M5a	M5b
379	HIM	SPC/WHIP	2	M5a	M5b
38	HIM	SPC/WHIP	2	L5	L5b
381	HIM	SPC/WHIP	2	M5a	M5b
387	HIM	SPC/WHIP	2	E3a	E3b
388	HIM	SPC/WHIP	2	M4b	M4b
39	HIM	SPC/WHIP	2	E4b	E4b
397	HIM	SPC/WHIP	4	M5a	M5b
4	HTH	SPC/WHIP	2	M4a	E4b
40	HIM	SPC/WHIP	2	M4a	E4b
400	HIM	SPC/WHIP	4	M4a	M4b
401	HIM	SPC/WHIP	3	M5b	M5b
416	HIM	SPC/WHIP	2	E5a	E5b
42	HIM	SPC/WHIP	2	M4b	E1
420	HIM	SPC/WHIP	2	E5b	E5b
425	HIM	SPC/WHIP	2	M5a	M5b

426	HIM	SPC/WHIP	2	E5a	E5b
436	HIM	SPC/WHIP	2	E5a	E5b
436	HIM	SPC/WHIP	2	E5a	E5b
443	HIM	SPC/WHIP	2	E4a	E4b
443	HIM	SPC/WHIP	2	E4a	E4b
445	HIM	SPC/WHIP	4	L3b	L3b
446	HIM	SPC/WHIP	2	M5a	M5b
447	HIM	SPC/WHIP	3	M3	M4b
453	HIM	SPC/WHIP	2	M4b	M4b
454	HTH	SPC	2	E5b	E5b
454a	HTH	SPC	2	M5b	E5b
455	HIM	SPC/WHIP	2	M5a	M5b
455a	HIM	SPC/WHIP	2	M4a	E4b
455b	HIM	SPC/WHIP	2	M5b	M5b
456	HIM	SPC/WHIP	2	M4b	M4b
461	HIM	SPC/WHIP	2	M5a	M5b
461	HIM	SPC/WHIP	2	M5a	M5b
465	HIM	SPC/WHIP	2	M4b	M4b
466	HIM	SPC/WHIP	2	M5a	E5b
472	HTH	SPC	2	E3b	E3b
473	HIM	SPC/WHIP	2	M4b	M4b
477	HIM	SPC/WHIP	3	M4b	M4b
478	HIM	SPC/WHIP	3	M5a	M5b
478a	HIM	SPC/WHIP	2	M5a	M5b
482	HIM	SPC/WHIP	2	M5a	M5b
484	HIM	SPC/WHIP	2	M5a	M5b
485	HIM	SPC/WHIP	2	M4b	M4b
488	HIM	SPC/WHIP	2	M5a	E5b
494	HIM	SPC/WHIP	4	M3	M3b
495	HIM	SPC/WHIP	2	M4b	M4b
496	HTH	SPC	2	M4b	E4b
499	HIM	SPC/WHIP	2	M5a	E5b
50	HIM	SPC/WHIP	2	M5a	M5b
500	HSH	WHIPFALL	2	L4a	E1
501	HIM	SPC/WHIP	2	M4a	M4b
502	HIM	SPC/WHIP	2	M5b	M5b
503	HIM	SPC/WHIP	2	M5b	M5b

506	HIM	SPC/WHIP	2	M5a	M5b
506a	HIM	SPC/WHIP	2	M3	E3b
507	HIM	SPC/WHIP	2	M5a	M5b
507	HIM	SPC/WHIP	2	M5a	M5b
508	HIM	SPC/WHIP	2	M4a	M4b
509	HIM	SPC/WHIP	2	M4b	M4b
51	HIM	SPC/WHIP	2	E2	E3b
513	HIM	SPC/WHIP	2	M4a	M4b
516	HIM	SPC/WHIP	2	M5a	M5b
518	HIM	SPC/WHIP	2	E5a	E5b
52	HIM	SPC/WHIP	2	M5a	M5b
520	HIM	SPC/WHIP	2	E5a	E5b
524	HIM	SPC/WHIP	2	M5b	M5b
526	HTH	SPC	2	M3	M4b
528	HIM	SPC/WHIP	2	M5b	M5b
529	HIM	SPC/WHIP	2	M4b	M4b
53	HIM	SPC/WHIP	2	M5b	M5b
534	HIM	SPC/WHIP	2	M3	E3b
55	HIM	SPC/WHIP	2	M3	E3b
57	HIM	SPC/WHIP	2	M5a	M5b
59	HIM	WHIPFALL	2	L4a	M4b
59a	HIM	WHIPFALL	2	M4a	M4b
60	HTH		2	M5a	M5b
600	HIM	SCP/WHIP	2	M5a	M5b
602	HIM	SPC/WHIP	2	L4a	M4b
61	HCR w/reserv	WHIPFALL	2	M4a	E1
68	HSN	WHIPFALL	2	M5a	M5b
69	HIM	WHIPFALL	2	M4a	M4b
75	HIM	SPC/WHIP	2	M5a	M5b
76	HIM	SPC/WHIP	2	M5a	M5b
79	HSG	SPC/WHIP	2	L4a	E1
80	HIM	SPC/WHIP	2	M5a	E5b
81	HIM	SPC/WHIP	2	L4a	M4b
85	HIM	SPC/WHIP	2	M5a	M5b
85	HIM	SPC/WHIP	2	M5a	M5b

Stand Number	Harvest Treatment	Post-SaleTreatment	PAG	Before Treatment Structure	After Treatment Structure
107	HIM	SPC/WHIP	2	M4b	M4b
115	HIM	SPC/WHIP	2	M5a	M5b
116	HIM	SPC/WHIP	2	M5a	M5b
117	HTH	SPC/WHIP	2	M5a	E5b
120	HIM	SPC/WHIP	2	M4b	M4b
124	HIM	WHIPFALL	2	L4a	M4b
125	HIM	WHIPFALL	2	L4a	M4b
127	HIM	WHIPFALL	2	L4a	M4b
128	HCR w/reserv	WHIPFALL	2	L4a	E1
129	HTH	SPC/WHIP	2	L4a	L4b
130	HIM	SPC/WHIP	2	L4a	M4b
131	HIM	SPC/WHIP	2	M5a	M5b
133	HIM	SPC	2	E4a	E4b
134	HIM	SPC/WHIP	2	M5a	M5b
140	HIM	SPC/WHIP	2	M5a	M5b
142	HIM	SPC/WHIP	2	M4a	M4b
143	HIM	SPC/WHIP	2	M3	E3b
144	HIM	SPC/WHIP	2	M5a	M5b
145	HIM	SPC/WHIP	2	M4b	M4b
146	HIM	SPC/WHIP	2	M4b	M4b
149	HIM	SPC/WHIP	3	M3	M4b
151	HCR w/reserves/HIM	WHIPFALL	2	M4b	E1/E4b
156	HIM	SPC/WHIP	2	M5a	M5b
157	HIM	SPC/WHIP	2	M4a	M4b
159	HIM	SPC/WHIP	3	M5b	M5b
161	HIM	SPC/WHIP	2	M4b	M5b
162	HIM	SPC/WHIP	2	M5a	M5b
163	HIM	SPC/WHIP	2	E5a	M5b
166	HIM	SPC/WHIP	2	M5a	M5b
168	HIM	SPC/WHIP	2	M5a	M5b
169	HIM	SPC/WHIP	2	M5a	M5b
170	HIM	SPC/WHIP	2	M5a	M5b
175	HIM	SPC/WHIP	2	M5a	M5b
176	HIM	SPC/WHIP	2	M5a	M5b
178	HIM	SPC/WHIP	2	E2	E3b
181	HIM	SPC/WHIP	4	L4b	L4b

182	HIM	SPC/WHIP	4	L4b	L4b
183	HTH	SPC	3	M3	M4b
186	HIM	SPC/WHIP	3	E4a	E4b
187	HIM	SPC/WHIP	3	M4b	M4b
188	HIM	SPC/WHIP	3	M4a	M4b
189	HIM	SPC/WHIP	3	M5a	M5b
190	HTH	SPC	3	M5b	M5b
192	HSL	SPC	3	M4b	M4b
193	HTH	SPC	3	M5b	M5b
194	HTH	SPC	2	M5b	E5b
195	HIM	SPC/WHIP	4	L5a	L5b
196	HIM	SPC/WHIP	3	M3	M4b
197	HIM	SPC/WHIP	3	M5a	M5b
198	HIM	SPC/WHIP	4	L3b	L3b
199	HIM	SPC/WHIP	3	M4b	M4b
204	HIM	SPC/WHIP	2	M5b	M5b
205	HTH	SPC	2	E5a	E5b
206	HIM	SPC/WHIP	2	E3b	E4b
208	HIM	SPC/WHIP	4	E5a	M5b
210	HIM	SPC/WHIP	2	E4b	E4b
211	HIM	SPC/WHIP	2	M5a	M5b
213	HIM	SPC/WHIP	2	M4a	M4b
214	HIM	SPC/WHIP	2	E5a	E5b
214a	HIM	SPC/WHIP	2	M4b	M4b
215	HIM	SPC/WHIP	2	M5b	M5b
216	HIM	SPC/WHIP	2	M4b	M4b
217	HIM	SPC/WHIP	2	M5b	M5b
220	HIM	SPC/WHIP	2	L5a	M5b
221	HIM	SPC/WHIP	2	M4b	M4b
222	HIM	SPC/WHIP	3	M4b	M4b
223	HIM	SPC/WHIP	2	M5a	M5b
223a	HSG	SPC/WHIP	4	L3b	E1
224	HIM	SPC/WHIP	2	M4a	M4a
226	HIM	SPC/WHIP	2	M5b	M5b
227	HIM	SPC/WHIP	2	M4b	M4b
229	HIM	SPC/WHIP	2	M5a	M5b
230	HIM	SPC/WHIP	2	M5a	M5b

232	HSG	SPC/WHIP	2	M3	E1
233	HIM	SPC/WHIP	2	M5a	M5b
234	HIM	SPC/WHIP	2	L5a	L5b
235	HSG	WHIPFALL	2	L3a	E1
237	HSG	WHIPFALL	2	M4a	E1
238	HSG	WHIPFALL	1	L3	E1
245	HIM	SPC/WHIP	2	M4b	M4b
246	HIM	SPC/WHIP	2	L4a	M4b
247	HSG	SPC/WHIP	2	L4a	E1
252	HIM	SPC/WHIP	2	M4a	M4b
253	HIM	SPC/WHIP	2	M4b	M4b
254	HIM	SPC/WHIP	2	M5b	M5b
255	HIM	SPC/WHIP	2	M4b	M4b
257	HIM	SPC/WHIP	2	M4b	M4b
258	HIM	SPC/WHIP	2	M5a	M5b
261	HIM	SPC/WHIP	2	E2	E3b
3	HIM	SPC/WHIP	2	M4b	M4b
310	HIM	SPC/WHIP	4	L4b	M4b
314	HTH	SPC/WHIP	4	M3	M3b
315	HTH	SPC/WHIP	3	M5b	M5b
316	HTH	SPC/WHIP	3	M5a	M5b
317	HTH	SPC/WHIP	4	L5a	L5b
317a	HTH	SPC/WHIP	3	M5a	M5b
326	HIM	SPC/WHIP	4	M3	M3b
327	HIM	SPC/WHIP	4	M4a	M4b
341	HIM	SPC/WHIP	3	M4b	M4b
343	HIM	SPC/WHIP	2	M5a	M5b
351	HIM	SPC/WHIP	2	M5a	M5b
352	HIM	SPC/WHIP	4	L3b	L3b
353	HIM	SPC/WHIP	4	L3b	L3b
354	HIM	SPC/WHIP	2	E5a	E5b
356	HIM	SPC/WHIP	2	E5a	E5b
360	HIM	SPC/WHIP	2	E5b	E5b
367	HIM	SPC/WHIP	4	M3	M3b
37	HIM	SPC/WHIP	2	M3	E3b
371	HIM	SPC/WHIP	4	M5a	M5b
372	HIM	SPC/WHIP	2	M5a	M5b

375	HIM	SPC/WHIP	2	M3	E3b
377	HIM	SPC/WHIP	4	M3	M3b
378	HIM	SPC/WHIP	4	M5a	M5b
379	HIM	SPC/WHIP	2	M5a	M5b
38	HIM	SPC	2	M5a	L5b
381	HIM	SPC/WHIP	2	M5a	M5b
387	HIM	SPC/WHIP	2	E3a	E3b
388	HTH	SPC/WHIP	2	M4b	M4b
39	HIM	SPC/WHIP	2	E4b	E4b
397	HIM	SPC/WHIP	4	M5a	M5b
4	HTH	WHIPFALL	2	M4a	E4b
40	HIM	SPC/WHIP	2	M4a	M4b
401	HIM	SPC/WHIP	3	M5b	M5b
416	HIM	SPC/WHIP	2	E5a	E5b
42	HSG	SPC/WHIP	2	M4b	E1
425	HIM	SPC/WHIP	2	M5a	M5b
426	HIM	SPC/WHIP	2	E5a	E5b
436	HIM	SPC/WHIP	2	E5a	E5b
443	HIM	SPC/WHIP	2	E4a	E4b
446	HIM	SPC/WHIP	2	M5a	M5b
447	HIM	SPC/WHIP	3	M3	M4b
453	HIM	SPC/WHIP	2	M4b	M4b
454	HTH	SPC	2	E5b	E5b
455	HIM	SPC/WHIP	2	E3b	M5b
455a	HIM	SPC/WHIP	2	E5a	M5b
456	HIM	SPC/WHIP	2	M4b	M4b
466	HIM	SPC/WHIP	2	M5a	M5b
472	HTH	SPC	2	E3b	E3b
477	HIM	SPC/WHIP	3	M4b	M4b
478	HIM	SPC/WHIP	3	M5a	M5b
482	HIM	SPC/WHIP	2	E5a	M5b
485	HIM	SPC/WHIP	2	M4b	M4b
488	HIM	SPC/WHIP	2	M5a	M5b
494	HIM	SPC/WHIP	4	M3	M3b
495	HIM	SPC/WHIP	2	M4b	M4b
496	HTH	SPC	2	M4b	E4b
499	HTH	SPC	2	L5a	M5b

50	HIM	SPC/WHIP	2	M5a	M5b
500	HSH	WHIPFALL	2	L4a	E1
506	HIM	SPC/WHIP	2	M5a	M5b
506a	HIM	SPC/WHIP	2	M3	E3b
507	HIM	SPC/WHIP	2	M5a	M5b
508	HIM	SPC/WHIP	2	M4a	M4b
509	HIM	SPC/WHIP	2	M4b	M4b
51	HIM	SPC/WHIP	2	E2	E3b
513	HIM	SPC/WHIP	2	M4a	M4b
516	HIM	SPC/WHIP	2	M5a	M5b
518	HIM	SPC/WHIP	2	E5a	E5b
52	HIM	SPC/WHIP	2	M5a	M5b
520	HIM	SPC/WHIP	2	E5a	M5b
524	HIM	SPC/WHIP	2	M5b	M5b
526	HTH	SPC	2	M4b	E4b
528	HIM	SPC/WHIP	2	M5b	M5b
53	HIM	SPC/WHIP	2	M5b	M5b
534	HIM	SPC/WHIP	2	M3	E3b
55	HIM	SPC/WHIP	2	M3	E3b
57	HIM	SPC/WHIP	2	M5a	M5b
59a	HIM	WHIPFALL	2	M4a	M4b
60	HTH		2	M5a	M5b
61	HCR	WHIPFALL	2	M4a	E1
68	HSV	WHIPFALL	2	M5a	M5b
69	HIM	WHIPFALL	2	M4a	M4b
75	HIM	SPC/WHIP	2	M5a	M5b
76	HIM	SPC/WHIP	2	M5a	M5b
78	HSG	WHIPFALL	2	L4a	E1
80	HIM	SPC/WHIP	2	M5a	M5b
81	HIM	SPC/WHIP	2	L4a	M4b
85	HIM	SPC/WHIP	2	M5a	M5b
90	HIM	SPC/WHIP	2	M5a	M5b