

BALD ANGEL VEGETATION MANAGEMENT PROJECT ENVIRONMENTAL ASSESSMENT



**La Grande Ranger District
Wallowa-Whitman National Forest
December 2006**



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- A. Alternative 2 – Data Table and Map
- B. Alternative 3 – Data Table and Map
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- D. Cumulative Effect Process and Area Activities
- E. Public Comments to Environmental Assessment

Changes Post Comment Period:

An earlier addition of Chapter 2 was inadvertently mailed out to the public during the comment period. The primary change from the version of Chapter 2 mailed out to this updated version is the treatment of snags within the project area. The previous version called for use of the District Snag Policy which had been changed to “**No snag removal**” and is accurately reflected in this version. Refer to the pages listed below for specifics. Chapters One and Three were correct in the mailing and already reflected the effects of this change in snag direction for the project.

Page 28 – Connective Corridor Units: Changed from 4-6 snags per acre retained to All snags would be retained.

Page 35 – Common Elements - Added 7. Snags section directing the retention of all snags \geq 12 inches dbh in all action alternatives.

Page 51 – General Soil and Water Mitigations – Added Temporary road direction for location, design, and management.

Page 63 – “Stocking levels exceeding recommendations on approximately 25%” was corrected to 52% as the numbers were accidentally transposed.

Page 123 – Changed typo INFS to INFISH.

BALD ANGEL VEGETATION MANAGEMENT ENVIRONMENTAL ASSESSMENT

La Grande Ranger District
Wallowa-Whitman National Forest

Chapter I: Purpose of and Need for Action

A. Introduction

The purpose of this Environmental Assessment (EA) is to evaluate the environmental impacts of proposed activities designed to restore and enhance ecosystems, and reduce fire danger within the Bald Angel project area.

B. Background

The 36,700 acre Bald Angel analysis area (subwatersheds 13D-F and 29D-F, and H) consists primarily of the National Forest system lands beginning at Bald Hill south of the 77 Road, east to the 7740 Road above Velvet Creek, follows the private land boundary along the south end of the project area, and is bordered on the eastern edges by the 7035 road, Goose Creek and the East Fork of Goose Creek. The project area is due east of Medical Springs and approximately 12 miles southeast of Union, Oregon. The project area does not affect any roadless areas as described in the Roadless Area Conservation FEIS and has been allocated to timber production, big game winter range, and old growth in the Wallowa-Whitman National Forest Plan.

Past management activities, aggressive fire suppression, drought, and insect and disease activity in the past contributed to the decline of forest and watershed conditions in this area over the last 20 years. Mountain Pine beetle and Western Pine Beetle are generally at endemic levels within the project area at the present time, however, they have shown an increase in recent years. The area around Langrell Gulch had beetle populations at epidemic levels with tree mortality spreading throughout the area. In response to this epidemic the Bald Angel Project Decision Memo was signed in 2004, and the insect mortality and overstocked stands immediately adjacent to the infestation were harvested the same year.

Overstocked stand conditions increase the risk of further loss of tree species. The landscape in the Bald Angel project area (Powder River/Pondosa- watershed 13 and Powder River/Keating- watershed 29) is currently outside of the desired range of variability for late and old forest structure, as well as desired levels for snags, down woody material, and big game cover. Further analysis indicates that long-term restoration needs still exist within the area.

Analysis of the existing condition for the Draft Powder River/Pondosa and Keating Watershed Analysis (slated for completion in 2006) and field reconnaissance completed for this project during the summers of 2000 - 2003 indicated that the project area has a considerable number of stands where natural disturbance patterns are out of balance with historic regimes resulting in over-stocking and high fuel loadings which leaves them at an increasing risk to insects, disease, and loss to wildfire. These areas may benefit from some form of stocking control and fuels reduction work.

C. Purpose and Need

In 1999, the Wallowa-Whitman Forest Leadership Team established a watershed restoration strategy with the overall goal to achieve Forest Plan direction and maintain or improve the baseline condition and health of all watersheds across the forest. The watershed restoration strategy was developed to assist in prioritization of restoration needs, aide in cumulative effects analyses, and display how projects are to improve or maintain baseline conditions over time.

The Prioritization of Watershed Restoration Process (POWR) is based upon the concept of “stressors and indicators.”

Stressors are effectors that push the ecosystem to the outer limits of the Historical Range of Variability (HRV). Ecosystems with high stressor values are more likely to experience large-scale re-adjustments from catastrophic events or disturbances.

Indicators are values that provide an indication of relative ecosystem function or health. Low indicator values are often associated with a system that is under stress.

Five stressors were selected to represent the primary effectors on watersheds. The stressors selected are fire risk, forest insect and disease, noxious weed invasion, and roads. Three indicators were selected to evaluate ecosystem health. These are aquatic (fish habitat), vegetation (HRV and structural stage departure), hydrologic function and wildlife habitat. Further analysis indicated that the Bald Angel project area does not have the capability to produce the habitat features needed to support lynx and is therefore not within a Lynx Analysis Unit.

The Powder River/Pondosa Watershed Rankings are as follows:

Stressors	Indicators
Fire – High	Aquatics – Low
Insects and disease – Moderate	Vegetation – Low
Road/Wildlife Security – High	Terrestrial Wildlife Habitat - Low
Noxious weeds - High	Hydrologic Function - High
Road/Stream Connectivity - High	

Given these ratings and the emphasis being placed on this area due to its location within and adjacent to the Medical Springs Wildland Urban Interface, a need was identified to be proactive in providing for long-term forest health and reduce the likelihood and severity of future insect infestations and wildfires. There is a need to reduce tree densities in overstocked stands. Thinning and improvement cuts in these stands would reduce competition and provide growing space for healthy trees to increase diameter growth. Thinning could also reduce the risk of damaging insect infestations, which are evident in overstocked stands, and appear to be experiencing increasing populations levels on the east side of the La Grande Ranger District at this time. Without treatment these overstocked stands would be at risk to future loss from insect infestations and wildfires (1990 W-W Forest Plan, Forest Management Goals for Protection, pg. 4-3).

There is a need to develop forest structure toward historic ranges (Regional Forester Forest Plan Amendment #2). Structural stages in the Bald Angel area are disproportionately at younger understory reinitiation stages, when compared to historic ranges. This is due to mortality from insect damage and past logging practices. Landscapes that reflect the Historic Range of Variation (HRV) generally meet connectivity and dispersal needs of wildlife species associated with different structural stages. Old growth dependent species could particularly benefit from development of Late and Old Structure (LOS). Salvage/sanitation cuts in understory reinitiation and thinning in understory reinitiation and stem exclusion stands could promote development of healthy stands toward LOS. Without treatment, a delay in development of HRV conditions is expected.

Reconnaissance of the LOS stands within the project area also revealed that single stratum large trees common (SSLT) LOS is severely deficient within the project area while multi-stratum large trees common is more abundant, although still within or below historic levels (Regional Forester Forest Plan Amendment #2). However, many of these MSLT acres were historically SSLT but due to the years of fire exclusion within the area, additional layers have encroached and changed the nature of these stands. There is an opportunity to convert some of these stands to SSLT and reflect what these sites would historically have represented on the landscape. Treatment in these stands by mechanical means would require a non-significant amendment to the Wallowa-Whitman National Forest Plan, which is

described in the proposed action below. Without treatment SSLT would continue to be deficient in the project area.

There is a need to restore healthy riparian conditions (1990 W-W Forest Plan, Forest Management Goals for Soil and Water, pg. 4-1). Properly functioning stream conditions depend on healthy riparian habitat conservation areas (RHCAs). Overstocked stand conditions resulting in stand density indexes that are up to 50% above the upper management zone within RHCAs may reduce the ability of these areas to maintain water quality, reduce sediment transport, and put these areas at risk to loss in the event of a wildfire. Removing dead trees, promoting new tree growth and accelerating tree growth through stocking control could promote healthier RHCAs, reduce the likelihood of a damaging wildfire, and promote future shade. Several miles of drawbottom roads are located within the project area. Roads are often a direct source of sediment to streams. Road reconstruction, closure and/or decommissioning has the potential to reduce the sediment potential and improve fisheries habitat. Without treatment and road closure/work, riparian areas would be slower to meet their riparian management objectives. (Regional Forester Forest Plan Amendment #4)

Within the project area there is a need to continue to reintroduce fire as a disturbance factor and to move toward a more historic fire frequency (Regional Forester Forest Plan Amendment #2). This includes objectives to maintain diversity and sustainable seral tree species, to reduce overstocking, and to maintain the preferred fuel models 2 and 8. A secondary objective is to enhance forage for livestock and wildlife by removing the dead grasses and shrubs and promote sprouting. Fire exclusion has resulted in an increase in understory shade tolerant fir. The understory is frequently overstocked, exhibiting poor vigor and susceptibility to insect and disease attack. Fire reintroduction in these drier plant associations would reduce fir populations and provide regeneration opportunities for more suited seral species. Fire reintroduction would help restore the area to historic conditions. Without fire, understory shade tolerant fir is expected to increase over time. This continues to increase the risk of damaging crown fires and insect outbreaks in the future.

Roads are identified in the table above as a high level stressor in this watershed. Analysis of the open road densities within the project area indicated that indeed this area does have open road densities that are well above Forest Plan guidelines for resource and habitat protection (1990 W-W Forest Plan, pgs. 4-56 and 4-60). These high open road densities in combination with unregulated cross-country OHV access create areas of low habitat effectiveness for big game. There is a need to reduce the miles of open road within the project area to provide for more big game security habitat. There is an opportunity to use an area closure as a method to achieve effective and economic closure of roads that have historically proven difficult to close and to address cross-country motorized use. Without these considerations, big game security habitat would continue to be compromised affecting big game health and survival.

These restoration efforts would reduce the risk of fire, insects, and disease (Integrated Scientific Assessment for Ecosystem Management in the Interior Columbia Basin - ISAEM - p. 113) and meet the goals and objectives of the W-W Forest Plan as amended. There is a need to maintain preferred seral species of ponderosa pine and western larch. These are fire tolerant species that have developed historically under frequently reoccurring ground fires. Sustainability and diversity in the warm, dry grand fir and pine associated biophysical group is expected to increase with reoccurring ground fires.

D. Proposed Action

In order to meet the purpose and need described above the following actions are proposed for the Bald Angel Restoration project area by the La Grande Ranger District. It proposes a variety of vegetation management treatment procedures for stands identified as needing fuels or density reduction. Nearly all of the stands identified as needing density management or fuels reduction would be treated. The proposed treatments are prescribed to address needs within the project area for the next 10+ years. Refer to maps and tables for site-specific activities, locations and definitions in the appendices.

Vegetation Management:

Fuels Reduction:

The natural fuels reduction areas were selected based upon several criteria including; access, biophysical group, topography, existing fuel conditions and potential fire behavior (refer to attached Prescribed fire maps in the appendices for unit locations). Treatments within these areas would consist of a combination of mechanical harvest/removal and prescribed burning.

Objectives in all units would be to: a) reduce stand densities in overstocked stands and ladder fuels; b) enhance forage; c) create defensible fuel profile zones in strategic areas to aid in fire suppression efforts and minimize natural resource impacts in the event of a wildfire; d) reintroduce fire as a disturbance factor on historical fire return intervals to reduce fir encroachment; e) promote healthy fire resistant stands at a landscape scale; f) promote large tree characteristics and provide for structural diversity.

Prescribed burning would occur when weather and fuel conditions are appropriate to meet the objectives and prescription for each unit. No more than a total of 10% of the available forage would be burned per year within the project area. Burning would be accomplished over the next 10 years. Existing plantations and thinning areas would be avoided during burn layout and implementation. Control lines would include roads, natural barriers and brush removal rather than bare mineral soil line construction where possible.

The following conditions are present in each burn block within the Bald Angel analysis area. Each condition would be considered for mechanical treatments needed to apply prescribed burning.

Condition A (Fire Regime 3/Condition Class 3): Non-harvest mechanical pretreatment would be a combination of thinning and cleaning to treat ladder fuels and down woody material to facilitate the use of prescribed fire. The prescribed burning would include jackpot burning/under burning to further reduce fuels. The result would be a mosaic pattern of burned and unburned areas. Approximately 50% or less of the burn block containing this condition could actually be burned.

Condition B (Fire Regime 1/Condition Class 3): A combination of harvest thinning and harvest sanitation would be used to mechanically pre-treat fuels to facilitate the use of prescribed fire. On these drier sites, burning could likely result in random patches of burned and unburned areas with approximately 75% of the area being burned.

Condition C (Fire Regime 3/Condition Class 3): Harvest treatments are designed to promote tree growth, discourage competition, reduce fuels in the form of litter, duff, and decadent grasses, thin suppressed thick clumps of regeneration, and enhance forage conditions. Canopy closure within these conditions would moderate fire behavior consumption contributing to patchy burn patterns leading to greater than 50 % surface fuel consumption.

Condition D (Fire Regime 3/Condition Class 2): These areas contain units that were precommercially cleaned and thinned within the last ten years. Therefore, burning would generally only occur around the edges of the thinned areas and would be very light in the cleaned areas resulting in <1% of the area burned.

Condition E (Fire Regime 1/Condition Class 2): Following a light mechanical cleaning of this understory, a low intensity under burn would be run through the area to reduce surface and ladder fuels. Approximately 50% of the area could be burned.

Burn Block	Total Block Acres	Approx. Actual Burn Acres
1	1085	626
2	1186	537
3	1345	707
4	4582	2695
5	3831	2301
6	2501	1253
7	1564	706
8	3889	2432
9	3069	1690
10	1314	823
Totals	24,367	13,770

Timber Harvest:

Proposed treatment would occur on approximately 4,869 acres of in the Bald Angel Restoration project area. Treatments include stand density management through commercial thinning (HTH), shelterwood (HSH), improvement cuts (HIM), sanitation harvest (HSA), overstory removal harvests (HOR), fuels reduction removals (HFU), fire cleaning (FCN) and stand cleaning (SCN) to reduce the risk of crown fires (refer to prescription descriptions below). These treatments are proposed to reduce stocking densities, remove diseased and poor growing trees, and promote stands with multi/single story large tree characteristics. Approximately 896 acres would be precommercially thinned to improve tree growth and select desirable tree species, 89 of those acres would be accomplished as a follow-up treatment after harvest.

Riparian treatment units (6, 8, 13, 14, 60, 84, 97, 98, 129, 131, and 132) would be treated using a commercial thinning within the riparian area. No activity buffers of 10 feet along intermittent non-fish bearing stream channels and 25 feet adjacent to perennial non-fish bearing stream channels would apply to each of these units. Stand density reduction treatments would occur outside of these no activity buffers to maintain and enhance riparian management objectives with specific treatment prescriptions coordinated between the Project Silviculturist, Watershed Specialist, and Fuels Planner. Follow-up treatment would generally match the treatments prescribed in the adjacent unit and could include use of precommercial thinning and prescribed fire to reduce residual fine fuels and prepare sites for planting. Planting of native shrub species and ponderosa pine would occur during the spring immediately following the burn if prescribed.

Forest Plan Amendment for Treatment in Late Old Structure Below the Historic Range of Variation – Stand density treatments throughout the project area have been designed to improve tree health and enhance long-term old growth characteristics. Forest Plan standards restrict harvest treatment in LOS that is below HRV. An HRV analysis of LOS, by biophysical grouping has been completed for this project area and as described above indicates deficiencies in both SSLT and MSLT old growth, with SSLT being nearly non-existent. MSLT structure is more prevalent in the project area, however, due to past management practices and fire exclusion which has promoted fir encroachment in the understory, many of these stands which were historically SSLT have now become MSLT.

In order to restore these stands to their historic structure, enhance the health of the stands, and reduce ladder fuels in LOS stands in the project area, the following modification is made to the Wallowa-Whitman National Forest Land and Resource Management Plan, Regional Forester Amendment #2, for the Bald Angel Vegetation Management Project Planning Area.

Current Direction: d. Scenario A If either one or both of the late and old structural (LOS) stages falls below HRV in a particular biophysical environment within a watershed, then

there should be no net loss of LOS from that biophysical environment. Do not allow timber sale harvest activities to occur within LOS stages that are BELOW HRV.

Amended Direction: d. Scenario A If either one or both of the late and old structural (LOS) stages falls below HRV in a particular biophysical environment within a watershed, then there should be no net loss of LOS from that biophysical environment. However, timber sale harvest activities may occur within LOS stages that are below HRV, if doing so will better meet LOS objectives by moving the landscape towards HRV, and provide LOS for the habitat needs of associated wildlife species (Regional Forester's 2430 Letter, "Guidance for Implementing Eastside Screens", dated June 11, 2003).

Treatments include commercial thinning of trees under 21 inches, reducing levels of standing and down material, thinning and cleaning of small diameter trees, pile and burn, and prescribed burning. Treatments under this amendment would not result in a net loss of old growth, but the amendment would provide for treatments that would maintain old growth habitat as defined by Forest standards and definitions. Old growth habitat is measured by levels of down wood, snags, number of canopy layers and large trees (See Regional Forester's amendment #2 –screens- and Wallowa-Whitman National Forest Recommended Definitions for New Structure Stages per Amendment #2, November 9, 1995).

Approximately 1,000 acres would receive commercial thinning prescriptions. Trees > 21 inches diameter would not be cut. Treatments would modify these multi-strata stands to single-strata stands and maintain adequate levels of down logs and snags. Affected Units: 1, 2, 6, 8, 9, 10-12, 18, 20, 23, 29, 30, 37-39, 41, 48, 57, 60, 70, 83, 95, 100, 102, 115, 120-122, 125-135, 137.

Connective Corridor Units – The goal within these units would be to maintain and enhance their cover and connectivity qualities such as medium to large trees as a common occurrence, canopy closure within the top 1/3 of site potential, and no less than 400 feet at the narrowest point.

Stocking levels would be managed to the Upper management zones for basal area except where tree quality and crown conditions are such that the Upper management zone is unattainable, in those areas, 20% of the stand would be in untreated clumps. Retain trees with down to 20% live crown if needed to maintain basal area levels. Snags would be retained at 4-6 trees per acre (tpa) and would be closer to 6 tpa wherever possible. Down logs would be retained at the following levels:

200 lineal feet per acre
Minimum lengths of logs 20 feet or largest available
Minimum of 12" small end diameter logs or largest available

Affected Units: 1-3, 6, 7, 12, 14, 18, 31-33, 36, 37, 41, 48, 49, 57, 60, 62, 63, 89, 100-102, 118-121, 126, 129-132, 136, 137

Removal Systems Summary:

Where treatments result in commercial products, they would be removed by tractor (3,885 acres), skyline (618 acres), and helicopter (359 acres) yarding systems. Approximately 10.7 MMBF of saw material and 1.8 MMBF of wood fiber is expected to be recovered from the proposed action.

3.14 miles of re-construction of systems roads is anticipated to improve drainage, reduce erosion and sedimentation, and reinforce the subgrade. Approximately 1.5 miles of new specified road construction is proposed and 8.9 miles of temporary spur roads are needed to facilitate removal of the materials.

Access and Travel Management Plan:

Travelways across the entire project area were analyzed to determine how best to manage access to meet resource needs and objectives. Approximately 16.64 miles of roads to be used by the project would be closed at the conclusion of harvest and project activities.

These closures would be accomplished with a combination of signing and/or physical barriers. Approximately 0.99 miles of additional roads used by the project were identified for closure to protect and enhance water quality and meet objectives for wildlife habitat. These roads would be decommissioned and no longer be available for future use. Decommissioning would result in the stabilization and restoration of these sites to a more natural state. Activities could include recontouring, culvert removal, and seeding.

Closure Area: In order to provide for big game security, a motorized closure area would be established in the Bald Angel project area (refer to closure area location map attached). All motorized travel would be restricted to signed open roads within the project area. Motorized use would be permitted within 300 feet of open roads to provide for dispersed camping opportunities, however, no cross-country travel would be permitted. This closure would remain in effect until the District motorized access planning process reflecting the new National Strategy is complete and a new plan in place.

E. Decisions to be Made

The Forest Supervisor of the Wallowa-Whitman National Forest is the official responsible for deciding the type and extent of management activities in the Bald Angel analysis area. The responsible official can decide on several courses of action ranging from no action, to one of many possible combinations for treating the area, while deferring treatment of others.

The decision will also determine if the proposed action or alternatives to the proposed action might cause significant effects requiring analysis in an Environmental Impact Statement.

Decision points to be chosen from in this document include the following:

1. Determine whether to implement one of the action alternatives described in this document to meet the purpose and need of this proposal or to select the no action alternative and defer management activities described in this analysis.
2. Specific points to be decided under each of the alternatives include but are not limited to:
 - In which stands will management be initiated and to what intensity to achieve fuel reduction goals?
 - In which stands and to what level should stocking and stand composition management be conducted to provide for long term health needs?
 - What are the total access needs (roads, trails, corridors) of the project area during and after project implementation?
 - What type of logging system is suitable to the needs of the objective in this project?
 - What type of aquatic restoration projects should be accomplished within the project area?
 - How much prescribed burning and what prescriptions should be re-introduced into the project area?
 - Should vegetation be managed in areas where it is not economically feasible?
 - Should management activities occur within riparian habitat conservation areas?
 - What type of long-term old growth network should be managed for in this area?
 - Should the project complete a non-significant Forest Plan Amendment for LOS treatments?

F. Desired Condition

Vegetative Structures and Health

Stands of varying structure and age, dispersed on a landscape level will provide a mixture of forage and thermal cover for big game, and LOS for old-growth dependent species. LOS stands are connected in at least two directions throughout the project area by stands

providing safe dispersal cover for species traveling between these habitat types. It is desirable for structural stages to be consistent with historical disturbance patterns, in terms of species composition and stocking levels.

It is desired to maintain tree stocking at acceptable levels and species composition within the historic ranges that are sustainable. Sustainability suggests stocking levels and species composition less prone to high intensity fires, epidemic insect and disease outbreaks.

Riparian Habitat Conservation Areas

It is desired to maintain water quality to a degree that provides for stable and productive riparian and aquatic ecosystems. Riparian management objectives and properly functioning conditions help determine the degree to which high water quality and riparian habitat is maintained.

Fire Return Intervals and Regimes

The desired future condition class within fire regimes 1, 2, and 3 within project area is condition class one. Fire return intervals within the analysis area were primarily low and mixed severity, and played an important role in shaping and maintaining the vegetative communities and wildlife habitat. Maintaining these low and mixed severity fire regimes over time will minimize the loss of Late and Old Structure and wildlife habitat for the vast majority of species that evolved within the historic fire regimes. Preferred fuel loadings are based on retaining adequate duff and coarse woody debris (CWD) to minimize soil exposure and maintain a healthy soil profile.

Wildlife Habitat

Stands are of different sizes and ages, dispersed to provide a mixture of forage and security cover for big game. Large diameter (greater than 20 inches) down woody debris and snags are evident. Down woody debris are at levels providing for the needs of wildlife species dependant on this habitat component. LOS is within the historic range of variation and is well connected to facilitate movement of wildlife species between distant LOS patches.

G. Project Area Description

The Bald Angel analysis area is in the geographical province of the Blue Mountains, including sections within T.6S R.41-43E and 7S, R. 42-43E, Willamette Meridian. The 36,700 acre project planning area is also the cumulative effects analysis area and includes subwatersheds 13D, E, and F of the Powder River/Pondosa (13) watershed and 29E, F, and H of the Powder River/Keating (29) watershed.

The Bald Angel analysis area stretches from 77 road in the Bald Hill area down to the Balm Creek Reservoir area and is approximately 12 miles southeast of Union, Oregon.

Sub-basin Description

The Bald Angel project area lies within the Powder River Subbasin which is part of the larger Snake River Basin, a tributary of the Columbia River basin. One of the primary reasons the Interior Columbia Basin Ecosystem Management Project (ICBEMP) was initiated was to develop management strategies using a comprehensive, "big picture" approach, and disclose interrelated actions and cumulative effects using scientific methods. With completion and release of the Integrated Scientific Assessment and the FEIS, new information became available which was considered during the development of this project.

The preferred alternative in the FEIS for the Interior Columbia Basin Ecosystem Management Project (ICBEMP) identifies this as a High Restoration Priority subbasin for landscape, economic, tribal, and aquatic components.

The intent of landscape restoration is to repattern vegetation patches and succession/disturbance regimes and to restore watershed and streams to a condition more consistent with landform, climate, and biological and physical characteristics of the ecosystem. Restored ecosystems would be more resilient to disturbances, more predictable, and would provide the range of habitats needed by aquatic and terrestrial species. Scarce habitats would be conserved in the short term while expanding these habitats through restoration in the long term.

Landscape restoration also includes Old Forest Habitat as a priority. The intent of restoration for these habitats is to focus on the vegetation cover types and structural stages that have declined substantially in geographic extent from the historical to the current period where they historically existed. Restoration would increase the geographic extent and connectivity of these source habitats and over time provide a framework for well-connected networks of source habitat for terrestrial species.

Aquatic restoration would reestablish watershed functions, processes, and structures, including natural diversity. The intent of management for watershed restoration would be to recognize the variability of natural systems while securing existing habitats that support the strongest populations of wide-ranging aquatic species and the highest native diversity and integrity, extend favorable conditions into adjacent watersheds to create a larger or more contiguous network of suitable and productive habitats, and restore hydrologic processes to ensure favorable water quality conditions for aquatic, riparian, and municipal uses.

The social-economic-tribal restoration component highlights areas where restoration activities directly influence human community economic, social, and cultural needs. Design and implementation of restoration activities should promote workforce participation, serve demands for commodity production at various levels, encourage intergovernmental collaboration, and consider tribal needs and interests.

Forest Plan Management Direction

This environmental assessment is tiered to the Final Environmental Impact Statement (FEIS) for the Wallowa-Whitman National Forest Land and Resource Management Plan, as amended. Major Plan amendments relevant to this project include:

- *EA on Continuation of the Interim Management Direction Establishing Riparian, Ecosystem, and wildlife Standards for Timber Sales, as signed on May 20, 1994, which provides additional standards and guidelines (USDA, 1994, and commonly known as the Screens);*
- *EA on Interim Strategies for Managing Fish-Producing Watersheds in Eastern Oregon and Washington, Idaho, Western Montana and Portions of Nevada, as signed on July 28, 1995, which provides additional standards and guidelines (USDA, 1995, and commonly known as INFISH).*

The Forest Plan, as amended, includes management goals and objectives and standards and guidelines, both forest-wide and specific to land allocations. With the exception of the Screens LOS guidelines proposed for amendment in this project, all proposed activities in this project are consistent with the management guidance and direction provided in the Forest Plan.

The project area is allocated under the Wallowa-Whitman National Forest Plan Forest and its Environmental Impact Statements (as amended) to the following management areas (refer to map in Appendix A). All applicable management direction specific to the following management areas in this project area apply to this project area:

MA1 – (24,169 acres). Emphasizes wood fiber production on suitable timberlands while providing relatively high levels of forage and recreational opportunities.

MA3 – (8,788 acres). These management areas provide a broad array of forest uses and outputs with emphasis on timber production. However, timber management is designed to provide near-optimum cover and forage conditions on big game winter and selected summer ranges.

MA15 – (1,311 acres). These areas are intended to maintain habitat diversity, preserve aesthetic values, and to provide old growth habitat for wildlife. Evidence of human activities may be present but does not significantly alter the other characteristics and would be a subordinate factor in a description of such a stand.

H. Key Issues

This section identifies the issues associated with the proposed action. In addition, concerns related to the proposed decision are also discussed. The interdisciplinary team of Forest Service resource specialists developed this list of issues with input from public scoping. The issues and concerns are the basis for subsequent steps of the analysis in formulating alternatives or developing constraints and mitigation measures.

Issues

The following preliminary issues have been identified by the Forest Service Planning Team:

- Improvement of Long Term Forest Health Conditions
- Deficient in LOS and Entire Area Outside HRV
- Big Game Security Habitat Impacted by Open Roads and Marginal Cover
- Area Outside of Historic Fire Return Intervals

Key issues were identified and subsequently used to develop a range of alternatives. The following section describes the key issues identified for this analysis and the key indicators used to evaluate each key issue. In all cases, other measurable aspects may be tracked throughout the analysis, however, they are supportive in nature and not considered key to the decision making process.

Issue: Improvement of Long Term Forest Health Conditions

The Bald Angel project area has many young, overstocked stands. Past activities and exclusion of fire have lead to an increase in stocking levels, fuel loadings, and understory in these stands. These stands are not growing to their site potential and if left untreated in the proposed action, the stand development could remain retarded and increase the risk of loss from insect mortality and wildfire.

Due to the size and diversity of the Bald Angel planning area, there are several factors and conditions affecting overall forest health as described by tree vigor,



stocking, species diversity, and stand conditions. Past insect epidemics left minor amounts of budworm and associated bark beetle mortality within the project area. However, mountain pine beetle and western pine beetle populations have shown an increase in the last year and populations in the area around Langrell Gulch have grown to epidemic levels with increasing levels of mortality in ponderosa pine.

A small (250 acres) timber sale project (Bald Angel Fuel Reduction project) was completed in 2004 to capture the mortality, remove the infested logs, and reduce the overstocking to improve tree vigor and health. However, the Bald Angel area still contains approximately 9,600 acres of high-density, at-risk stands within the project area. The proposed action calls for treatment of approximately half of those acres. Retaining areas of overstocked stand conditions retards stand development and increases the risk of loss from insect mortality. Accelerated stand development through thinning would promote tree health and vigor and the development of structural stages closer to historic ranges within the area.

Overstocking inhibits development of trees to late/old structural stages. The most abundant structural stage found in the analysis area is understory re-initiation (UR). UR contains a second generation of trees established under an older overstory. With overstocking, development of the URs second layer would be slow and susceptible to many insects, pathogens and disturbances. This second layer also contributes to an increase in ladder fuels which feed fires into the crown of the trees. Running crown fires increase the potential for stand replacement types of fires.

The area has a smaller percentage of stem exclusion, closed canopy (SECC). Both of these structure types (UR and SECC) are experiencing competition from overstocking resulting in tree stress. Competition and stress increase susceptibility to insect and disease and retard movement of these structures to late and old stages.

Overstocking may also lead to less effective wildfire suppression tactics, resulting in loss of important structural components. Fighting fire in dense stands is more difficult and dangerous.

Silvicultural and fuel treatment opportunities are designed to thin overstocked clumps, reduce forest and stand susceptibility to future outbreaks of insects and the potential for damaging wildfire, and reduce encroachment of fir on warm or dry sites. Without changes in forest stand composition and canopy layering, insect outbreaks will continue to develop in the future.

Public feedback from the Proposed Action varied from support of commercial timber harvest within the area to meet project objectives to support of only thinning of small diameter non-commercial materials. One commenter indicated that the use of logging to reduce beetle populations is simplistic at best and doesn't take into account the causes of the beetle epidemics, nor the beneficial impacts of those epidemics.

Key Indicators:

- Acres of stand density reduction

Issue: Deficient in LOS and Entire Project Area Outside HRV

The Bald Angel analysis area is deficient in LOS and below the historic range of variability (HRV) for this type of structure in all biophysical environments, particularly in single stratum large trees common (SSLT) structures. Analysis of the project area shows that some of the multi-stratum large trees common (MSLT) areas are in biophysical environments that should be or were historically SSLT. While there is an opportunity to treat these areas and convert them to SSLT, there is concern with the treatment of any old growth in the proposed action.

An analysis of the historical range of variability (HRV) was done to assess current forest conditions compared to what ecologists believe existed during the pre-settlement era (Bald Angel Analysis File). Approximately 39,000 acres were assessed to determine the amount and distribution of LOS habitat. This is an appropriate scale to analyze HRV and is meaningful in terms of landscape patterns as they relate to the distribution of wildlife habitat. HRV is important to wildlife populations because the distribution, quality and quantity of habitat largely determine the potential for a wildlife species to exist at viable levels. As habitat was converted, fragmented, and opened to motorized access, many species were reduced in number and others were precluded from portions of their geographic range altogether.

The following defines biophysical group within the analysis area:

Biophysical Groups Definitions

Biogroup	Definition
G1	Cold/Dry Whitbark Pine-Doug-fir-Subalpine fir
G3	Cold/Dry Grand fir
G4	Cool Grand fir
G5	Warm Grand fir
G6	Warm/Moist Douglas-fir
G7	Warm/Dry Doug-fir-Ponderosa Pine
G8	Hot/Dry Ponderosa Pine

The following table compares existing old growth acres to the HRV in the analysis area.

Single-stratum, large trees common (SSLT) and Multi-stratum, large trees common (MSLT), and understory reinitiation (UR): Existing and Historic Range of Variation

Bio-group	Total Acres in Biogroup	SSLT (existing) (% of biogroup)	SSLT HRV (% of biogroup)	MSLT (existing) (% of biogroup)	MSLT HRV (% of biogroup)	UR (existing) (% of biogroup)	UR HRV (% of biogroup)
G1	33	0	1-10%	24%	1-10%	3%	5-25%
G3	816	0	0%	4%	30-60%	81%	5-25%
G4	7,372	0	0%	6%	30-60%	76%	5-25%
G5	11,424	0	15-55%	9%	5-25%	75%	1-10%
G6	3,075	0	15-55%	7%	10-30%	70%	1-10%
G7	5,292	0	15-55%	11%	5-25%	74%	1-10%
G8	854	2%	20-70%	0%	2-15%	52%	0

Approximately 6% of the forested area in this analysis area is in a late/old condition. The historical range of variability ranges from 1-70% depending on biophysical environment. The table above illustrates some large deficiencies in late/old structure in all biophysical environments, except for MSLT in G5 (lower end of range), and G7 (middle of range). Biogroup G1 also falls within the HRV for MSLT, but with only 33 acres there would be no utility in applying an HRV analysis. The largest deficiencies in late/old structure exist in biogroups G4, G5, and G6. The understory reinitiation structural stage far exceeds the HRV for this structure within the project area and therefore provides the greatest opportunities to accelerate structure toward LOS (MSLT and SSLT).

Late/old habitat is not well connected anywhere in analysis area, with many patches isolated by more than a mile from the next closest patch. The most abundant structural stage available to provide some level of connectivity between late/old patches is understory re-initiation.

Public input on the Proposed Action related to LOS did not support the conversion of MSLT to SSLT because they felt that this action was not meeting the intent of Screens and they called for either no treatment at all in LOS or no net loss of LOS.

Key Indicators:

- Acres of understory reinitiation accelerated toward Single Stratum and Multi-Stratum Large Trees (SSLT and MSLT)
- Acres of MSLT converted to SSLT
- Acres of treatments within connective corridors.

Issue: Big Game Security Habitat Impacted by Open Roads and Marginal Cover

Past insect and management activities as well as current recreation levels have contributed to wildlife habitat degradation creating less than optimum cover and security habitat conditions within the Bald Angel project area. Treatments proposed in the proposed action have the potential to negatively affect existing cover and and big game security habitat.

Nearly 9,000 acres of this area is winter range (Management Area 3 in the LRMP). The winter range is situated along the south and west boundaries of the analysis area, at lower elevations. The remainder of the area is transitional and summer range. Much of the winter range on private lands is crowded by agriculture and human development, but the southern portion of this area is bordered by a sizable band of undeveloped sagebrush rangeland. The western boarder has scattered homes and ranches and county highway 203. These developments contribute to some conflicts with elk on winter range but the conflicts are minor when compared to other places with higher densities of human development immediately adjacent to public lands.



An analysis of elk habitat, Habitat Effectiveness Index (HEI) was conducted for the area using a model developed by Thomas et al. (1988) and a revised summer range model by Leckenby (1988) and is summarized in the following table.

Habitat Effectiveness Summary using two road analysis methods.

Habitat Effectiveness Variable	Habitat Effectiveness Value	Minimum Standard in LRMP
HE cover	0.67	≥30% of forested acres in a cover condition
HE size and spacing	0.69	
HE roads, density	0.36	MA-1 2.5mi/mi ² MA-3 1.5mi/mi ²
HE roads, distance bands	0.17	
HE total (road density)	0.55	MA-1 >0.50 MA-3 average 0.74
HE total (distance bands)	0.43	

An HEI value of 0.43 (which uses a distance band method for the roads variable) indicates the standard for HEI is not being met, and 0.55 (using road density method for the roads variable) indicates the standard for HEI is slightly exceeding the minimum requirement. Considering the fact that motorized access occurs on closed roads and cross country, the overall HEI value of 0.43 is likely the more accurate value. The potential for disturbance is much less during the winter when snow limits access into the area and the majority of elk are on winter ranges. Disturbance is highest during hunting seasons.

Forested stands with relatively closed canopies function as thermal and security cover, providing a visual barrier from predators and reducing the difference between an animal's body temperature and ambient air temperature. Cover exists on 54% of the analysis area, 18% satisfactory and 36% marginal, resulting in a cover quality value of 0.67. The HE_c (cover) value only reflects the amount of satisfactory cover relative to marginal cover, and does not relate to abundance of cover across the landscape. The quantity of cover is factored into the size and spacing variable. A mosaic of forage and cover patches is desirable on elk ranges. Size and spacing of cover is optimal (HEI value of 1.0) when all satisfactory cover is within 600 feet of forage, and all forage areas are within 600 feet of satisfactory cover. The HE_s (size and spacing) is 0.69, which indicates a high degree of cover and forage interspersion.

Excessive open road densities have deleterious effects on habitat effectiveness by taking habitat out of production (1 mile = 4 acres of land), reducing the effectiveness of cover and increasing disturbance to elk. The HE_r roads value is 0.36 when calculated using the traditional road density method, and 0.17 when using a distance band roads analysis that considers all roads available to motorized traffic. The assumption that all roads without promulgated closures are equal in their effects to elk over-estimates the effects of roads. Some roads that are closed with earthen barricades are actually functioning as closed roads, many others continue to receive use by motorized vehicles and function as open roads. In the absence of actual road use data, the above approach is used with the recognition that the actual HE_r (roads) is likely somewhere between 0.17 and 0.36.

Unregulated use of off highway vehicles likely has a deleterious effect on elk distribution in this area, particularly during elk hunting seasons. Impacts of off highway vehicle use on closed roads and cross country travel are not considered in the HEI analysis. As a result, the HE_r (roads) variable (by either the density or distance band method) underestimates the effects of motorized access to elk habitat effectiveness.

Poor elk distribution during the spring, summer and fall months has been an on-going concern within this project area. Large parcels of private lands attract and retain elk through much of the year, likely due to the low levels of disturbance they encounter there. Elk spending most of the year on private lands creates problems for some landowners through crop and fence damage and utilization of limited winter forage. Additionally, elk that reside on private lands during fall are not available for hunting and viewing on public land. The Catherine Creek Wildlife Management Unit (WMU) has inherently low densities of elk, but the poor distribution is likely the result of unregulated motorized access. Although the frequency of motorized traffic appears low in this area, access by ATV's, motorcycles, and full sized vehicles is unpredictable and widespread. Many roads that were closed to reduce disturbance to wildlife continue to function as open roads. Firewood cutters and hunters have constructed routes around closure devices, and off highway vehicles use closed road beds and travel cross country to access the area.

Feedback on the Proposed Action from a local and a regional environmental organization was primarily focused on no road building within the project area. They supported the area closure and road decommissioning proposals, but were not in favor of any new road construction. No other participants in the proposed action scoping process mentioned roads or road construction.

Key indicators:

- Acres of Satisfactory thermal cover converted to Marginal thermal cover or forage
- Acres of Marginal thermal cover converted to Forage
- Percent of analysis area further than 0.90 km (moderate quality security habitat) from a motorized route.

Issue: Fire Return Intervals, Risks, and Regimes

The Bald Angel area is outside of the historic fire return intervals and could experience higher levels of risk to loss from wildfire, and is experiencing condition class changes farther from their historic ranges in many frequent fire regimes. Treatment of fuels mechanically in the proposed action raises the concern over the potential for short-term increases in fuel loadings/fire hazard due to logging slash and the drying effects of increased light reaching the forest floor in treated stands.

Fire exclusion policies since the turn of the century have resulted in vegetation changes. Grand fir at high densities has developed in fire adapted plant communities. As densities increase, more ground and ladder fuels exist, increasing the probability of high intensity fires (W-W Land and Resource Management Plan, 1990).

Historically fire was a dominant disturbance process in the Blue Mountains. Low intensity fires crept through the drier forests and grasslands every 7 to 35 years. Moister sites experience fire every 40 to 150 years. The results were a mosaic of vegetation patterns from hot, intense fires, and light ground fires. While there is no historic data of what fuel levels were in the Blue Mountains, it is evident that fuel levels were lower and maintained by fire as a natural disturbance process. Fire regimes are a predetermined frequency cycle for fire return intervals within a particular vegetation profile and described in the table below.

Fire Regime Group	Vegetation Types	Historical Frequency (Fire Return Interval)	Historical Severity
1	Includes lower and mid-elevation forested plant associations - All ponderosa pine types; Dry-Douglas fir/ pine grass; and grand fir/grass.	0 – 35 years	Low severity. Large stand replacing fires can occur under certain weather conditions, but are very rare (200+ years).
2	Includes low and mid elevation grassland plant associations - True grasslands; juniper/grass; juniper/big sage; Mt big sage/grass; and Mt shrub/grass.	0 – 35 years <ul style="list-style-type: none"> ▪ True grasslands and savannahs with FRI (fire return intervals) of less than 10 years. ▪ Mesic sagebrush communities with FRI of 25 – 35 years and occasionally up to 50 years. ▪ Mountain shrub communities with FRI 	Stand replacing.

Fire Regime Group	Vegetation Types	Historical Frequency (Fire Return Interval)	Historical Severity
3	<p>Consists of forest plant associations found at mid elevation, more mesic sites than fire regime 1</p> <p>3a - Mixed conifer 3b - Dry western hemlock; mesic grand fir; 3c - white bark pine below 45 degrees latitude; cool, mesic grand fir and Douglas -fir</p>	<p>35 – 100+ years</p> <p>3a - < 50 years 3b - 50 - 100 years 3c - 100 - 200 years</p>	<p>Mixed Severity</p> <p>3a - Low severity tends to dominate. 3b - Mixed severity 3c - High severity tends to dominate.</p>
4	<p>Forested species found at mid to high elevation – Lodge pole, sub alpine fir, spruce</p> <p>4a - Lodge pole pine above ponderosa pine; aspen embedded in dry grand fir ; 4b - Sub alpine fir; white bark pine above 45 degrees latitude; and mountain hemlock; 4c - Spruce-fir; western larch; western white pine.</p>	<p>35 – 100+ years</p> <p>4a - 35 – 100+ years 4b - 100 + years 4c - 100 – 200 years</p>	<p>Stand replacing</p> <p>4a - stand replacing 4b - stand replacing, patchy arrangement 4c - stand replacing</p>
5	Black sagebrush; salt desert scrub; alpine communities; sub alpine heath	Greater than 200 years	Stand replacing, or no fire

Fuel conditions are an important factor in wildland fire behavior. Heavy fuels, lying under a dense canopy of tree crowns, create optimum conditions for stand replacement fire events, and further loss of LOS. Higher levels (over 10 tons per acre) of 0-3" fuels increase the potential for intense, lethal fire behavior.

The following tables display acres for each of the condition classes found in the Bald Angel Analysis area, by fire regime. Approximately 192 acres are not rated because they won't burn:

Fire Regime	Acres Of Condition Class 3	Acres Of Condition Class 2	Acres Not Rated	Total Acres By Fire Regime
1	9,652	455		10,160
2	433	5,145		5,583
3	7,494	298		7,809
4	6,336	200		6,672
Not Rated			192	192
TOTAL	23,915	6,098	192	30,205

The following pictures are examples of stands in a condition class 3 and 2 within the analysis area followed by a table defining these condition classes.



Condition Class 3



Condition Class 2

Condition Class	Description
1	Fire regimes are within or near historical ranges, and the risk of losing key ecosystem components is low. Vegetation conditions in terms of species composition and structural stage are in tact and functioning within the historical range.
2	Fire regimes have been moderately altered from their historical range. The risk of losing key ecosystem components is moderate. Fire frequencies have departed from historical frequencies by one or more interval returns (increased or decreased). This results in moderate changes to one or more of the following: Fire size, Intensity and Severity, and Landscape patterns. Vegetation conditions in terms of species composition and structural stage have been moderately altered from historical conditions.
3	Fire regimes have significantly altered from their historical range. The risk of losing key ecosystem components is high. Fire frequencies have departed from historical frequencies by multiple return intervals. This results in dramatic changes to one or more of the following: Fire size, Intensity and Severity, and Landscape patterns. Vegetation conditions in terms of species composition and structural stage have been significantly altered from historical conditions.

Current Condition classes represented within the Bald Angel project area are the result of both natural and human activities. The analysis area overall has a significant deficit in late and old structure; and a large surplus of Stand Initiation (SI) and Understory Re-initiation (UR). Past timber harvest activities and fire exclusion have contributed to these conditions.

High and moderate departures for the analysis area are primarily experienced in fire regime groups 1 and 3, with a stand structural stage of under story re-initiation. These are generally overstocked , have a ladder fuel component of shade tolerant fir, and /or have heavy concentrations of standing dead and down fuels.

High and moderate departures are also common in stand initiation structural stage in fire regimes 1 and 3. Within the next 10 to 15 years these stands are at risk of developing into a suppressed condition with a higher risk to insects, disease, and stand replacing fire due to high levels of crown bulk densities.

Feedback on the Proposed Action indicated support for the use of prescribed fire, especially in fire adapted ecosystems, however there was mixed or no support for the use of mechanical fuels reduction (timber harvest) as a pre-treatment or treatment alternative. They suggested that fuel reduction focus on the removal of trees <12 inches dbh with no removal of canopy fuels. There was

concern over the potential to increase fuel hazards in the area from logging slash and drying of the site from increased exposure to sun and wind. The effectiveness of thinning as a fuels reduction tool was also a question posed by the commenter.

Key Indicators:

- Acres treated within fire regimes of high departure from historical fire return intervals
- Acres treated within fire regimes of moderate departure from historical fire return intervals
- Acres treated with high or moderate risk to wildfire damage due to heavy fuel loadings

H. Other Issues

Some issues, concerns, and opportunities raised during the scoping process were not considered to be significant in relation to the proposed action. They are, however, considered important in achieving the goals and objectives of the proposed action and in meeting the intent of its purpose and need and are covered in this section.

Unless otherwise noted in the following narratives, the issues, concerns, and opportunities outlined below will be addressed in Chapter II, under Management Direction Common to All Action Alternatives, Management Requirements, Constraints, and Mitigation Measures, and/or in management direction for each action alternative. Potential environmental consequences will be disclosed in Chapter III. In general, all issues brought up during scoping for this project have been described in this section and were covered as described above.

Public comments raised the issue of uninventoried Roadless within the project area. This issue was considered by the ID Team but not discussed further as this project will have no effect on the small unroaded area within this project area. Only limited amounts of prescribed fire is called for in that area with no timber harvest or road building, therefore the unroaded nature of the area will be maintained and no further discussion is required or necessary.

1. Indian Treaty Rights and Trust Responsibilities

The Forest Service manages ceded tribal lands under trust responsibilities as described in tribal treaties. Forest Service policy includes the establishment and maintenance of government-to-government relationships with the Nez Perce and Confederated Tribes of the Umatilla Indian Reservation (CTUIR) for the purpose of building stable, long-term relationships, which result in positive, mutually understood, and beneficial solutions to common situations.

The Nez Perce maintains usual and accustom fishing grounds in the Powder River. Our treaties provide that Native Americans will continue to have the right to erect suitable buildings for fish curing, privileges of hunting, gathering roots and berries, and pasturing stock on un-claimed lands.

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2. Water Quality, Fisheries, and Riparian Habitat

The analysis area lies within NFS Watersheds 13 (Powder River-Pondosa) and 29 (Powder River-Keating) and includes subwatersheds 13D (Big Creek-Medical Springs), 13E (Big Creek – Big Creek

Ditch), 13F (Upper Big Creek), 29D (Upper Goose Creek), 29E (Balm Creek), 29F (Clover Creek), and 29H (Tucker-Houghton Creeks). Watershed and fisheries analysis for this project incorporate the watershed analysis, water quality databases, field surveys, and professional judgment.

The primary streams within the project area include Big Creek, Balm Creek, Burn Creek, Conundrum Creek, Lick Creek, Velvet Creek, Alder Creek, Tucker Creek, Goose Creek, and Clover Creek. There are 28.56 miles of perennial fish bearing streams, 196.85 miles perennial and intermittent non-fish bearing and 253.83 miles of ephemeral draws within the Bald Angel project area.

Instream Habitat – The streams surveyed within the project area varied considerably with instream habitat conditions. Of the seven primary streams surveyed within the project area, Burn Creek, Conundrum Creek, Lick Creek and Velvet Creek had width to depth measurements that meet INFISH standards for width to depth ratios while Big Creek, WF Goose Creek and Balm Creek did not meet the recommended levels. All of the streams within the project area are well below the objective of 96 pools/mile and are considered in poor condition related to that variable. With the exception of Burn Creek, all streams had adequate levels of large woody debris within the project area, however, Conundrum Creek, Lick Creek, Velvet Creek and WF Goose Creek all had less than 80% stable banks.

Streams surveyed in the project area were dominated by a sapling/pole size overstory and grass/forb understory with some reaches supporting large mature trees. This riparian vegetation type, in general, provides low levels of future recruitment of LWD and is susceptible to becoming over stocked with small trees resulting in a suppression of the release of resources for tree growth and stable riparian type vegetation (i.e. shrubs, sedges and rushes). The cover measured on the surveyed streams were, on average, providing 60% shade and low to moderate (21% to 40%) fish hiding cover.

Stands that are adequately stocked are growing at full potential and provide sufficient canopy cover, root mass, evapotranspiration, and recruitment material for proper hydrologic functions. Adequately stocked stands are also less susceptible to risk of catastrophic fire and infestations of insects and disease. All of the subwatersheds in the Bald Angel project area have 20% or less of RHCA stands in an adequately stocked condition. There is an opportunity to treat within RHCA's and enhance RMOs. *There was concern expressed by one commenter about mechanical treatments within RHCA's related to whether there was any scientific support for this type of activity.*

Water Quality – The ODEQ assigns specific standards for water quality parameters based on beneficial uses. Water bodies that do not meet State standards are generally listed as water quality-limited streams under section 303(d) of the Clean Water Act. Beneficial uses of water in the Bald Angel project area include stock watering, irrigation, and resident fish and aquatic life. There are no streams listed on the ODEQ 303 (d) list as water quality limited in the Bald Angel project area.

Roads provide a substantial source of sediment and a mechanism for delivering sediment to the stream systems. The amount varies by density, location and condition of roads. The road densities in the subwatersheds in the analysis area range from 1.1 mi/mi² to 7.3 mi/mi² and for the entire analysis area is 3.3 mi/mi². An inventory of potential valley bottom roads within RHCA buffers in the analysis area resulted in approximately 233 miles of existing roads (open, closed, FS and Non-FS). Roads within RHCA buffers can reduce the effectiveness of buffering capacity, provide active sources of sedimentation, negatively affect terrestrial inputs to riparian areas, decrease riparian habitat. Road reconstruction, closure and/or decommissioning have the potential to reduce the sediment potential and improve fisheries habitat.

Fisheries- There are no listed fish species or designated critical habitat within the project area or analysis area. The USDA Forest Service Regional Forester's (Region 6) candidate 2 sensitive species redband trout (*O. mykiss gibbsi*) are found on the La Grande Ranger District and are in the Bald Angel project area. There are approximately 30 miles of fish bearing streams out of 85 miles of perennial streams in the project area. Non-game fish species such as sculpins (*Cottus sp.*) and suckers (*Catostomus sp.*) are also present within the project area.

Overall Fish and Watershed Condition

In the Bald Angel project: all seven subwatersheds (SWS) were identified as “Functioning Appropriately” (FA) for water quality and disturbance history (ECAs); five SWS were identified as FA, one “Functioning at Risk” (FAR) and one “Functioning at Unacceptable Risk” (FAUR) for physical barriers that block fish passage; six SWS were identified as FA and one as FAR for large woody debris; all seven SWS were identified as FAUR for pool frequency; three SWS were identified as FA, two SWS as FAR and two as FAUR for streambank stability; six SWS were identified as FA and one as FAR for width/depth ratio; and, three SWS were identified as FA and three as FAUR for road density and location. The majority of the SWSs are FA with a few of the SWS FAR and FAUR that have high road densities, drawbottom roads, and irrigation ditches that are blocking fish passage.

3. Soil Quality and Productivity

Most soils in the project area have developed from two parent materials: basalt/andesitic basalt and volcanic ash. Prior to 6,850 years before present (BP), soils were developing primarily in basalt residuum, colluvium and alluvium. About 6,850 BP, approximately 2 feet of Mt Mazama ash was deposited over the basalt-derived soils. During the past 6,850 years, differential natural erosion rates within the project area produced many different soils, ranging from thin, rocky, residual basalt-derived soils on ridgetops with no remaining ash cap, to deep volcanic ash deposits over residual colluvial basalt-derived soils on toeslopes. Fifteen soil series and three soil subgroups have been mapped in the project area. Six of these soils have substantial influence from volcanic ash.

Surveys within each stand proposed for treatment in the Bald Angel project area indicate that all of the units are well below the 20% detrimental soil condition (DSC) threshold set in the Forest Plan. The project area as a whole was also analyzed and is estimated to be at slightly less than 10% DSC. This includes machine impacts related to logging, roads, quarries and reservoirs, and historic erosion in rangelands, which is being maintained by high natural rodent activity. Rodents prevent reestablishment of native perennial grasses and shrubs by frequently churning the soil, which also maintains competitive forb communities. Severe burn effects are negligible due to little prescribed fire and wildfire in the analysis area.

To ensure protection of long-term soil productivity, Region 6 has established soil quality standards and guidelines (USFS 1998) for compaction, puddling, displacement, burning, erosion and mass wasting. Soil management efforts should concentrate on controlling erosion (surface erosion and mass movement), minimizing damage to the soil (compaction, displacement, puddling, severe burning), and minimizing road building and other developments, which remove land from the productive base.

4. Air Quality and Smoke Management

The analysis area is located 25 miles southeast of the city of La Grande, 10-15 miles from the towns of Cove and Union, and 15 miles from the Baker Valley. The City of La Grande is monitored by the Oregon Department of Environmental Quality for federal air quality standard compliance. The Eagle Cap Wilderness is immediately adjacent to the east of the Bald Angel analysis area. The concern is to maintain air quality standards for this class I airshed and the City of La Grande.

Wildfire events in the Bald Angel analysis area that escape initial attack have the potential to spread onto private lands and the adjacent Eagle Cap Wilderness.

The analysis area has a high risk of affecting air quality because of its location. Prescribed burning should be carefully coordinated with the Department of Environmental Quality to prevent smoke related problems.

5. Noxious Weeds

The introduction and proliferation of noxious weeds through project activities is a concern. The analysis for vegetation management is conducted in accordance with the 1990 Forest Plan Standards and Guidelines and the Integrated Noxious Weed Management Plan - Wallowa Whitman National Forest (INWMP, 1992). Management activities will give consideration and evaluation of prevention strategies during the planning process (INWMP, Chapter V. Prevention Strategies, Section B).

There are 30 known noxious weed locations within the Bald Angel Planning area, primarily along roadways. Diffuse knapweed, Whitetop, Scotch thistle, and yellowstar thistle are the weed species represented within these infestations (refer to the GIS Noxious Weed layer for locations). These species are rated as high priority weeds because they are invasive, persistent, and prolific reproducers. They displace desirable vegetation, and presently occur in infestations at scales that are feasible to treat. Project design and activities must take these populations into consideration to ensure that they are not spread further throughout the project area.

6. Range and Livestock Management

The project area includes portions of the Balm Creek, Big Creek, and Gilkison C&H, Frazier Mountain, Fruit Springs, Hootin Rock, Goose Creek C&H, and Upper Clover grazing allotments on the La Grande Ranger District. These allotments are all grazed by cattle and are administered by the La Grande District, the Whitman Unit, and the Baker Bureau of Land Management. It is important that activities associated with this project do not impact pasture rotations or compromise the integrity of range improvements necessary for management of rangeland resources on the allotments. Improvements and trails must be restored to their original condition to facilitate movement of livestock within the pastures, gates must be closed, and problems coordinated with the Rangeland Managers to ensure immediate resolution.

7. Cultural Resources

Public law requires federal agencies to identify and protect natural, cultural, historical, and archeological resources and sites and to consult with interested parties on the effect of proposed actions.

Cultural sites located within and adjacent to the analysis area should be protected throughout project implementation to prevent damage to these resources.

8. Management Indicator Species (MIS) and Proposed, Endangered, Threatened, and Sensitive Species (PETS) - Wildlife and Plants

The management indicator species (MIS) of the Wallowa-Whitman National Forest and the habitat or habitat component that they represent are shown in the table below. All the species in this table are known or suspected to inhabit the analysis area, although American marten is likely represented in low numbers. The scarcity of marten in this area is likely due to a combination of inherent habitat capability and fragmentation from past logging.

Management Indicator Species.

SPECIES	HABITAT
Pileated woodpecker (<i>Dryocopus pileatus</i>)	Old growth and mature forests
Primary cavity excavators *	Snags
Northern goshawk (<i>Accipiter gentiles</i>)	Old growth and mature forest
Rocky Mountain elk (<i>Cervus elaphus</i>)	Cover/forage
American marten (<i>Martes americana</i>)	Old growth and mature forest

* northern flicker (*Colaptes auratus*), Lewis' woodpecker (*Melanerpes lewis*), yellow-bellied sapsucker (*Sphyrapicus varius*), Williamson's sapsucker (*Sphyrapicus thyroideus*), red-naped

sapsucker (*Sphyrapicus nuchalis*), hairy woodpecker (*Picoides villosus*), downy woodpecker (*Picoides pubescens*), white-headed woodpecker (*Picoides albolarvatus*), Northern three-toed woodpecker (*Picoides tridactylus*), black-backed woodpecker (*Picoides arcticus*), mountain chickadee (*Parus gambeli*), black-capped chickadee (*Parus atricapillus*), white-breasted nuthatch (*Sitta carolinensis*), red-breasted nuthatch (*Sitta Canadensis*), and pygmy nuthatch (*Sitta pygmaea*).

Management indicator species (MIS) serve as indicators of the effects of management activities by representing a broad range of other indigenous wildlife species. The management indicator species that may be impacted by this project include: the primary cavity excavators (including pileated woodpecker), elk, American marten, and northern goshawk.

Northern goshawk surveys were completed and did not produce any new sites. The known sites will be protected and post-fledging areas have been identified.

The Bald Angel project area presently provides poor marten habitat due to a combination of inherent habitat capability and forest fragmentation from past harvest activity.

PETS species and their habitat must be considered and protected during all proposed activities. Suitable habitat and wildlife PETS species known or suspected to occur within or immediately adjacent to the analysis area have been identified in the Bald Angel Biological Evaluation and Biological Assessment documents in the analysis file.

Sensitive plant species are known to occur within the analysis area. A list of these plants, and their location is provided in the Botany report, residing in the project analysis file. Project design and monitoring criteria should provide for protection of known sites. No known location or habitat for any Threatened or Endangered plant species exists within the project area. There is habitat and potential for the occurrence of R-6 Sensitive plant species within the project area. Surveys have been conducted at the appropriate time of year to determine species occurrence within the project area.

9. Prescribed Burning and Big Game/Migratory Birds

Experience on the district indicates the greatest potential for impacting calving habitat occurs during post sale slash treatment activities. Calving and fawning typically occurs in elevations less than 4,000 feet, areas of low disturbance, gentle topography, and near water sources. The majority of calves and fawns are born between May 15 and June 15.

In 1990, the National Fish and Wildlife Foundation proposed an initiative for the conservation of migratory land birds that breed in North America and winter in neotropical countries. Recent analyses of local and regional bird population counts, radar migration data, and capture data from banding stations show that forest-dwelling bird species, many of which are neotropical migrants, have experienced population declines in many areas of North America (Finch 1991). Factors contributing to population declines include forest fragmentation on the breeding grounds, deforestation of wintering habitats, pesticide poisoning, or the cumulative effects of habitat changes.

10. Access and Travel Management (A&TM)

The La Grande District has a District Access and Travel Management Plan (A&TM) which is a reflection of previous decisions focused on reducing forest road densities to within Forest Plan guidelines. Access and travel management implementation has been sporadic within the Bald Angel project area; and as such, it has not been fully implemented. Monitoring also indicates that some of the closures have not been completely effective due to the flat nature of the terrain. Analysis of the existing plan for the area indicates that the proposed open road network may not be the most appropriate one for current conditions and uses and would benefit from an update.

In several of the subwatersheds below, project area boundaries which stop at Forest boundaries, remove large portions of the subwatersheds from this analysis resulting in several with a very small number of acres being analyzed. In those situations, road densities are skewed to the high side due to the inappropriate scale of the analysis area for an evaluation of this type.

Transportation system management is important because in addition to big game disturbance, roads can be a source of sediment, intercept groundwater flow, increase the drainage network, reduce large shade-producing trees, and confine stream channels preventing lateral stream movement.

The total (including open and closed) road densities in the subwatersheds in the analysis area range from 1.1 mi/mi² to 7.3 mi/mi² with densities for the entire analysis area at 3.3 mi/mi². An inventory of valley bottom roads resulted in approximately 233 miles of existing roads (open, closed, FS and Non-FS). The District uses the NOAA Fisheries conservation recommendation from the 1996 BO for LRMPs for open and closed road density for steelhead habitat of less than 2 miles per square mile and no valley bottom roads per entire subwatershed as a guide to assess the hydrologic function of the subwatersheds included in the project area. Road reconstruction, closure and/or decommissioning have the potential to reduce the sediment potential and improve fisheries habitat. Project activities should be directed to maintain the planned road density levels and not exceed levels guidelines established by the Forest Plan.

SWS	Management Areas	Project Area (sq. mi)	Open Road Density (mi./sq. mi.)	Forest Plan Road Density Guideline
13D	1	0.54	0.5	2.5
	3	2.99	1.8	1.5
	15	0.15	0.2	N/A
13E	1	5.89	3.1	2.5
	3	2.87	1.6	1.5
	15	0.15	0.0	N/A
13F	1	17.99	3.1	2.5
	3	4.82	2.3	1.5
	15	0.97	0.2	N/A
29D	1	6.4	5.3	2.5
	3	.001	17.5	1.5
	15	0.07	1.0	N/A
29E	1	5.76	4.1	2.5
	3	3.72	1.7	1.5
	15	0.67	3.5	N/A
29F	1	0.59	5.8	2.5
	3	2.93	1.9	1.5
29H	1	0.6	4.3	2.5
	3	2.64	2.1	1.5

11. Safety

Standing dead trees near areas of concentrated public use, such as recreation sites or main traveled roads, represent a public safety hazard. Log haul on high recreation use roads could create conflicts with public users and a potential safety hazard.

Aerially yarded logs over road open to vehicular traffic with either skyline or helicopter creates a concern for public safety.

12. Water Rights

The Wallowa-Whitman National Forest has reserved water rights within the Bald Angel area with a priority date of 1906. Concerns relating to water rights include how much water can be used during project implementation for uses such as road construction and reconstruction and at what time of year can the water resources be used.

13. Standing and Down Woody Materials

Firewood cutters have severely reduced the larch and Douglas-fir snag component along all open roads and in areas where roads have been created by firewood cutters. In addition, during the elk and deer hunting season, dispersed campers use dead trees for firewood; ponderosa pine and western larch snags are the preferred species. In general, snags and down woody material are not distributed uniformly throughout the analysis area. Ponderosa pine stands are often snag and down woody material deficient. *Commenters on the Proposed Action were concerned over an apparent conflict between snag deficiencies within the area and removal of dead trees.*

14. Recreation and Visuals

No developed recreation facilities exist within the project area, recreation is primarily focused on day trip activities such as snowmobile riding, firewood gathering, hiking, hunting, mushroom and huckleberry picking during the summer months. The highest use in this area is experienced during the big game hunting seasons when hunters occupy many of the dispersed campsites within the area. This project needs to maintain an appropriate level of recreation opportunities for the users within this area.

Many users of the area desire the roaded natural experience, using dispersed campsites. They desire natural appearing settings, few encounters with other people and low level of administrative control. Others enjoy the upland settings with no recreational facilities and the primitive recreational experience. Many people value the ecological integrity of the area and desire the area to be impacted only by natural processes. It is important to recognize the values of all constituents and manage with all aspects in mind.

The 67 Road, 77 Road, and 70 Road are heavily used, primary access roads into this project area. The 67 and 77 roads are both sensitivity level one roads and the 70 road is a sensitivity level 2. Although many elements of the ecosystem affect the aesthetic experience, within the project area the condition of vegetation and the condition of the recreational settings affect the landscape character most directly. Unhealthy, overstocked stands and impacts to the recreation setting are two major impacts that detract from the desired landscape character. Implementation of projects that improve these conditions will improve the ecological and scenic integrity.

There is an opportunity to bring vegetation species composition and structure into the mean historical range of variability. Thinning overstocked stands in a manner that would create a spatial and structural mosaic that supports fire resistant species. If the distinctive character of open stands of large trees is regained, the ecological integrity should rise to high. Some short term effects to scenic integrity could be caused by introduced fire, such as scorched needles and small pockets of dead trees.

I. Summary of Scoping Process

Public scoping for the Bald Angel Restoration project was initiated in the July, 1996 under the names of the Tucker Creek and Sawdust projects. These projects were identified as a part of the 5-year District Vegetation Management program in the La Grande District Schedule of Proposed Actions (SOPA). In January 2000, these two projects were combined to become the Tucker Dust project in the SOPA. In the Fall of 2002, the project boundaries were adjusted and the project was renamed Bald Angel and has appeared in each quarterly SOPA since then. This mailing is distributed to a mailing list of 100 - 600 (Forest-wide SOPA) individuals, organizations, and agencies. Between 1997 and 2002 three Environmental organizations and one individual expressed interest in this project.

A detailed description of the proposed action was mailed on April 22, 2005 to approximately 100 forest users and concerned publics soliciting comments and concerns related to this project. One letter of response and three phone calls were received from interested parties, which are part of the Comments Appendix of the EA.

On May 12, 2005, the Bald Angel Interdisciplinary Team and Ranger met with several interested local landowners within the project area to discuss and clarify the proposed action. In general they were in favor of the activities proposed.

A brief overview of the project was presented to the Union County Community Forest Restoration Board as a part of District program of work for 2004-2006. Members also received a copy of the Proposed Action.

Scoping and consultation for the project was initiated and is ongoing with the CTUIR and ODF&W.

This project has been submitted to The State Historical Preservation Officer (SHPO) for review.

An analysis file for this project is available for public review at the La Grande Ranger District. The analysis file includes specialist's reports, data specific to the project, public notifications and their responses, meeting notes, and miscellaneous documentation.

Chapter II: Alternatives, Including the Proposed Action

A. Introduction

This section describes a reasonable range of alternatives as they address the purpose and need for action and as they respond to the issues.

B. Alternative Development Process

The National Environmental Policy Act (NEPA) directs the Forest Service to use an interdisciplinary approach which will ensure the integrated use of natural and social sciences and the environmental design arts [NEPA, section 102(2)(A)].

An ID team developed alternatives based on the purpose and need of the project and the key issues and other concerns identified in Section 1 of this assessment. Forest Service management objectives are incorporated into alternatives by following standards and guidelines of the Wallowa-Whitman National Forest Plan as amended.

C. Alternatives Considered, but Eliminated from Detailed Study

The following alternative options were considered during the development of this analysis but were eliminated from detailed study as described below.

Alternative A - No harvest removal treatment:

An alternative, which would only accomplish those treatments that did not require mechanical harvest and commercial removal of materials from the project area was considered by the ID Team. Only pre-commercial thinning, cleaning, prescribed burning, and road management as described in the proposed action were considered for implementation. Eliminating mechanical harvest and commercial removal of the wood products severely reduces the amount of prescribed fire opportunities within the project area to where only 44% of the total burn block acres will receive treatment due to elimination of pre-treatment.

Of the burn block acres treated, higher mortality is anticipated due to lack of pre-treatment fuels reduction activities. In general, mortality within the dominant canopy trees would range between 10-20%, codominants would be at approximately 15-20% mortality, and mortality of the seedling/sapling component would range between 50-75%. Mortality would be random and would not necessarily leave the best trees on site and may well kill the best trees available.

This alternative eliminates 4,869 acres of stand density work needed in the overstory and increases the risk to insect and disease within the project area. These acres would continue to develop with high tree densities and high fuel levels. Prescribed fire in many of these acres would be eliminated as a management option due to the higher risk of crown fire and losing control of the burning operation. Overtime, the risk of unwanted crown fires (from wildfires) would increase in areas of high fuel loading.

This alternative was eliminated from detailed study because it fails to adequately respond to the purpose and need of reducing tree densities in overstocked stands. 3,567 acres of high priority over-stocked stands would not be treated. These stands would remain stagnant and susceptible to insects and disease. Elimination of these acres would not meet the purpose and need of increasing stand vigor, forest health, promoting seral structure commensurate to historic disturbance factors, and changing condition classes.

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This alternative was also eliminated from detailed study in this project as it does not meet the purpose and need in terms of reducing the fire and insect and disease stressors because it does not provide for long-term forest health, move forest structure toward historic ranges, restore riparian conditions in areas of high mortality, or allow reintroduction of fire and reduction of fuel loadings in the areas of highest concern.

Finally, this alternative would not respond to growing public acceptance to thin overstocked stands prior to implementing prescribed burning. Local support is documented in Dr. Bruce Shindler's recent (2002) publication; "Overall support continues to be strong for both prescribed fire and mechanized thinning" and, "Primary results from this study indicate the presence of a knowledgeable general public in the Blue Mountains, solid support for both prescribed fire and mechanized thinning to reduce forest fuels, and an overall stability of public attitudes throughout the study period" ([A Longitudinal Analysis of Fuel Reduction in the Blue Mountains: Public Perspectives on the use of Prescribed Fire and Mechanized Thinning](#), pp. 45 and 50).

Alternative B - No treatment of LOS Stands:

No treatment in any stands with structure classified as LOS (1,237-1,445 acres) within the project area was considered in the range of alternatives for this project. Deferring treatment of the LOS stands within this project area would mean treating only 59% of the need within the project area. Of the stands that would be dropped, 87% are rated as high priority stands for treatment due to overstocking, high fuel loadings, and risk from insects and diseases.

Many of these stands are within the burn blocks established in this project area for prescribed fire, the lack of mechanical pre-treatment within several of the burn blocks would reduce the prescribed burning opportunities by approximately 2,000 acres and increase the potential for tree mortality within the burn blocks as described in Alternative A above.

This alternative was eliminated from detailed study because it did not meet the purpose and need to manage the stands toward the historic range of forest structures within the project area, specifically converting MSLT structures to the severely deficit SSLT structure. It would also not improve long term forest health in stands rated as a high priority for treatment based on the stand health and vigor. Elimination of these acres would not meet the purpose and need of increasing stand vigor, forest health, and promoting seral structures which reflect historic disturbance types and levels.

D. Alternatives Considered in Detail

Elements Common To the Action Alternatives

1) Silvicultural Treatment Prescriptions/Objectives

Prescriptions/objectives:

The following describes the treatment objectives, methods and anticipated outcomes for the vegetation management to be accomplished within the project area.

Stocking Levels for Forested Stands – Stand density ranges have been developed for each conifer plant association (PAs). Ponderosa pine PAs are different from Douglas-fir PAs. The range is based, in part, on the growing capacity (or site potential) of each plant association. Tree densities would be reduced to various levels along the range of basal area, depending on management objectives. A stand can be managed to the upper management zone, which would be the high end of this range and prevents development of a suppressed crown class. Or it can be managed to the lower management zone, which would be the lower end of this range allowing a substantial portion of a site's resources to be captured to tree growth.

Upper Management Zone (UMZ) – For the Bald Angel area the UMZ will be the level of tree stocking that maintains the maximum amount of sustainable tree cover. This level avoids development of suppressed trees and precludes significant amounts of density-related tree mortality.

Lower Management Zone (LMZ) – The lower limit of full site occupancy where a significant portion of site resources can be captured as tree growth.

Treatment Priority Ratings:

High Priority – Stands were rated as a high priority for treatment if they were overstocked with basal areas near or above the UMZ. These stands are at higher risk to insect and disease infestations, as well as fire caused mortality in the event of a wildfire in the area.

Low Priority – While these stands are still a priority for treatment, they are considered of lower priority because their existing density is already near the LMZ and while they would benefit from a treatment they could hold for the next 5-10 years without treatment with minor long term negative effects.

Connective Corridor Units:

The goal within these units would be to maintain and enhance their cover and connectivity qualities such as medium to large trees as a common occurrence, canopy closure within the top 1/3 of site potential, and no less than 400 feet at the narrowest point.

Stocking levels would be managed to the upper management zones for basal area except where tree quality and crown conditions are such that the upper management zone is unattainable, in those areas, 20% of the stand would be in untreated clumps. Retain trees with down to 20% live crown if needed to maintain basal area levels. All snags would be retained. Down logs would be retained at the following levels:

200 lineal feet per acre

Minimum lengths of logs 20 feet or largest available

Minimum of 12" small end diameter logs or largest available

Prescriptions:

Sanitation harvest (HSA) prescription is designed to remove dead, damaged, or susceptible trees to prevent the spread of pests or pathogens.

Thinning harvest (HTH) prescription is designed to stimulate the growth of the trees that remain.

Shelterwood harvest (HSH) prescriptions in which a stand of trees is removed through a series of cuttings designed to establish a new layer.

Improvement harvest (HIM) prescription cutting made in stands for the purpose of improving the composition and quality by removing trees of undesirable species, form or condition from the main canopy.

Overstory removal harvest (HOR) cutting that removes older trees that overtop a more desirable younger stand.

Precommercial thinning (SPC) cutting or removal by slashbuster of selected trees in a young stand to stimulate the growth of the trees that will remain on the site.

Fuels Reduction (HFU) removal of down or standing material to reduce the fuel loading of the site.

Post-harvest follow-up:

Units would be monitored following harvest activity for site preparation, regeneration, or stand improvement needs. Reforestation work would be accomplished on sites that are below recommended stocking levels (180 – 300 trees per acre depending on the site) through planting or natural regeneration.

2) Riparian Habitat Conservation Areas (RHCA)

Riparian treatment units (refer to specific units under each alternative description) would be treated using a commercial thinning within the riparian area. No activity buffers of 10 feet along intermittent non-fish bearing stream channels and 25 feet adjacent to perennial non-fish bearing stream channels would apply to each of these units. Stand density reduction treatments would occur outside of these no activity buffers to maintain and enhance riparian management objectives with specific treatment prescriptions coordinated between the District Silviculturist, Watershed Specialist, and Fuels Planner. No equipment would be permitted within the no-activity buffers. Outside of these buffers the detrimental soil conditions would be limited to 10% of the RHCA area. Follow-up treatment would generally match the treatments prescribed in the adjacent unit and could include use of precommercial thinning and prescribed fire to reduce residual fine fuels and prepare sites for planting. Planting of native shrub species and ponderosa pine would occur during the spring immediately following the burn if prescribed. During burning activities, a backing fire only would be permitted within the no treatment buffers, while direct ignition may be permitted within the mechanically treated areas.

The expected result is accelerated recovery of riparian vegetation conditions - enhanced forage and resistance to fire. Improvements in vegetative conditions are expected to increase the number of high quality pieces of large woody material acting on the channels and floodplains in the future.

With the exception of those units modified as described above, all other treatment units in the action alternatives would incorporate the default INFISH RHCA no-cut buffer guidelines (refer to the Riparian section of the Management Requirements, Constraints and Mitigation Measures portion of this Chapter).

3) Fuels Reduction

The natural fuels reduction areas were selected based upon several criteria including; access, biophysical group, topography, existing fuel conditions and potential fire behavior (refer to Fuel Block maps in the appendices for unit locations). Treatments within these areas would consist of a combination of mechanical harvest/removal and prescribed burning.

General Mechanical Prescriptions:

Associated with harvest units the following would occur:

1. Treatments would reduce overstocking of trees >7" dbh to recommended stocking levels per biophysical group.
2. 2-8 snags (depending on type of site) per acre >12" dbh and at least 35 feet tall would be retained while snags >5" dbh in excess of recommended snag levels would be removed.
3. Down wood would be retained at 120-140 lineal feet of down wood composed of pieces at least 12" diameter on the small end and at least 20 feet long. All other materials >3" in diameter could be reduced to 25 tons or less per acre.

General Prescribed Fire Prescriptions:

- a. Fires would generally be low intensity (2-4 foot flame lengths with occasional torching).
- b. Fuel loading goals would be as described in the following table:

Fuel Size Class	Desired Tons/Ac	Lineal Feet
0-3" Diameter	< 3	
3-9" Diameter	3	
12" Plus Diameter	5-15	120-140

- c. Trees ≤ 5" dbh that are mistletoe infected, suppressed, or encroaching on fire regime 1 areas could be eliminated.

Prescribed burning would occur when weather and fuel conditions are appropriate to meet the objectives and prescription for each unit. No more than a total of 10% of the available forage would be burned per year within the project area. Burning would be accomplished over the next 10 years. Existing plantations and thinning areas would be avoided during burn layout and implementation.

Control lines would include roads, natural barriers and brush removal rather than bare mineral soil line construction where possible. With the exception of the RHCA treatment units described under the Modified RHCA section above, all other treatment units calling for the use of prescribed fire would not permit direct ignition within 150' of any Class I and III stream channels and 50' of Class IV stream channels. Low intensity fire would be allowed to back into all RHCAs. Reducing these fuels will enhance forage habitat and increase overstory growth rates by making nutrients readily available after burning is completed.

The following conditions are present in each burn block within the Bald Angel analysis area. Each condition would be considered for mechanical treatments needed to apply prescribed burning. In general, the percentage of each condition within the burn blocks is as follows:

Burn Block	Condition A	Condition B	Condition C	Condition D	Condition E
1	5%	50%	25%	10%	10%
2	10%	20%	30%	20%	20%
3	10%	30%	40%	10%	10%
4	15%	45%	30%	5%	5%
5	15%	50%	25%	5%	5%
6	20%	20%	40%	10%	10%
7	15%	30%	25%	15%	5%
8	20%	50%	15%	5%	10%
9	5%	50%	20%	5%	10%
10	5%	70%	10%	10%	5%

Condition A: Northern aspects consisting of mixed conifer types where the ridgetops and southern aspects transition into ponderosa pine and Douglas-fir. Mechanical pretreatment would be a combination of harvest thinning and harvest sanitation to mechanically treat ladder fuels within high density stands, suppressed and diseased under story, and down

woody material along the ridge top to facilitate the use of prescribed fire at intensities consistent with the natural fire regimes of south/southwest aspects. The prescribed burning would include jackpot burning/under burning to further reduce fuels. The result would be a mosaic pattern of burned and unburned areas. Approximately 50% or less of the burn block containing this condition could actually be burned.

Condition B: These areas consist primarily of dryer sites characterized by ponderosa pine. A combination of harvest thinning and harvest sanitation would be used to mechanically pre-treat fuels to facilitate the use of prescribed fire at intensities consistent with the natural fire regimes of south/southwest aspects. On these drier sites, burning could likely result in random patches of burned and unburned areas with approximately 75% of the area being burned.

Condition C: This area is largely ponderosa pine/pine grass with areas of Larch and Lodge pole pine intermixed. Fire return intervals are at or beyond the upper end of the historical range of variability. Treatments are designed to promote tree growth, discourage competition, reduce fuels in the form of litter, duff, and decadent grasses, thin suppressed thick clumps of regeneration, and enhance forage conditions. Canopy closure within these conditions would moderate fire behavior consumption contributing to patchy burn patterns lending to greater than 50 % surface fuel consumption.

Condition D: These areas are comprised of mixed conifer exhibiting a variety of stand structural stages on the northern aspects, and dry ponderosa pine and Douglas-fir sites on the ridge and southern aspects. The ridge top and southern aspects contain units that were precommercially cleaned and thinned within the last ten years. Cleaned areas consist of a range of pole size and larger ponderosa pine trees. Areas that were precommercially thinned in the last five years consist of mixed conifer regeneration and would be excluded from under burning activities for approximately the next ten years. Therefore, burning would generally only occur around the edges of the thinned areas and would be very light in the cleaned areas resulting in <1% of the area burned.

Condition E: This area is primarily ponderosa pine with Douglas-fir. The understory is suppressed and the Douglas-fir has moderate to severe mistletoe. Following a light mechanical cleaning of this understory, a low intensity under burn would be run through the area to reduce surface and ladder fuels. Approximately 50% of the area could be burned.

4) Aspen Restoration

Encroaching conifers are hindering regeneration of approximately 25 acres of two quaking aspen stands located below the Balm Creek Reservoir on the southwest slopes east of the 7040 road that parallels Balm Creek and north of the 7040300 road in T7S, R43E, section 20 in the Balm Creek subwatershed (29E). The objectives for this project are to set back succession by removing or killing most conifers within the aspen stands, and introducing some disturbance to the soil and vegetation. This will reduce competition and stimulate suckering. Trees 21" dbh and greater will not be harvested.

Commercial size trees that are in surplus of snag and down woody material requirements would be cut and removed with Units 123 and 125 of the timber sale. Portions of the soil would be scarified and slash burned on site. At the conclusion of these ground disturbing treatments, the area would be fenced with elk proof fencing to protect new sprouts. Monitoring will occur to measure the results of this portion of the project.

5) Access and Travel Management – Roads Analysis

Travelways across the entire project area were analyzed in the Bald Angel Roads Analysis to determine how best to manage access to meet resource needs and long-term objectives. Management recommendations from the Roads Analysis were carried forward into this project and analyzed at a site specific level to develop a long-term Access and Travel Management Plan for the project area.

The road management plan objectives for this project area will primarily reflect the current District Access and Travel Management Plan with modifications for long term open and closed roads (See maps in Appendices A and B). An open road network has been identified as well as a closed road network which will be maintained for fire suppression, permittee administrative needs, and future management options. In addition to this closed road network, many roads and segments were identified for permanent closure (decommissioning).

All roads within the project area have specific Road Management Objectives related to use, maintenance level and criteria, safety, service levels, drainage and erosion control methods. These management objectives were reviewed and analyzed by the team and adjusted to resolve resource issues and budgetary restrictions where appropriate. Road Management Objectives would generally remain as they are currently established for all of the roads, with a few minor modifications based on current use, projected long term use, and budget levels.

The following list is of roads identified for decommissioning within the Bald Angel project area through the Roads Analysis (refer to the Transportation Plan in the Analysis File for specific segments to be closed). In general, roads scheduled for decommissioning are the first priority for closure and those closed by the Bald Angel project (signified by a (*) in the table) should be completed within 2 years after the conclusion of the Bald Angel harvest activities. The remainder of the decommissioning roads will be accomplished using appropriated funds as they become available. Timing for these closures would most likely occur within the next 5-8 years, however, in the interim, these roads will be designated as closed under the Area Closure.

Decommissioned roads could be wing ripped, recontoured, culverts pulled, scattered with slash and large rocks where available, and seeded with native seed as conditions warrant. If the old roadbed has already returned to vegetation production and has hydrologically stabilized (no visible signs of active erosion and is capable of infiltration), then the road will be considered decommissioned and the road signs will be taken down and the roads removed from the Forest maps.

The roads used for log removal by the project will be closed upon completion of log removal activities. The remainder of the roads not used by the project and scheduled for closure (signs and barrier placement) will occur within 5 years after the conclusion of Bald Angel vegetation management activities.

Decommission Roads:

Road Number	Selected Miles	Road Number	Selected Miles	Road Number	Selected Miles
6700215	0.58	7050015	0.15	7740440	0.52
6700217	0.15	7050016	0.27	7746060	2.53
6700496	0.36	7050021	0.35	7746080	0.36
6700521	0.06	7050026 *	0.24	7746083	0.13
6700527	1.0	7050033 *	0.23	7746200	1.74
6700541	0.78	7055000	1.0	7746205	0.20
6700542	0.11	7055232	0.09	7746241	0.21
7000452	0.15	7055233	0.16	7746243	0.4
7000457	0.19	7055236	0.19	7746263	0.08
7000471	0.17	7055237	0.07	7746286	0.41
7000551	0.14	7055238	0.66	7746343	0.39
7000740 *	0.22	7055240	0.39	6700600	0.77
7000744	0.18	7055300	0.44		
7040300	2.51	7055444 *	0.3		
7040305	0.3	7065155	0.24		
7040585	0.33	7065170	0.19		
7040610	0.14	7065175	0.38		
7040612	0.15	7065176	0.27		
7045040	0.5	7065177	0.54		
7045050	0.44	7065178	0.06		
7045082	0.42	7065207	0.2		
7045380	0.57	7065217	0.13		
7045383	0.34	7700878	0.21		
7045402	0.14	7740190	1.07		
7045414	0.33	7740228	0.41		
7045418	0.62	7740235	0.48		
7045425	0.37	7740237	0.06		
7045462	0.54	7740309	0.8		
Total	29.11 miles	(* = Rds decommissioned by Bald Angel project)			

Closure Area: In order to provide for big game security a motorized closure area would be established in the Bald Angel project area (refer to closure area location map in the appendices). The closure area boundary is defined by the Forest Service boundary to the west and south, the 77 Road along the North, and the 77, 67, 70, 7035 and 7035076 Roads along the east. All boundary roads are open for motorized travel.

All motorized travel would be restricted to signed open roads within the project area. Motorized use would be permitted within 300 feet of open road to provide for dispersed camping opportunities, however, no cross-country travel would be permitted. This closure would remain in effect until the District motorized access planning process which reflects the National Strategy is complete and a new plan in place.

Open Roads within Area Closure - Portions of or the entire length of the following roads will be designated as open for motorized travel in the Bald Angel Area Closure Area. Refer to the Closure Area map in the appendices for specific open road locations.

6700000	6750000	7000550	7045000	7700580	7740051
6700141	6750100	7000555	7045370	7700872	7740300
6700150	7000000	7000580	7050000	7700900	7740330
6700350	7000250	7000720	7050028	7700940	7740400
6700525	7000359	7000741	7050060	7700945	7746000
6700700	7000390	7035000	7055000	7700980	7746050
6700720	7000400	7035075	7055430	7740000	7746240
6700800	7000475	7035350	7065000	7740005	7746410
6700830	7000498	7040000	7700000	7740020	7746500
					7746560
6700885	7000500	7040300	7700550	7740050	7746595

6) Forest Plan Amendment for Treatment in Old Growth Below HRV

Stand density treatments throughout the project area have been designed to improve tree health and enhance long-term old growth characteristics. Forest Plan standards restrict harvest treatment in LOS that is below HRV. An HRV analysis of LOS, by biophysical grouping has been completed for this project area which indicates deficiencies in both SSLT and MSLT old growth, with SSLT being nearly non-existent. MSLT structure is more prevalent in the project area, however, due to past management practices and fire exclusion many of these stands which were historically SSLT have now become MSLT.

In order to restore these stands to their historic structure, enhance the health of the stands, and reduce ladder fuels in LOS stands in the project area, the following modification is made to the Wallowa-Whitman National Forest Land and Resource Management Plan, Regional Forester Amendment #2, for the Bald Angel Restoration Project Planning Area.

Current Direction: d. Scenario A If either one or both of the late and old structural (LOS) stages falls below HRV in a particular biophysical environment within a watershed, then there should be no net loss of LOS from that biophysical environment. Do not allow timber sale harvest activities to occur within LOS stages that are BELOW HRV.

Amended Direction: d. Scenario A If either one or both of the late and old structural (LOS) stages falls below HRV in a particular biophysical environment within a watershed, then there should be no net loss of LOS from that biophysical environment. However, timber sale harvest activities may occur within LOS stages that are below HRV, if doing so will better meet LOS objectives by moving the landscape towards HRV, and provide LOS for the habitat needs of associated wildlife species (Regional Forester’s 2430 Letter, “Guidance for Implementing Eastside Screens”, dated June 11, 2003).

Treatments include commercial thinning of trees under 21 inches, reducing levels of standing and down material, thinning and cleaning of small diameter trees, pile and burn, and prescribed burning. Treatments under this amendment would not result in a net loss of old growth, but the amendment would provide for treatments that would maintain old growth habitat as defined by Forest standards and definitions. Old growth habitat is measured by levels of down wood, snags, number of canopy layers and large trees (See Regional Forester’s amendment #2 –screens- and Wallowa-Whitman National Forest Recommended Definitions for New Structure Stages per Amendment #2, November 9, 1995).

Refer to each Alternative description for units which would be affected by this amendment.

7) Snags

Due to the low number of snags available within the project area, application of the original snag retention levels below described in the Proposed action would in reality mandate the retention of all snags ≥ 12 inches dbh in all action alternatives.

Snag retention was based on plant association groupings and summarized generally as follows:

- Dry biophysical environments – retain 2 snags per acre.
- Moist biophysical environments – retain 4-6 snags per acre.
- Cold biophysical environments – retain 6-8 snags per acre.

Therefore, with the exception of an occasional snag removed for safety or construction clearing, no snags ≥ 12 inches dbh will be removed with this project, further discussion of the specifics of snags (distribution, size, species, type, and biophysical environments) can be found in the analysis file and the Wildlife Inventory and Effects Analysis.

Alternative Descriptions

A) Alternative 1 - No Action

This alternative constitutes the "No Action" required by NEPA. Timber harvest and other management activities identified in the Bald Angel Vegetation Management analysis would be deferred. This alternative forms the baseline for comparison of the action alternatives.

B) Alternative 2 – Proposed Action [Refer to map and data tables in Appendix B]

Alternative theme

Alternative two was designed to address the purpose and need through maximizing vegetation management treatment within the project area to enhance stand health and vigor, reduce fuel loadings, and enhance LOS stand structures. In addition to the vegetative management projects described under the Common Elements section and the alternative description below, access and travel management in terms of physical closures, decommissioning, and promulgated area closures would be accomplished to enhance wildlife, fisheries, recreation, and hydrology resources. In alternative 2, nearly all of the stands (both high and low priority) identified as needing density management or fuel reduction would be treated.

Alternative two is driven by the following key issues: 1) Improvement of long term forest health conditions; 2) Deficiency in LOS and area outside of HRV; 3) Big game security habitat; and 4) Return of fire intervals.

Vegetation Management:

Fuels Reduction:

Objectives in all units would be to: a) reduce stand densities in overstocked stands and ladder fuels; b) enhance forage; c) create defensible fuel profile zones in strategic areas to aid in fire suppression efforts and minimize natural resource impacts in the event of a wildfire; d) reintroduce fire as a disturbance factor on historical fire return intervals to reduce fir encroachment; e) promote healthy fire resistant stands at a landscape scale; f) promote large tree characteristics and provide for structural diversity.

Mechanical fuels prescriptions and prescribed fire prescriptions will be as described under the Common Elements section above.

Prescribed burning would occur when weather and fuel conditions are appropriate to meet the objectives and prescription for each unit. No more than a total of 10% of the available forage would be burned per year within the project area. Burning would be accomplished over the next 10 years. Existing plantations and thinning areas would be avoided during burn layout and implementation.

Control lines would include roads, natural barriers and brush removal rather than bare mineral soil line construction where possible. No direct ignition would occur within riparian areas, however fires would be allowed to back into the riparian areas. Reducing these fuels would enhance forage habitat and increase overstory growth rates by making nutrients readily available after burning is completed.

Burn Block	Acres	Approx Burn Acres	Treatment Methods
1	1085	626	Mechanical treat units 6-8, and TSI Unit 147. Follow up with jackpot burning where called for in Rx and underburning in all of Block 1, primarily hand ignition – especially along PVT boundaries. Coordination needs PVT boundaries.
2	1186	537	Mechanical treat units 1-5, 12, 13, 34, and TSI Units 145-151, 157. Follow up with jackpot burning where called for in Rx and underburning in all of Block 2, hand ignition. Coordination needs: TSI units.
3	1345	707	Mechanical treat units 16-17, 20-22, 25, 34, and cleaning unit 15 and TSI Units 152-153, 155-156. Follow up with jackpot burning where called for in Rx and underburning. Hand ignition in Block 3 with the exception of the SW portion which could receive aerial ignition. Coordination needs: TSI units and goshawk nest.
4	4582	2695	Mechanical treat units 18-21, 23-27, 28(SCN), 29-33, 35-38, and TSI Units 153, 155, 58-160. Follow up with jackpot burning where called for in Rx and underburning. Combination of hand ignition around TSI and mechanical units and aerial ignition outside of those. Coordination needs: TSI units, PVT land boundaries, and burning in Unit 37 with Botanist
5	3831	2301	Mechanically treat units 38-41, 44-45, 47-48, and TSI units 162-165. Follow up with jackpot burning where called for in Rx and underburning, hand and aerial ignition.
6	2501	1253	Mechanical treat units 45-46, 111-114, 116, and 141-143. Follow up with jackpot burning where called for in Rx and underburning, hand and aerial ignition. Coordination needs: PVT land boundaries.
7	1564	706	Mechanical treat units 107-110, 117-119, 136, 138-141, 144, and TSI Units 154, 167, 170-171. Follow up with jackpot burning where called for in Rx and underburning. Hand ignition around TSI and near PVT. Coordination needs: TSI units, PVT land boundaries, pileated post-fledging area.
8	3889	2432	Mechanically treat units 49-63, 102-106, and TSI Units 168-169. Follow up with underburning, hand and aerial ignition. Coordination needs: TSI and PVT land boundaries.
9	3069	1690	Mechanical treat units 58-60, 64-69, 66 (SCN), 73-74, 77-78, and 97-101. Follow up with jackpot burning where called for in Rx and underburning. Hand and aerial ignition. Coordination needs: Goshawk nest protection.
10	1314	823	Mechanical treat units 4-6, 8-9, 11-12, 15, 17-18, 22, 26, 93, 97-98, and 120. Follow up with jackpot burning where called for in Rx and underburning. Hand and aerial ignition. Coordination needs: Sedge monitoring with Botanist, PVT land boundaries.
Totals	24,367	13,770	

Timber Harvest:

Proposed treatment would occur on approximately 4,869 acres of in the Bald Angel project area. Treatments include stand density management through commercial thinning (HTH), shelterwood (HSH), improvement cuts (HIM), sanitation harvest (HSA), overstory removal harvests (HOR), fuels reduction removals (HFU), fire cleaning (FCN) and stand cleaning (SCN) to reduce the risk of crown fires (refer to prescription descriptions below). These treatments are proposed to reduce stocking densities, remove diseased and poor growing trees, and promote stands with single story large tree characteristics. Stands would be opened up, stimulating growth of residual trees. No live trees larger than 21 inches in diameter would be cut except for an occasional tree removed for safety or construction clearing. Shelterwoods on 90 acres would remove poor growing, less vigorous trees while maintaining most of the larger component (trees larger than 18 inches dbh). The larger

overstory component will remain and planting will ensure a healthy, viable understory. These stands will become Multi-stratum large tree (MSLT) structure stands. Approximately 26 acres of shelterwood treatment are also proposed on mistletoe affected Douglas-fir which will be removed, reducing the spread and resulting in a shelterwood. Approximately 860 acres would be precommercially thinned to improve tree growth and select desirable tree species, 96 of those acres would be accomplished as a follow-up treatment after harvest. Approximately 352 acres of release treatments would be accomplished within harvest units and 130 acres in non-harvest units. Approximately 235 acres of planting would occur in areas, that are below stocking and classified as having regeneration difficulties due to ground conditions and lack of adjacent seed sources, are lacking a healthy understory and/or to provide species composition appropriate to the site.

Riparian treatment units (6, 8, 13, 14, 60, 84, 97, 98, 129, 131, and 132) would be treated using the prescriptions previously described under Common Elements.

Forest Plan Amendment for Treatment in Old-growth Below HRV – An HRV analysis of LOS, by biophysical grouping has been completed for this project area and as described above indicates deficiencies in both SSLT and MSLT old growth, with SSLT being nearly non-existent. MSLT structure is more prevalent in the project area, however, due to past management practices and fire exclusion which has promoted fir encroachment in the understory, many of these stands which were historically SSLT have now become MSLT.

The Forest Plan would be modified in this project as described under common elements above and approximately 1,445 acres of LOS would receive commercial thinning prescriptions. Trees > 21 inches diameter would not be cut. Treatments would modify these multi-strata stands to single-strata stands and maintain adequate levels of down logs. Affected Units: 1, 2, 6, 8, 9, 10-12, 18, 20, 23, 29, 30, 37-39, 41, 48, 57, 60, 70, 84, 96, 100, 102, 115, 120-122, 125-135, 137.

Connective Corridor Units – As stated under common elements, the goal within these units would be to maintain and enhance their cover and connectivity qualities such as medium to large trees as a common occurrence and canopy closure within the top 1/3 of site potential.

Affected Units: 1-3, 6, 7, 12, 14, 18, 31-33, 36, 37, 41, 48, 49, 57, 60, 62, 63, 89, 100-102, 118-121, 126, 129-132, 136, 137

Removal Systems Summary:

Where treatments result in commercial products, they would be removed by tractor (3,885 acres), skyline (618 acres), and helicopter (359 acres) yarding systems. Approximately 10.7 MMBF of saw material and 1.8 MMBF of wood fiber is expected to be recovered from the proposed action.

2.26 miles of re-construction of systems roads is anticipated to improve drainage, reduce erosion and sedimentation, and reinforce the subgrade. Approximately 1.7 miles of new specified road construction is proposed and 10.4 miles of temporary spur roads are needed to facilitate removal of the materials.

Access and Travel Management Plan:

Travelways across the entire project area were analyzed under the project Roads Analysis to determine how best to manage access to meet resource needs and objectives. Roads described under the Common Elements section would be decommissioned, closed, and promulgated within the area closure with the exception of those roads identified to remain open for long term access into the area. Approximately 16.64 miles of roads to be used by the project would be closed at the conclusion of harvest and project activities. These closures would be accomplished with a combination of signing and/or physical barriers. Approximately 0.99 miles of additional roads used by the project were identified for closure to protect and enhance water quality and meet objectives for wildlife habitat. These roads

would be decommissioned and no longer be available for future use. Decommissioning would result in the stabilization and restoration of these sites to a more natural state. Activities could include recontouring, culvert removal, and seeding.

C) Alternative 3 - (Preferred) [Refer to map and data tables in appendix A]

Alternative theme:

Alternative three was designed to address the purpose and need through emphasizing retention of critical high quality cover and connective corridor areas to provide cover and connectivity habitat while other overstocked stands are treated to accelerate development of long term landscape cover and large structure needs. The highest quality, functional cover stands and best available connective corridor stands would be either retained for their cover value in this alternative or the prescription modified to provide functional corridors between stands of LOS. Stands at risk to insects and disease due to overstocking or that would not remain healthy for the next 15-20 years were of a higher priority for treatment and were not deferred for treatment in this alternative. Long-term transportation needs were balanced with big game habitat security needs in this alternative through reduction in the number of miles of new temporary and specified road construction.

The following units (or portions of these units) were deferred from treatment consideration in this alternative to protect sensitive species, connective corridors, and retain short-term key cover areas or structural components in this alternative. Units: 2, 9, 16, 17, 18, 19, 27, 32, 42, 43, 64, 65, 85, 86, 87, 88, 94, 98, 99, 101, 114, 115, 117, 120, 129.

In addition to the vegetative management projects described under the Common Elements section and the alternative description below, access and travel management in terms of physical closures, decommissioning, and promulgated area closures would be accomplished to enhance wildlife, fisheries, recreation, and hydrology resources. In alternative 3, nearly all of the stands identified as a high priority for needing density management or fuel reduction would be treated.

Alternative three is driven by the following key issues: 1) Improvement of long term forest health conditions; 2) Deficiency in LOS and area outside of HRV; 3) Big game security habitat; and 4) Return of fire intervals.

All or portions of approximately 43 units were deferred from treatment consideration or had prescription modifications in this alternative to retain high quality cover, connective corridors, and provide species protection within the project area.

Vegetation Management:

Fuels Reduction:

Objectives in all units would be to: a) reduce stand densities in overstocked stands and ladder fuels, enhance forage, create defensible fuel profile zones in strategic areas to aid in fire suppression efforts and minimize natural resource impacts in the event of a wildfire, and b) reintroduce fire as a disturbance factor on historical fire return intervals to reduce fir encroachment, promote healthy fire resistant stands at a landscape scale, promote large tree characteristics, provide for structural diversity, and improve forage.

Mechanical fuels prescriptions and prescribed fire prescriptions will be as described under the Common Elements section above. Timing of the prescribed burns would be the same as described under Alternative Two.

Control lines would include roads, natural barriers and brush removal rather than bare mineral soil line construction where possible. No direct ignition would occur within riparian areas, however fires would be allowed to back into the riparian areas. Reducing these fuels would enhance forage

habitat and increase overstory growth rates by making nutrients readily available after burning is completed.

Burn Block	Acres	Approx Burn Acres	Treatment Methods
1	1085	626	Mechanical treat units 7-8, and TSI Unit 147. Follow up with jackpot burning where called for in Rx and underburning in all of Block 1, primarily hand ignition – especially along PVT boundaries. Coordination needs PVT boundaries.
2	985	443	Mechanical treat units 1-5, 12, 13, 34, and TSI Units 145-151, 157. Follow up with jackpot burning where called for in Rx and underburning in all of Block 2, hand ignition. Coordination needs: TSI units.
3	1033	544	Mechanical treat units 20-22, 25, 34, cleaning unit 15, and TSI Units 152-153, 155-156. Follow up with jackpot burning where called for in Rx and underburning. Hand ignition in Block 3 with the exception of the SW portion which could receive aerial ignition. Coordination needs: TSI units and goshawk nest.
4	4582	2695	Mechanical treat units 20-21, 23-27, 28(SCN), 29-31, 33, 35-38, and TSI Units 153, 155, 58-160. Follow up with jackpot burning where called for in Rx and underburning. Combination of hand ignition around TSI and mechanical units and aerial ignition outside of those. Coordination needs: TSI units, PVT land boundaries, and burning in Unit 37 with Botanist.
5	3698	2220	Mechanically treat units 38-41, 44-45, 47-48, and TSI units 162-165. Follow up with jackpot burning where called for in Rx and underburning, hand and aerial ignition.
6	2501	1253	Mechanical treat units 45-46, 111-113, 116, and 141-143. Follow up with jackpot burning where called for in Rx and underburning, hand and aerial ignition. Coordination needs: PVT land boundaries.
7	1350	610	Mechanical treat units 107-110, 118-119, 136, 138-141, 144, and TSI Units 154, 167, 170-171. Follow up with jackpot burning where called for in Rx and underburning. Hand ignition around TSI and near PVT. Coordination needs: TSI units, PVT land boundaries, pileated post-fledging area.
8	3842	2403	Mechanically treat units 49-63, 102-106, and TSI Units 168-169. Follow up with underburning, hand and aerial ignition. Coordination needs: TSI and PVT land boundaries.
9	2964	1631	Mechanical treat units 58-60, 64-69, 66 (SCN), 73-74, 77-78, and 97, 99-100. Follow up with jackpot burning where called for in Rx and underburning. Hand and aerial ignition. Coordination needs: Goshawk nest protection.
10	1,314	823	Mechanical treat units 4-6, 8, 11-12, 15, 22, 26, 93, and 97-98. Follow up with jackpot burning where called for in Rx and underburning. Hand and aerial ignition. Coordination needs: Sedge monitoring with Botanist, PVT land boundaries.
Totals	23,460	13,248	

Timber Harvest:

Proposed treatment would occur on approximately 4,193 acres of in the Bald Angel project area. Treatments include stand density management through commercial thinning (HTH), shelterwood (HSH), improvement cuts (HIM), sanitation harvest (HSA), overstory removal harvests (HOR), fuels reduction removals (HFU), fire cleaning (FCN) and stand cleaning (SCN) to reduce the risk of crown fires (refer to prescription descriptions below). These treatments are proposed to reduce stocking densities, remove diseased and poor growing trees, and promote stands with single story large tree characteristics. Stands would be opened up, stimulating growth of residual trees. No live trees larger than 21 inches in diameter would be cut except for an occasional tree removed for safety or construction

clearing. Shelterwoods on 90 acres would remove poor growing, less vigorous trees while maintaining most of the larger component (trees larger than 18 inches dbh). The larger overstory component will remain and planting will ensure a healthy, viable understory. These stands will become Multi-stratum large tree (MSLT) structure stands. Approximately 784 acres would be precommercially thinned to improve tree growth and select desirable tree species, 20 of those acres would be accomplished as a follow-up treatment after harvest. Approximately 296 acres of release treatments would be accomplished within harvest units and 130 acres in non-harvest units. Approximately 209 acres of planting would occur in areas, which are below stocking and classified as having regeneration difficulties due to ground conditions and lack of adjacent seed sources.

Riparian treatment units (Unit 13) would be treated using the prescriptions previously described under Common Elements.

Forest Plan Amendment for Treatment in Old-growth Below HRV – An HRV analysis of LOS, by biophysical grouping has been completed for this project area and as described above indicates deficiencies in both SSLT and MSLT old growth, with SSLT being nearly non-existent. MSLT structure is more prevalent in the project area, however, due to past management practices and fire exclusion which has promoted fir encroachment in the understory, many of these stands which were historically SSLT have now become MSLT.

The Forest Plan would be modified in this project as described under common elements above and approximately 1,237 acres of LOS would receive commercial thinning prescriptions. Trees > 21 inches diameter would not be cut. Treatments would modify these multi-strata stands to single-strata stands and maintain adequate levels of down logs. Affected Units: 1, 6, 8, 10-12, 20, 23, 29, 30, 37-39, 41, 48, 57, 60, 60A, 70, 84, 96, 100, 102, 121-122, 125, 126, 128, 129, 131-133, 135, 137.

Connective Corridor Units – As stated under common elements, the goal within these units would be to maintain and enhance their cover and connectivity qualities such as medium to large trees as a common occurrence and canopy closure within the top 1/3 of site potential.

Connective Corridor Units: 1, 3, 6, 7, 7A, 12, 14, 31, 33, 36, 37, 41, 48, 49, 57, 60, 60A, 62, 63, 89, 100, 102, 118, 119, 121, 126, 129, 131, 132, 136, 137

In Alternative 3 the following changes in connective corridor units were made to retain connectivity but were identified as a high priority for treatment due to stand health (active insect infestations) or their biophysical environment was such that UMZ prescriptions were either not attainable or inappropriate for that biophysical environment. For those units listed above which were not changed, the prescription would meet the goals described above.

Deferred Units from Alt 2 (or portions of units deferred in Alt 3): 1, 2, 6, 17, 18, (500 feet along the boundary of unit 27), 32, 42, 85, 101, 114, 117, 129

Affected Units:

To UMZ: 7, 8, 12, 37, 49, 60A, 89,
36 – to upper one half of management zone (70-90 basal area),
40 – northern 3 acres of unit,
57 – 7 acres to UMZ – rest to LMZ,

To LMZ: 7A, 60,
13 & 14 – except 600 feet along boundary where leave higher basal area,
76- to 25% above LMZ,

Removal Systems Summary:

Where treatments result in commercial products, they would be removed by tractor (3,514 acres), skyline (570 acres), and helicopter (109 acres) yarding systems. Approximately 9.3 MMBF of saw material and 1.6 MMBF of wood fiber is expected to be recovered from the proposed action.

2.26 miles of re-construction of systems roads is anticipated to improve drainage, reduce erosion and sedimentation, and reinforce the subgrade. Approximately 1.6 miles of new specified road construction is proposed and 5.36 miles of temporary spur roads are needed to facilitate removal of the materials.

Access and Travel Management Plan:

Travelways across the entire project area were analyzed under the project Roads Analysis to determine how best to manage access to meet resource needs and objectives. Roads described under the Common Elements section would be decommissioned, closed, and promulgated within the area closure with the exception of those roads identified to remain open for long term access into the area. Approximately 15.48 miles of roads to be used by the project would be closed at the conclusion of harvest and project activities. These closures would be accomplished with a combination of signing and/or physical barriers. Approximately 0.76 miles of additional roads used by the project were identified for closure to protect and enhance water quality and meet objectives for wildlife habitat. These roads would be decommissioned and no longer be available for future use. Decommissioning would result in the stabilization and restoration of these sites to a more natural state. Activities could include recontouring, culvert removal, and seeding.

D) Alternative 4 - (No New Road Construction – Temporary or Specified) [Refer to map and data tables in appendix C]***Alternative theme:***

Alternative four was designed to address the purpose and need through emphasizing retention of critical high quality cover and connective corridor areas to provide cover and connectivity habitat while other overstocked stands are treated to accelerate development of long term landscape cover and large structure needs. It also was in response to comments and concerns received during scoping related to the extent of road development required for the project. The ID Team used Alternative 3 as a base for this alternative and deferred whole stands or portions of stands that would require new road construction (temporary and specified).

Where possible, different yarding systems were considered which would not require road construction. However, analysis of the units where yarding systems would be changed (tractor yarding to forwarder yarding) indicated that sufficient trips over the forwarder trails would create defacto road beds and the effects would be the same as if they had been bladed for temporary roads. Therefore, those units were dropped in this alternative.

As a result, approximately 484 acres were dropped in this alternative. Of this total, approximately 474 acres were identified as a high priority for treatment and 10 acres are of lower priority. Dropping these units also slightly reduces the acres available for prescribed burning due to a lack of the pre-treatment required to be able to successfully put fire into these areas and meet prescriptions. Approximately 1,200 acres would not be available for prescribed burning treatment.

The highest quality, functional cover stands and best available connective corridor stands would be either retained for their cover value in this alternative or the prescription modified to provide functional corridors between stands of LOS. Stands at risk to insects and disease due to overstocking or that would not hold for the next 15-20 years were of a higher priority for treatment and were not deferred for treatment in this alternative.

The following units (or portions of these units) were deferred from treatment consideration in this alternative to reduce road building, protect sensitive species, connective corridors, and retain short-term key cover areas or structural components in this alternative. Units: 2, 3, 6, 7, 9, 16, 17, 18, 19, 27, 32, 33, 35, 36, 42, 43, 58, 60, 64, 65, 75, 85, 86, 87, 88, 90, 91, 93, 94, 98, 99, 101, 114, 115, 117-120, 129, 144.

In addition to the vegetative management projects described under the Common Elements section and the alternative description below, access and travel management in terms of physical closures, decommissioning, and promulgated area closures would be accomplished to enhance wildlife, fisheries, recreation, and hydrology resources.

Alternative four is driven by the following key issues: 1) Improvement of long term forest health conditions; 2) Deficiency in LOS and area outside of HRV; 3) Big game security habitat; and 4) Return of fire intervals.

Vegetation Management:

Fuels Reduction:

Objectives in all units would be to: a) reduce stand densities in overstocked stands and ladder fuels, enhance forage, create defensible fuel profile zones in strategic areas to aid in fire suppression efforts and minimize natural resource impacts in the event of a wildfire, and b) reintroduce fire as a disturbance factor on historical fire return intervals to reduce fir encroachment, promote healthy fire resistant stands at a landscape scale, promote large tree characteristics, provide for structural diversity, and improve forage.

Mechanical fuels prescriptions and prescribed fire prescriptions will be as described under the Common Elements section above. Timing of the prescribed burns would be the same as described under Alternative Two.

Control lines would include roads, natural barriers and brush removal rather than bare mineral soil line construction where possible. No direct ignition would occur within riparian areas, however fires would be allowed to back into the riparian areas. Reducing these fuels would enhance forage habitat and increase overstory growth rates by making nutrients readily available after burning is completed.

Burn Block	Acres	Approx Burn Acres	Treatment Methods
1	735	424	Mechanical treat unit 8 and TSI Unit 147. Follow up with jackpot burning where called for in Rx and underburning in all of Block 1, primarily hand ignition – especially along PVT boundaries. Coordination needs PVT boundaries.
2	985	443	Mechanical treat units 1, 4, 5, 12, 13, 34, and TSI Units 145-151, 157. Follow up with jackpot burning where called for in Rx and underburning in all of Block 2, hand ignition. Coordination needs: TSI units.
3	1033	544	Mechanical treat units 20-22, 25, 34, cleaning unit 15, and TSI Units 152-153, 155-156. Follow up with jackpot burning where called for in Rx and underburning. Hand ignition in Block 3 with the exception of the SW portion which could receive aerial ignition. Coordination needs: TSI units and goshawk nest.
4	4232	2488	Mechanical treat units 20-21, 23-27, 28(SCN), 29-31, 36-38, and TSI Units 153, 155, 58-160. Follow up with jackpot burning where called for in Rx and underburning. Combination of hand ignition around TSI and mechanical units and aerial ignition outside of those. Coordination needs: TSI units, PVT land boundaries, and burning in Unit 37 with Botanist.
5	3698	2220	Mechanically treat units 38-41, 44-45, 47-48, and TSI units 162-165. Follow up with jackpot burning where called for in Rx and underburning, hand and aerial ignition.
6	2501	1253	Mechanical treat units 45-46, 111-113, 116, and 141-143. Follow up with jackpot burning where called for in Rx and underburning, hand and aerial ignition. Coordination needs: PVT land boundaries.
7	1350	610	Mechanical treat units 107-110, 118-119, 136, 138-141, 144, and TSI Units 154, 167, 170-171. Follow up with jackpot burning where called for in Rx and underburning. Hand ignition around TSI and near PVT. Coordination needs: TSI units, PVT land boundaries, pileated post-fledging area.
8	3842	2403	Mechanically treat units 49-57, 59, 61-63, 102-106, and TSI Units 168-169. Follow up with underburning, hand and aerial ignition. Coordination needs: TSI and PVT land boundaries.
9	2964	1631	Mechanical treat units 58-59, 64-69, 66 (SCN), 73-74, 77-78, and 97, 99-100. Follow up with jackpot burning where called for in Rx and underburning. Hand and aerial ignition. Coordination needs: Goshawk nest protection.
10	814	509	Mechanical treat units 4-5, 8, 11-12, 15, 22, 26, and 97-98. Follow up with jackpot burning where called for in Rx and underburning. Hand and aerial ignition. Coordination needs: Sedge monitoring with Botanist, PVT land boundaries.
Totals	22,260	12,525	

Timber Harvest:

Proposed treatment would occur on approximately 3,709 acres of in the Bald Angel project area. Treatments include stand density management through commercial thinning (HTH), shelterwood (HSH), improvement cuts (HIM), sanitation harvest (HSA), overstory removal harvests (HOR), fuels reduction removals (HFU), fire cleaning (FCN) and stand cleaning (SCN) to reduce the risk of crown fires (refer to prescription descriptions below). These treatments are proposed to reduce stocking densities, remove diseased and poor growing trees, and promote stands with single story large tree characteristics. Stands would be opened up, stimulating growth of residual trees. No live trees larger than 21 inches in diameter would be cut except for an occasional tree removed for safety or construction clearing. Shelterwoods on 68 acres would remove poor growing, less vigorous trees while maintaining most of the larger component (trees larger than 18 inches dbh). The larger

overstory component will remain and planting will ensure a healthy, viable understory. These stands will become Multi-stratum large tree (MSLT) structure stands. Approximately 784 acres would be precommercially thinned to improve tree growth and select desirable tree species, 20 of those acres would be accomplished as a follow-up treatment after harvest. Approximately 296 acres of release treatments would be accomplished within harvest units and 110 acres in non-harvest units. Approximately 209 acres of planting would occur in areas, which are below stocking and classified as having regeneration difficulties due to ground conditions and lack of adjacent seed sources.

Riparian treatment units (Unit 13) would be treated using the prescriptions previously described under Common Elements.

Forest Plan Amendment for Treatment in Old-growth Below HRV – An HRV analysis of LOS, by biophysical grouping has been completed for this project area and as described above indicates deficiencies in both SSLT and MSLT old growth, with SSLT being nearly non-existent. MSLT structure is more prevalent in the project area, however, due to past management practices and fire exclusion which has promoted fir encroachment in the understory, many of these stands which were historically SSLT have now become MSLT.

The Forest Plan would be modified in this project as described under common elements above and approximately 1,086 acres of LOS would receive commercial thinning prescriptions. Trees > 21 inches diameter would not be cut. Treatments would modify these multi-strata stands to single-strata stands and maintain adequate levels of down logs. Affected Units: 1, 8, 10-12, 20, 23, 29, 30, 37-39, 41, 48, 57, 70, 84, 96, 100, 102, 121-122, 125, 126, 128, 129, 131-133, 135, 137.

Connective Corridor Units – As stated under common elements, the goal within these units would be to maintain and enhance their cover and connectivity qualities such as medium to large trees as a common occurrence and canopy closure within the top 1/3 of site potential.

Connective Corridor Units: 1, 12, 14, 31, 36, 37, 41, 48, 49, 57, 62, 63, 89, 100, 102, 118, 119, 121, 126, 129, 131, 132, 136, 137

In Alternative 4 the following changes in connective corridor units were made to retain connectivity but were identified as a high priority for treatment due to stand health (active insect infestations) or their biophysical environment was such that UMZ prescriptions were either not attainable or inappropriate for that biophysical environment. For those units listed above which were not changed, the prescription would meet the goals described above.

Affected Units:

To UMZ: 8, 12, 37, 49, 89,
36 – to upper one half of management zone (70-90 basal area),
40 – northern 3 acres of unit,
57 – 7 acres to UMZ – rest to LMZ,

To LMZ:
13 & 14 – except 600 feet along boundary where leave higher basal area,
76- to 25% above LMZ,

Removal Systems Summary:

Where treatments result in commercial products, they would be removed by tractor (3,209 acres), skyline (398 acres), and helicopter (109 acres) yarding systems. Approximately 8.1 MMBF of saw material and 1.4 MMBF of wood fiber is expected to be recovered from the proposed action.

2.26 miles of re-construction of systems roads is anticipated to improve drainage, reduce erosion and sedimentation, and reinforce the subgrade. No new specified or temporary road construction are needed to facilitate removal of the materials.

Access and Travel Management Plan:

Travelways across the entire project area were analyzed under the project Roads Analysis to determine how best to manage access to meet resource needs and objectives. Roads described under the Common Elements section would be decommissioned, closed, and promulgated within the area closure with the exception of those roads identified to remain open for long term access into the area. Approximately 16.22 miles of roads to be used by the project would be closed at the conclusion of harvest and project activities. These closures would be accomplished with a combination of signing and/or physical barriers. Approximately 0.99 miles of additional roads used by the project were identified for closure to protect and enhance water quality and meet objectives for wildlife habitat. These roads would be decommissioned and no longer be available for future use. Decommissioning would result in the stabilization and restoration of these sites to a more natural state. Activities could include recontouring, culvert removal, and seeding.

Management Requirements, Constraints and Mitigation Measures

The following items are included in all action alternatives, unless otherwise noted, and provide the measures necessary to keep project impacts at acceptable levels. These items would be applied to the proposal as it is implemented on the ground. Unless specifically identified as a mitigation measure, the following are considered either management requirements or constraints.

A) Soil Quality

Mass stability will be maintained (Forest Plan Soils S&G #1; FSM 2521.03.1.b R6 Supplement 2500-98-1), including stability of any existing landslides.

Soil productivity will be maintained by complying with Regional standards and guidelines in FSM 2521.03, R6 Supplement 2500-98-1. The standard is to “leave at least 80% of an activity area in acceptable soil quality condition.” Specific standards are defined for soil compaction, puddling, displacement, burning, surface erosion and mass wasting. Guidelines are defined for organic matter and soil moisture regime.

Compliance with soil quality standards in FSM 2521.03, R6 Supplement 2500-98-1, will be determined through use of protocols described in “Interim Protocol for Assessment and Management of Soil Quality Conditions,” Wallowa-Whitman National Forest, Version 3.3, September 2001 or subsequent version. Burn conditions will be monitored using “fire severity” (burn intensity) and “severity burn” (burn area) concepts in Fire’s Effects on Ecosystems, by DeBano, Neary & Folliott, 1998, p. 63, as required by the current BAER manual, or appropriate modifications thereof to address thresholds in soil standards or hydrologic models.

The following soil guidelines from the Wallowa-Whitman National Forest publication, *Watershed Management Practices - Guide for Achieving Soil and Water Objectives*, (BMP's) are applicable to this sale:

Existing infrastructure: Existing landings and skid trails will be used as much as reasonable and practical.

Soil Moisture: Under saturated soil conditions no off-trail skidding or machine falling is allowed. Skidding on designated trails may be allowed as long as such use does not cause deep rutting (4 inches and greater) or high erosion potential. Allowing skidding under these conditions makes mitigation by subsoiling less effective and should be avoided both on and off trails. Existing skid

trails will be used as much as reasonable and practical as well as use of BMPs such as waterbars and not operating in wet conditions mitigations. (Sale Design H3)

Subsoiling: Evaluate activity areas for the need for subsoiling following use by the sale. (Site Preparation and Watershed Restoration E1)

Approved skid trails, maximizing use of existing skid trails and landings, logging over snow or frozen ground, or some equivalent system for limiting the impact and aerial extent of skid trails and landings will be used to limit cumulative increases from multiple entries in tractor logging areas.

Recommended tons per acre of coarse woody material for long-term soil productivity are listed with Wildlife constraints under "Snags and Down Woody Material" for wildlife and soils.

To minimize accelerated erosion and to provide for long-term soil productivity, 85-100% ground cover will be maintained in forestlands and 65-85% ground cover will be maintained in rangelands, except for short-term reductions associated with management activities, or where natural potential is different. Standards for minimum percent effective ground cover during the first and second years following major disturbance are described in FSM 2500, R6 Supplement 2500-98-1, 2521.03. Erosion control methods are listed under the Water Quality and the Logging and Sale Design sections.

B) Water Quality

1. *Water Quality Standards*

Meet (or show progress toward meeting) water quality standards for Waters of the State of Oregon (Oregon Administrative Rules, Chapter 340-41) through project design, application and monitoring of best management practices (BMPs) as defined in the Code of Federal Regulations [40CFR 130.2(m)]. BMPs are used for various situations encountered during layout and administration of the timber sale contract and other activities. BMPs are listed in several sections of these constraints, including the "Logging and Sale Design" section, and in other documents, including the Wallowa-Whitman Watershed Management Practices Handbook, which is on file at the La Grande Ranger District.

2. *Erosion Control Methods*

Highly disturbed areas (which may include: skid trails, roads, skyline corridors, landings, road cuts and fills, etc.) will be seeded. The seed mix to be used will consist of native species, or a non-native species mix, to be approved by the District Diverse Species Program (contact program coordinator for the exact species mix and seeding schedule). This may include one fast germinating annual grass species to provide immediate ground cover. Seed application rates will be adjusted, as needed, to compensate for the broadcast method of application, and to generate vegetation densities adequate to provide a deterrent to noxious weed invasion.

Seed will be certified weed free, per the Wallowa-Whitman Integrated Noxious Weed Management Plan protocol.

Erosion control measures will be taken on all skid trails and temporary roads as needed. Spacing of waterbars will be determined by on the ground conditions and guidelines stated in the Sale Administration Handbook.

Slash and soil material may be left in the trail to divert water, or the subsoiling can be done to provide lead-off drainage from the trails.

C) Riparian Habitat and Fisheries

RHCAs were delineated along all riparian corridors, wetlands, intermittent streams, and other areas that help maintain the integrity of aquatic ecosystems. RHCAs 1) influence the delivery of sediment, organic matter, and woody debris to streams, 2) provide root strength for bank and channel stability, 3) shade the stream, and 4) protect floodplains and water quality.

The RHCA widths described below are minimum widths to be applied in all treatment units with the exception of site specific RHCA modifications described under each action alternative:

- 1) *Fish Bearing Streams* – No harvest 300 feet on either side of the flood plain.
- 2) *Permanently Flowing Non-Fish Bearing Streams* – No harvest 150 feet on either side of the flood plain.
- 3) *Ponds, Lakes, Reservoirs, and Wetlands greater than 1 acre* – No harvest 150 feet from the edge of the wet area.
- 4) *Seasonally Flowing or Intermittent Streams, Wetlands less than 1 acre, landslide, and landslide-prone areas* - No harvest 50 feet on either side of the flood plain, no harvest within the extent of landslides and landslide-prone areas.

In ephemeral draws, trees will be left at a minimum of two large trees per 100 feet of draw bottom for future down woody material recruitment. All bank stabilizing, hardwood, and non-merchantable trees will be left.

Layout and marking of treatment units with treatments within the RHCAs will be done in conjunction with the watershed specialist identified for the project.

D) Wildlife

1) Down Woody Material (for wildlife and soils)

Where material is available, all treatment units (harvest and prescribed burn) will exceed the minimum levels for down woody material described in the table below for each species. The pieces per acre are the minimums required by the Forest Plan for wildlife and would be used in the appropriate contract provision:

SPECIES	PIECES PER AC	PIECE LENGTH AND DIAMETER SMALL END		TOTAL LINEAL LENGTH	Approximate TONS PER ACRE
		Diameter	MinLength		
Ponderosa Pine	3-6	12"	6ft	20-40 ft	0.2 - 0.4
Mixed Conifer	15-20	12"	6ft	100-140 ft	1.0 – 1.5
Lodgepole pine	15-20	8"	6ft	120-160 ft	0.5 – 0.8

The above pieces per acre are the minimums required by the Forest Plan for wildlife and would be used in the appropriate contract provision; it is desirable to meet the following tons/acre of coarse woody material for soil productivity after harvest/burn operations:

TONS PER ACRE	PLANT ASSOCIATION
5-10	Douglas-fir/spirea, Douglas-fir/elk sedge, Douglas-fir/pinegrass, Grand fir/pinegrass, Ponderosa pine/pinegrass, ponderosa pine/elk sedge, ponderosa pine/snowberry
7-15	Grand fir/twinflower, grand fir/huckleberry, grand fir/spirea, sub-alpine fir, and lodgepole pine

Coarse wood material includes all diameter classes. The large (>12") snags and logs should be protected during any prescribed burning.

2) Raptors

Of the nineteen historic raptor nest sites found and relocated, three were found to be active during field reconnaissance for this project. Unit boundaries have been modified to protect the nest trees and layout in those units will be coordinated with the project Wildlife Biologist for units 6, 16, and 98.

An operating restriction in these units will be recommended based on proximity and topography between the nest trees and potential disturbances from March 15th to August 31st.

If additional raptor nests are located during layout and marking, appropriate protection measures will be prescribed.

3) Sensitive Habitats

Plant communities adjacent to sensitive/unique habitats will be protected by maintaining vegetative structure characteristic of the edge inherent to these areas. These areas include cliffs, caves, talus, natural openings, and meadows. No harvest buffers or retention of higher basal area will be used to maintain the context of these features.

Buffer widths for sensitive habitats will be at least 100 feet, possibly more on some habitats. The degree of activity allowed within these buffers will vary depending on the type of sensitive habitat. Natural openings will generally not receive a buffer but will have prescription modifications to the upper management zone to maintain the integrity of the inherent edge for these areas.

Grassy scabs and meadows will not be used as locations for landings or skid trails unless no other location is practical. In those situations where landings are necessary, using the edge of these openings is preferred.

4) Big Game Winter Range

Logging operations will be conducted outside the period between December 15 through April 30. Waivers to operate during this time period may be requested of the District Ranger.

Affected Units: Alternative 2: 6–11, 35–37, 55, 56, 70-76, 78-97, 122
Alternative 3: 6–11, 35–37, 55, 56, 70-76, 78-84, 87-93, 95-97, 122
Alternative 4: 8-11, 36-37, 70-76, 78-84, 87-92, 95-97, 122

5) Management Indicator and Neotropical Migratory Species

One pileated woodpecker nest has been located in Burn Block 7 which will be avoided during burning activities. Prescribed fire activities in Burn Block 7 will be coordinated with the project Wildlife Biologist to ensure protection of this area.

Should the presence of other management indicator species, other than those protected by the design criteria and specifications above or the stream buffers discussed earlier, be discovered in any units programmed for prescribed burning the following protective measures could be applied either separately or in combination to reduce possible impacts to snags with nest cavities, protect other nest sites during burning: a) fuel distribution around snags, b) varied lighting techniques, c) fall burning, d) deferred burning until after the unit is no longer being used during the reproductive period.

E) Fuels and Smoke Management

Project Generated Slash:

Trees (5-7 inch DBH) that are dead, diseased, damaged, or not required for future stand structure will be felled and removed to reduce heavy fuel loadings, fire risk, and stocking densities.

Landing slash will be pile burned in landing areas or scattered when amounts do not warrant piling.

Road Construction/Reconstruction Slash – Disposal of all created slash is based on “least cost” method. Where a road traverses through a harvest unit the fuel treatment should closely correspond to the treatment of slash in the unit.

Smoke Management:

A voluntary Smoke Protection Zone has been established around the City of La Grande. Northeast Oregon Inter-agency Dispatch Center (NOIDC) will be contacted prior to any prescribed burning on National Forest Lands.

Prescribed burning activities are coordinated with the Oregon Department of Environmental Quality by NOIDC to assure that burning conditions will meet with air quality standards for personal health in the City of La Grande. Visual quality standards will be protected in the Eagle Cap Wilderness area during the peak recreational use period of July 1 through September 15. These actions respond to the non-key issue of air quality.

RHCA Burning Procedures:

During prescribed burning in harvest units, direct ignition will be prohibited within 150' of class I, II, and III streams (with the exception of the modified RHCA units described in the Common Elements section of this Chapter). Use RHCA distances described under the Riparian Habitat and Fisheries section of constraints and mitigation measures.

Prescribed fire will be kept to a minimum inside RHCAs. Brushline (no mineral soil exposed) will be constructed if necessary within RHCAs to keep fires from burning riparian vegetation.

Fisheries and watershed personnel will be notified prior to burning near RHCAs, and will be on site when burning near RHCAs occurs.

Prescribed Burn Units:

Prescribed burning in units that have been mechanically treated may be delayed 2-3 years after the completion of the mechanical treatment to allow the stand to recover from thinning. This decision will be coordinated with the project Silviculturist prior to any planned ignitions.

Prescriptions on Warm/Dry sites (open pine with grass understory) will limit burn effects to the low-severity burn class which means less than 17% high severity plus moderate severity will be allowed on treated grounds.

Prescriptions on Cool/Moist sites will limit burn effects to the moderate-severity burn class with no more than 40% high severity plus moderate severity will be allowed on treated grounds.

No direct ignition will occur immediately adjacent to large down logs.

Water sources needed during prescribed fire operations will consist of temporary sumps. Sites to be identified at a later date will be constrained by the following:

- a) Seed disturbed ground following operations with a mix recommended by the District Diverse Species Coordinator if appropriate.
- b) Locate site to minimize washout and erosion potential.
- c) Springs and elk wallows will be avoided.
- d) Avoidance of potential habitat of PETS plant species.

F) Logging and Sale Design

The sale area boundary will be the project area boundary as described under Project Area Description, section I of this EA and identified on alternative maps in appendices A, B, and C.

All units with ponderosa pine listed as one of the principal conifer species shall be cut between July 1st and December 1st.

Trees selected for retention under the Tree Improvement Program will be protected during project activities.

General Soil and Water Mitigations:

Generally, ground-based yarding will not occur on ground steeper than 35%. Ground-based yarding on slopes over 35% and greater than 200 feet distance will be identified during pre-sale activity (layout and marking) and approved by the Forest Service Representative/Sale Administrator and district hydrologist/fisheries biologist.

Short, steep areas in tractor ground (up to 200 feet and 50% slope) should require winch lines on all skidding equipment operating on those slopes or use of forwarders which provide full suspension of logs during skidding/yarding.

Skid trails will not be located in ephemeral drainage bottoms and will not cross ephemeral draws on an average of more than once every 200 feet of linear distance.

Designated skid trails will be pre-approved in advance of felling operations by the Forest Service Representative or Sale Administrator to minimize detrimental soil impacts. A unit-by-unit evaluation of detrimental soil conditions will be made in sensitive units upon completion of logging activities. Where detrimental soil impacts exceed twenty percent (20%) of the total acreage within the project area, including landings and system roads, restoration treatments will be considered. Detrimental soil conditions include compaction, puddling, displacement, and severe burning, surface erosion and mass wasting.

Recommended average minimum skid trail spacing for ground-based equipment is 60 feet, center to center for mechanized harvesting, and 80-100 feet for conventional hand felled trees. Require directional felling to minimize soil disturbance during skidding operations. Recommended minimum skyline corridor spacing is 150 feet, center to center, to minimize ground disturbance and protect residual trees. See Soil Quality section.

The normal operating season for the analysis area is July 1 to October 31.

To prevent road damage and maintain water quality, road use will be restricted to dry or frozen conditions. If road use is approved outside the normal operating season, drainage structures (waterbars, Utah dips) will be kept in a functional condition, and daily operations will be managed to minimize sediment transport from roads. Operations will cease when roads turn muddy and/or rutting occurs, resulting in sediment transportation. Reference the district forest roads and erosion control document in analysis file, transportation section.

Temporary roads will not be constructed immediately adjacent to or within riparian areas. Any planned reconstruction or construction of roads crossing riparian areas will not alter stream or groundwater flow

characteristics to the extent that it will impact the riparian area. Locate roads to avoid paralleling stream channels in streamside management units. Roads will be managed to minimize impacts to water quality and fish and wildlife habitat. Design and maintain road drainage to prevent the influx of significant amounts of road sediment runoff into streamcourses.

Temporary roads will be obliterated at the completion of harvest activities and put back into production. Obliteration may include re-contouring, scattering slash, subsoiling, and seeding, as ground conditions dictate.

Drainage structures will be installed and maintained on all open roads within RHCAs, using spacing guides listed in the Watershed Management Practices Handbook.

Road maintenance will maintain existing drainage features. Post-haul maintenance will protect the road surfaces during future periods of inactivity and may require construction of additional drainage features. Cross drains will not discharge onto erodible slopes or directly into stream channels, including ephemeral drainages.

G) Range

Allotment boundary fences and other improvements damaged during the grazing season must be repaired to their functional condition immediately and damage outside the grazing season must be repaired two weeks prior to permitted livestock entry. Any damage occurring to existing range improvements should be reported to the District range manager and/or private landowner. This responds to the non-key issue of range and livestock management.

All range improvements will be protected during prescribed burning activities. If damaged they will be repaired as discussed above.

H) Proposed, Endangered, Threatened, and Sensitive Species (PETS)

Biological evaluations and/or assessments have been completed for plants, fish, and wildlife PETS species. Contract provisions will be included to provide for the protection of areas where PETS occur and for those that may be discovered in the area during the contract period.

Burning in Burn Blocks 4 and 10 will be coordinated with the District Botanist to facilitate timely monitoring of the effects of burning on the sensitive *Carex backii*, in order to complete monitoring before activities, immediately after burning occurs, and again the year following burning to study the effect of burning on Plant PETS species.

Layout of Unit 37 will be coordinated with the District Botanist to ensure protection of a *Carex backii* population from ground disturbing activities. This site will also be marked as an Area to Protect (ATP) on the contract sale maps.

I) Managing Competing and Unwanted Vegetation

An assessment report of known noxious weed populations is available in the Analysis File. Noxious weed locations also appear on project maps in the analysis file. If new noxious weed infestations are located within the project area, a noxious weed inventory and site assessment will be completed.

The analysis for vegetation management is conducted in accordance with the 1990 Forest Plan Standards and Guidelines, the 1998 Forest Noxious Weed EA, the Integrated Noxious Weed Management Plan - Wallowa Whitman National Forest (INWMP, 1992), and the 2005 Pacific Northwest Region Invasive Plant Program Preventing and Managing Invasive Plants FEIS. Management activities will give consideration and evaluation of prevention strategies during the planning process (INWMP, Chapter V. Prevention Strategies, Section B).

The following measures shall be implemented to reduce new establishment or spread of noxious weeds and responds to the non-key issue of noxious weeds:

Known sites are as follows:

GIS SITE ID #	W-W SITE #	SPECIES	UNIT #	COMMENTS
001	6-0016	CADR	123	7040-305 rd
004	6-0010	CEDI/CADR	Possible haul	6700 rd
005	6-0017	CEDI		Balm Creek Dam
092	6-0027	CADR/ONAC	Possible haul	6700-060 rd
125	6-0041	CADR	38	6700-525 rd
127	6-0042	CADR/PORE	37	6700-6710 rd
145	6-0042	CEDI/CADR	57	6700 rd
146	6-0042	CEDI/CADR	Possible haul	6700 rd
147	6-0042	CEDI/CADR	Possible haul	6700 rd
157		CADR	89, 92	7050 rd
182	6-0015	CESO		Copper Butte
184	6-0066	CADR	89, 92	7050 rd
211	6-0081	CADR	108, 109	7000-080 rd
212	6-0104	CADR/CEDI	Possible haul	7040 rd
213	6-0103	CADR	Possible haul	7000 rd
214		CADR	Possible haul	7050 rd
216	6-0080	CEDI	53, 54, 57	7055 rd/ Burn Creek
217	6-0091	CADR/CIAR	166	6700-800
218	6-0094	CEDI	143, 144	6700-350
223	6-0066	CADR	Possible haul	7050 rd
224	6-0015	CADR	Possible haul	7050-060
226	6-0085		107	7045-475
229	6-0103	CADR	Possible haul	7000-825
230	6-0042	PORE	Possible haul	6700 rd
231	6-0081	CADR	Possible haul	7000-rd
232	6-0081	CADR	110, 119	7000-rd
290		CEDI	Possible haul	6700-050 rd
316		CADR/ONAC	86	
336		CADR/ONAC	86	
368		CEDI	25, 152, 153	7746

No road construction or maintenance should occur at these sites, until the previous years dead plants/stalks have been removed.

1. Noxious weed locations are on the Alternative maps for the Bald Angel EA in the analysis file. A copy of these will be included in the contract preparation package, for use by the sale administrator. These sites will be reviewed with the contractor and mitigations explained.
2. Timber harvest activities should take place over snow where feasible.
3. Monitor the following units post harvest and other areas of disturbance as funding allows, for a period of up to five years; will be included in the KV - mitigations.

These units all lie adjacent to or over existing infestations, mostly roadside. Affected Units (Action Alternatives): 25, 37, 38, 53, 54, 57, 86, 89, 92, 107, 108, 109, 110, 119, 123, 143, 144, 152, 153 and 166.

Noxious weed infestations presently occur within the following road prisms scheduled for maintenance in the Bald Angel project:

Road	Species
6700	CEDI/CADR
6700-350	CEDI
6700-525	CADR
6700-800	CADR/CIAR
7000	CADR/CEDI
7000-825	CADR
7040	CADR/CEDI
7050	CADR
7055	CEDI
7746	CEDI

Before road maintenance activities on these roads occurs the contracting officer (COR) will contact the District Noxious Weed Coordinator, to inform him of maintenance plans. The Noxious Weed Coordinator will take the appropriate action to treat the noxious weeds on the infested portions of these roads. (Note: Recommended treatment includes removal of previous year's stalks, to be conducted before maintenance activities occur there; and maintenance activities should not be conducted after the current year's plants have bolted and flowered (mid to late June) unless prior treatment of current year's growth occurs.)

4. If new noxious weed infestations are located within the project area, a noxious weed inventory and site assessment (as defined in the W-W INWMP) will be completed. Location of other species, conditions or future treatments may require additional analysis to determine the appropriate treatment method.
5. All mapped weed sites will be designated as "Areas to Protect" (no decking, skidding or equipment) and include in the contract package (use C.512), for use by the sale administrator. Logs should not be skidded or yarded through areas infested by noxious weeds. Landings and log decks should not be built on or near sites of noxious weed infestation.
6. Roads to be closed will be inspected for known and new noxious weed infestations (and treated as determined to be necessary) prior to road closure. When opened for logging operations, Sale Administrator will notify the Noxious Weed coordinator.
7. Highly disturbed areas (which may include: skid trails, landings, road cuts and fills, etc.) will be seeded. The seed mix to be used will consist of native species, or a non-native species mix, to be approved by the District Diverse Species Program. This may include one fast germinating annual grass species to provide immediate ground cover. Seed application rates will be adjusted, as needed to compensate for the broadcast method of application, and to generate vegetation densities adequate to help in deterrence of noxious weed invasion.
8. Seed will be certified weed free, per the Wallowa-Whitman INWMP protocol.
9. All hay or straw used for mulching, erosion control, or other rehabilitation purposes will be weed free (per the Wallowa-Whitman INWMP protocol).
10. Road rock source pits/quarries will be inspected for noxious weed infestations prior to use and transport. Rock source material infested with high priority noxious weed propagules (A bud or shoot capable of developing into an adult) will not be utilized.
11. All equipment to be operated on the project area will be cleaned in a manner sufficient to prevent noxious weeds from being carried onto the project area. This requirement does not apply to

passenger vehicles or other equipment used exclusively on roads. Cleaning, if needed, will occur off of National Forest System lands. Cleaning will be inspected and approved by the Forest Officer in charge of administering the project. (Use D.6343 Option #2).

J) Water and Material Sources

Material sources, if needed, will be existing sources. No expansion of sources is anticipated. All work will stay within existing source boundaries. The following rock pits have been identified for project use pending noxious weed inventories (see #11 above):

Source locations:

1. T.6 S., R.42 E, NW1/4 Sec.2, W1/2 Sec.17, NE1/4 Sec.20, NE1/4 Sec.22, S1/2 Sec.23, and NE1/4 Sec.26.
2. T.6 S., R.43E., Sec.1/4 Sec. 31, and NW1/4 Sec.32.
3. T.7S., R.42E., E1/2 Sec.4, W1/2 Sec.5.
4. T.7S., R.43E., NE1/4 Sec.7.

Water sources will be designated from the La Grande Ranger District Water Source Inventory. Available water sources within this area are as follows:

Sources: 087-01 through 087-15, 088-01 through 088-50, 099-01 through 099-18, 100-01 through 100-05, and 100-08

K) Precommercial Thinning

1. The following constraints will apply to all Precommercial thinning (SPC) units:
 1. Spacing along perennial streams will be 8' x 8', within 100' of the stream bank. All trees cut within 10 feet of streams will be directionally felled toward the stream so that the slash is within the channel unless it interferes with a culvert.
 2. Vegetative visual screens will be maintained adjacent to roads open to vehicular traffic (See District Access and Travel Management Plan) to reduce site distances and maintain big game security.
 3. All snags within thinning units will be maintained on site to provide wildlife habitat. Trees 7-9 inches DBH infected with dwarf mistletoe will be girdled to insure the regenerating understory does not become infected. Dwarf mistletoe-infected lodgepole pine trees up to 7 inches DBH will be cut.
 4. Appropriate contract clauses will be incorporated into the final contract for protection of raptor nest sites if any are discovered during project implementation.
 5. Appropriate contract clauses to protect cultural resources and Proposed, Endangered, Threatened, or Sensitive (PETS) species will be incorporated into the final contract to protect these resources should they be discovered during project implementation.
 6. Special or unique features such as rock outcroppings and wet meadows were avoided through thinning unit design (See Wildlife Habitats in Managed Forests in the Blue Mountains of Oregon and Washington, Thomas 1979, on file at the La Grande Ranger District Office). However, if additional features are encountered during unit layout, well defined edges around these areas will be achieved by retaining a feathered no-cut buffer of at least a hundred feet projected into the stand from the mid-line of the ecotone (area where there is a marked difference in vegetative communities).

7. Thinning design will incorporate concerns related to biodiversity and wildlife habitat. This includes, but is not limited to, developing a mosaic throughout the landscape by leaving areas un-thinned, variable leave tree spacing, and maintaining as much overstory as possible (consistent with item #3 above) within thinning units. Activities will be coordinated with the District Wildlife Biologist.
8. Thinning will be accomplished when possible, while trees are less than 2" in stem diameter. Trees of this size have faster decay rates and fuel loads will be reduced sooner. Where TSI slash affects a large area (40 contiguous acres) whether from this years or previous years, activity will be spread out over several years to reduce fuel accumulations. This mitigation may be waived by the fuels management specialist assigned to the project if determined that fuel loadings are at acceptable levels. Generally 2-3 years is required for needles to fall off, at which time the fire hazard is significantly reduced.
9. Slash treatment is required within 100 feet of an open collector (4 digit) road. Treatments will consist of pull back of all slash 5 feet beyond the shoulders on each side. In areas with cut and fill construction, this distance shall be measured from 5 feet beyond the top of the bank to 5 feet beyond the point where the shoulder meets the fill slope (i.e. hinge point of road shoulder and fill slope). All roads shall be kept free of thinning slash, whether the road is blocked by barriers or not. Within the 100 foot area along the roads maximum slash depth will be 18 inches; boles over 15 feet and greater than 2 inch cut diameter shall be bucked in half.
10. Slash treatment is required within 200 feet of private land boundaries. Treatments will consist of pull back of all slash within 5 feet of the edge of private lands. Within 200 feet of the boundary maximum slash depth will be 18 inches; boles over 15 feet and greater than 2 inch cut diameter shall be bucked in half.
11. All units with ponderosa pine listed as one of the principal conifer species shall be cut between July 1st and December 1st.
12. In areas where the unit extends down to the stream, spacing has been reduced from 12'x 12' to 8'x 8' for a 100 foot strip along the stream, in order to retain stream shading and hiding cover, along with promoting overstory development.
13. Special areas (springs, seeps, etc) will be given a 50 foot buffer.
14. Leave trees shall be selected within the following order of species preference, the most preferred species listed first: ponderosa pine, western larch, Douglas-fir, Engelmann spruce, white/grand fir, lodgepole pine, and sub-alpine fir. This order of preference only applies if the trees are free of damage or defect.
15. Active raptor nest sites will be protected by seasonal restrictions. If raptor nests are found, restrictions will apply (see project file).
16. Slash shall be immediately removed from all open roads. Trees will be felled away from roads and established trails. Pull back of all slash will occur 5 feet beyond the shoulders on each side. In areas with cut and fill construction, this distance shall be measured from 5 feet beyond the top of the bank to 5 feet beyond the point where the shoulder meets the fill slope (i.e. hinge point of road shoulder and fill slope). All roads shall be kept free of thinning slash, whether the road is blocked by barriers or not. A spotter shall be required when felling trees which may reach the roadway.
17. Some units contain riparian buffer strips along existing waterways. Spacing will be 8' x 8', for 100 foot strip off the waterways edge.
18. Slash treatment is required within 200 feet of private land boundaries. Treatments will consist of pull back of all slash within 5 feet of the edge of private lands. Within 200 feet of the boundary

maximum slash depth will be 18 inches; boles over 15 feet and greater than 2 inch cut diameter shall be bucked in half.

L) Cultural Resource Protection

No cultural sites were discovered during surveys in proposed activity areas for this project. However, should any sites be discovered during project activities, the Heritage Technician for this project will be notified immediately and appropriate protection measure employed.

M) Recreation

Maintain the character of dispersed camping sites by cleaning up project-created slash. Maintain access to dispersed sites on roads to be left open. Leave adequate space for camping at the point where roads are closed.

N) Improvement-Mitigation Measures with KV or Appropriated Funds

The following projects were identified by the ID team and prioritized in the following order:

ESSENTIAL KV

A) Planting

Alternative 2 = 235 acres @ \$455/acre = \$106,925
 Alternative 3 = 209 acres @ \$455/acre = \$95,095
 Alternative 4 = 209 acres @ \$455/acre = \$95,095

B) Site Preparation Burning for Natural Regeneration

Alternative 2 = 189 acres @ \$150/acre = \$ 28,350
 Alternative 3 = 131 acres @ \$150/acre =

MITIGATION (Non-essential KV - in order of priority)

A) Noxious weed control - Grass seeding, control, and monitoring.

- Seeding - 15% of tractor and landing acres @ \$15 per acre.
- Control - 1% of seeded acres @ \$189 per acre. (hand work or chemical if available)
- Monitor KV Work (seeding and control) - @ \$2.88 per acre.

B) Subsoiling

Alternative 2 – 487 acres @ \$125/acre = \$60,875
 Alternative 3 – 420 acres @ \$125/acre = \$52,500
 Alternative 4 – 371 acres @ \$125/acre = \$46,375

ENHANCEMENT (non-essential KV in order of priority)

Indicator	Alt 2	Alt 3	Alt 4
1. Road Decommissioning/Barricade	\$169,700	\$168,500	\$169,700
2. Release Treatments (@\$220/ac)	\$266,640	\$237,600	\$237,600
3. Prescribed Burn Fuels Reduction	\$688,500	\$662,400	\$626,250
4. Aspen Restoration fencing	\$10,000	\$10,000	\$10,000
Total	\$1,134,840	\$1,078,500	\$1,043,550

Bald Angel - Alternatives at a Glance

Alternative Elements	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Harvest Treatment Acres	0	4,869 acres	4,193 acres	3,709 acres
Prescribed Fire Acres	0	13,770 acres	13,248 acres	12,525 acres
Acres of Modified RHCA Treatments	0	127.7 acres	16 acres	16 acres
LOS Acres Treated	0	1,445 acres	1,237 acres	1,086 acres
Road Closure	0	16.64 miles	15.48 miles	16.22 miles
Road Decommission – Project		29.1 miles	29.1 miles	29.1 miles
Road Decommission - Sale		0.99 miles	0.76 miles	0.99 miles
Roads Promulgated		80 miles	80 miles	80 miles
Release Treatments (w/o harvest)	0	860 acres	784 acres	784 acres
Release Treatments (w/harvest)	0	352 acres	296 acres	296 acres
Planting	0	235 acres	209 acres	209 acres
Yarding Systems:				
Tractor	0	3,885 acres	3,514 acres	3,209 acres
Skyline	0	618 acres	570 acres	398 acres
Helicopter	0	359 acres	109 acres	109 acres
Road Work:				
Reconstruction	0	2.26 miles	2.26 miles	2.26 miles
Specified Road Construction	0	1.7 miles	1.6 miles	0 miles
Temporary Road Construction	0	10.4 miles	5.36 miles	0 miles
Saw/Chip Volume Recovered	0	12.5 MMBF	10.9 MMBF	9.6 MMBF

Comparison of How the Alternatives Respond to the Key Issues

The following table compares each alternative with the key issues and key indicators identified in section I.

Comparison Factors		Alternatives			
Key Issue	Key Indicators	1	2	3	4
Overstocking & Stand Health	• Acres of stand density reduction (Commercial and Precommercial)	0	5555 Acres	4889 Acres	4477 Acres
	• Percent of Total Need Treated		68%	60%	55%
LOS Deficiency	• Acres of understory reinitiation accelerated toward MSLT/SSLT	0	2,811 ac	2,501 ac	2,251 ac
	• Acres of MSLT converted to SSLT	0	1,107 ac	997 ac	997 ac
	• Acres of treatment within connective corridors	0	937 ac	604 ac	516 ac
Lack of Big Game Security	• Acres of Satisfactory thermal cover converted to Marginal thermal cover or forage	0	1,843 ac	1,382 ac	1,187 ac
	• Acres of Marginal cover converted to forage	0	3,118 ac	2,771 ac	2,596 ac
	• Percent of analysis area further than 0.90km from motorized route	0.05	17%	17%	>17%
Outside of Historic Fire Return Intervals, Risks, and Regimes	• Acres treated within fire regimes of high departure from historical fire return intervals	0	4,080 ac	3,785ac	3,399 ac
	• Acres treated within fire regimes of moderate departure from historical fire return intervals	0	574 ac	371 ac	371 ac
	• Acres treated with high or moderate risk to wildfire damage due to heavy fuel loadings (Mechanical + Rx Burn)	0	H =16,721 ac M =2,995 ac	H =15,726 ac M =2,292 ac	H =14,863 ac M =2,292 ac

Monitoring Plan

Monitoring specific to project activities, and not in conjunction with research studies, would be accomplished to assure that activities conform to objectives of the Forest Plan. Project level monitoring is a component of Forest Plan monitoring. The following types of monitoring will be accomplished:

Implementation Monitoring - Are mitigation measures and BMPs being implemented as planned?

For example, monitoring of sale layout and timber designation will occur to assure proper application of all identified constraints and mitigation measures. Monitoring will also consist of timber sale contract administration to ensure that all required mitigation measures are properly implemented and are effective.

Included in the monitoring activities is compliance monitoring of Proposed, Endangered, Threatened, and Sensitive species (PETS). If PETS are discovered in the area during project activity they will be protected in accordance with appropriate contract provisions. Additional site monitoring by the district fisheries and watershed staff during road construction, pre-sale layout and marking, and timber harvest will be undertaken to assure compliance with water quality standards, hydrology, and soil parameters.

Effectiveness Monitoring - Did mitigation and protection measures result in desired effects?

A walk-through survey of the project area during implementation and after sale closure will be conducted to qualitatively monitor on-site and downstream effects of project implementation.

If monitoring shows that mitigation measures of BMP's are not being implemented as planned or are not being effective in meeting resource objectives, activities will cease or be modified to correct problems.

Monitoring in areas where INFISH RHCA widths are modified and burned by direct ignition will be undertaken at five-year intervals to determine vegetative responses.

Other

Regeneration Monitoring - Planting monitoring will occur in years one, three, and five following treatment. Natural regeneration monitoring will occur in years three and five following treatment.

Prescribed Burning Monitoring - Fire Management will conduct monitoring of the prescribed burned acres as outlined in the District Prescribed Burn Monitoring Plan.

Noxious Weeds - The following elements will be monitored and documented; for a list of the responsible person, refer to the Noxious Weed Report in the analysis file:

- Effectiveness of treatments.
- Cost of the project (direct and indirect)
- Analysis of unintended effects.
- Impacts to human health
- Analysis of the degree of success.
- Effectiveness and adherence to the mitigation measures.

Fisheries and Watershed - The following is a list of monitoring activities for fisheries and watershed resources, which have been or will be implemented prior to and following the Bald Angel Timber Sale projects. These activities will provide information on evaluation of the sale and for future planning of projects in the area.

- a. Monitor the project to ensure that all standards and guidelines in the Wallowa-Whitman Forest Plan are met through implementation of mitigation measures as identified by the interdisciplinary team.
- b. RMOs as described in Forest Plan Amendment #4 (INFISH) will be monitored within two years of project completion. Monitoring of RMOs will evaluate the effectiveness of RHCAs. Photo points will be established and monitored in areas where INFISH RHCA widths are modified.
- c. Stream Habitat Surveys - Stream habitat and riparian surveys will be carried out within five years of project completion. These surveys will evaluate fish habitat quality as well as channel and riparian habitat conditions.
- d. Project Implementation - Monitoring of the implementation of project designs and mitigation measures will be accomplished frequently throughout the life of the project by La Grande fisheries/hydrology personnel and the timber sale administrator.

Soils - Monitoring will be undertaken

- 1) To ensure that best management practices and mitigating measures incorporated into the sale are being followed, and
- 2) To determine if these practices and measures are adequate to meet the intent of management directives.

Monitoring of sale layout and contract administration will be undertaken to ensure proper application of all identified constraints and mitigating measures. Ground-based harvest units will be monitored to ensure adequate spacing between skid trails, restriction of equipment to skid trails, prevention of wet weather yarding, and effective subsoiling of compacted skid trails and landings. As a result of site-specific surveys, the following 13 units (50, 67, 84, 88, 100, 106, 108, 109, 111, 133, 141, 143) are a high priority for monitoring to ensure that project design and mitigations are properly implemented to ensure DSC levels remain below Forest Plan minimums.

Post-harvest activities will be monitored to ensure that guidelines to minimize soil disturbance are being followed. Subsoiling will be monitored to ensure additional soil damage related to project implementation is negligible. Burning will be monitored to ensure high and moderate fire severity are within the limits described as low-severity burn or moderately-low severity burn, depending on burn objectives.

Wildlife –

What	Type	When	Who	Why
Snags, logs Sample of units	Implementation	During logging, one year after logging	TS administrator & wildlife personnel	To determine if prescribed material was retained
Aspen Restoration	Effectiveness (photographic and narrative records)	Five years following implementation.	Wildlife Biologist or Botanist	Monitor success of aspen regeneration and growth and apply adaptive management as needed to meet objectives.

Botany – Sensitive Plant Species

What	Type	When	Who	Why
Burn Blocks 4 and 10	Implementation, Effectiveness	Prior to logging, Prior to burning, immediately after burning, and one year following burning	District Botanist	To determine nature and extent of potential impacts to plant species

Chapter III. Environmental Consequences

A. Introduction

This section discloses the environmental consequences (effects) of implementing the alternatives (including the proposed action) described in section II. The effects analysis forms the basis of comparison of the alternatives through evaluation of the key issues and select non-key issues.

Direct, indirect, and cumulative effects will be discussed. The effects analysis process and all known baseline activities used by the Interdisciplinary team for their analyses is located in Appendix D of this EA. The duration of direct, indirect, and cumulative effects varies, and is addressed by each resource and subject area to follow. Key indicators will be used to measure alternatives for each key issue. The effects will be discussed by resource or subject area and key issues and indicators will be addressed under the appropriate area. The scale of analysis of effects is on a subwatershed level, including the subwatersheds identified in section I, unless otherwise identified.

Detailed analyses, literature citations, and supporting information are contained in each individual resource specialists' reports in the project analysis file at the La Grande District Office.

B. Alternative Evaluation as They Respond to the Key Issues

Silviculture/Vegetation Management – Improvement of Long Term Forest Health Conditions

Introduction

There are several factors in the Bald Angel Analysis Area that affect overall landscape health as described by tree health and vigor and insect/disease susceptibility. These factors are major silvicultural concerns to implementing the Wallow-Whitman Forest Plan in regards to the timber standards and guidelines and direction for Management areas 1 and 3.

The project area as defined on the maps in the appendices is the analysis area for this resource area. This analysis is separated into two sections and describes the direct, indirect and cumulative effects on Vegetation Health as a result of A) Stand Density Management and B) Other Activities Common to the Action Alternatives.

Stocking levels exceed recommended numbers in approximately 25% of the stands across all biophysical groups in the Bald Angel Planning area.

The current management strategy is to manage stands within a range of densities that maintains tree health and vigor. The lower range or lower management zone (LMZ) would maintain stocking at a point where significant portion of the site resources is captured in tree growth. The upper range of density or upper management zone (UMZ) prevents the establishment of a suppressed tree class to develop. Stands near or above the UMZ are more likely to develop stress, be less vigorous, and contain more mortality.

To restore and maintain the landscape, silvicultural treatments can be used to modify and rejuvenate the forested landscape in the analysis area. Improvement cuttings, shelterwood, commercial thinning and salvage/sanitation are types of silvicultural methods that can improve landscape health, reduce the risk of insect mortality and wildfire, begin to provide a range of structures for the long term, release potential of the sites, and alter species composition.

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Detailed analyses, literature citations, and supporting information are contained in each individual resource specialists' reports in the project analysis file at the La Grande District Office. The Inventory, Biological Evaluations, and Effect Analysis documents for Silviculture, Wildlife, Fire/Fuels, Economics, Fisheries and Watershed, Soils, PETS Species, Roads Analysis, Range, Noxious Weeds, Cultural/Heritage, and Recreation/Visuals resources are incorporated by reference in this document.

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The project area as defined on the maps in the appendices is the analysis area for this resource area. This analysis is separated into two sections and describes the direct, indirect and cumulative effects on Vegetation Health as a result of A) Stand Density Management and B) Other Activities Common to the Action Alternatives.

Stocking levels exceed recommended numbers in approximately 52% of the stands across all biophysical groups in the Bald Angel Planning area.

The current management strategy is to manage stands within a range of densities that maintains tree health and vigor. The lower range or lower management zone (LMZ) would maintain stocking at a point where significant portion of the site resources is capture in tree growth. The upper range of density or upper management zone (UMZ) prevents the establishment of a suppressed tree class to develop. Stands near or above the UMZ are more likely to develop stress, be less vigorous, and contain more mortality.

To restore and maintain the landscape, silvicultural treatments can be used to modify and rejuvenate the forested landscape in the analysis area. Improvement cuttings, shelterwood, commercial thinning and salvage/sanitation are types of silvicultural methods that can improve landscape health, reduce the risk of insect mortality and wildfire, begin to provide a range of structures for the long term, release potential of the sites, and alter species composition.

The Key indicator is as follows:

- Acres of stand density reduction accomplished

Effects Analysis

No Direct, Indirect, or Cumulative Effects

The following restoration activities associated with the Bald Angel project are of such limited and constrained nature they would not disturb the forested vegetation in the project area and would therefore have no effect on Vegetation resources or activities.

- Area Closure
- Road Reconstruction

These activities and their effects will not be discussed further in the Vegetation section.

A. Stand Density Management

Direct and Indirect Effects on Vegetative Health

ALTERNATIVE 1 – NO ACTION

Cool Grand Fir Group

Density related mortality would continue to increase and much of the understory component would be suppressed in 10 percent of this group. Many of these stands would remain in a condition of low vigor, until a disturbance occurs, which increases the risk of insect and disease damage and reduces growth potential. Competition would also have its effect on the larger component and would contribute to increased mortality. There would be a delay in attaining a healthy viable multistory condition in these stands. This delay will be until a disturbance occurs, followed by natural regeneration. There are three major disturbance factors in this group: fire disturbance with a frequency of between 35 and 100+ years, insect disturbance with greater frequencies than in the past (Scott; 1996) and forest pathogens with an unknown frequency. Fire and insect/disease risks will not be reduced and structural stages would be mostly understory re-initiation until a disturbance changes conditions.

Warmer Grand Fir/Douglas-fir-Ponderosa Pine Group

In 22 percent of these stands, fir would continue to occupy parts of the stands reducing the regeneration of seral species. Without some type of disturbance these stands would continue to have an excessive fir component. If left untreated these stands would continue to exhibit reduced growth rates and become more susceptible to diseases and insects. Fire and insect/disease risks will not be reduced and structural stages would be largely understory re-initiation and multi-stratum with large trees until a wildfire creates stand initiation conditions.

This alternative would result in a continued decline in overall forest health due to overstocking which increases susceptibility to insects and diseases, as well as, increases in fire intensities. Fuel loadings will continue to be excessive and contribute to higher fire intensities than those that would

have occurred historically. Overstocked stands would continue to be selected for haphazard stocking reduction by future insect/disease outbreaks. The warmer biophysical groups would continue to be in an overstocked, low vigor condition. The risk of losing these stands to mountain or western pine beetle would increase (Sartwell and Stevens 1975; Hessburg, Mitchell and Filip 1994). Additional growth to trees would be reduced and movement towards larger diameter trees would be delayed until densities were reduced. Cooler biophysical groups would continue to be at risk to insect/disease damage and stand replacement fires. The desired future condition of meeting stocking levels and species composition is not considered with this alternative.

ALTERNATIVES TWO THREE and FOUR

These alternatives, as noted in the table below, are a combination of improvement cuttings (HIM), shelterwood (HSH), overstory removals (HOR), commercial thinning (HTH), sanitation/salvage harvest (HSA/HSV), fuels reduction activities (HFU), prescription fire and artificial and natural regeneration. These treatments would provide stocking levels and species composition compatible with site production to promote healthy, vigorous stand conditions and begin to provide vegetative conditions in terms of structural stages and patch sizes which are within the Historic Range of Variability (HRV). Woody debris would be left on the site to contribute to the nutrient level (long term site productivity) and enhancement of small mammal habitat. Prescribed underburning in treated stands of the drier biogroups would occur in three to five years. Burning is designed to reintroduce fire in drier biogroups to emulate natural fire return interval and return fire to its role as an ecosystem process. Prescribe burning would also be done in stands to provide for additional openings to assist natural and artificial regeneration.

Summary of Acres Treated and Volume Harvested

ALT	Volume MMBF	HFU	HIM	HOR	HSA	HSH	HTH	RELEASE
		Acres						
1	0	0	0	0	0	0	0	0
2	12.5	105	962	60	183	188	3356	701
3	10.9	99	792	60	158	117	2962	701
4	9.6	99	727	60	133	79	2678	701

As stated in the Introduction above, stocking levels exceed recommended numbers in approximately 25% of the stands across all biophysical groups in the Bald Angel Planning area. Overstocking can lead to an increase in beetle populations, reduced health of the stand, decreases in production of both the overstory and understory, and alter stand structures and compositions. In many instances, stress, particularly drought stress is compounded by overstocking (Fiddler, et.al., 1995). This stress can lead to losses in tree growth and increases in insect and disease caused mortality. Appropriate stocking levels can help to increase tree growth and fire, insect, disease resistance of stands (Lambert, 1993). The number of stands treated would measure the effectiveness of the alternatives towards reducing stand density.

Under Alternative 2, 68% of the acres identified as needing silvicultural treatment are treated. 12.5 million board feet is generated from 4,869 acres. In Alternative 3, 59% of overstocked stands are treated producing 10.9 million board feet from 4,193 acres. And in Alternative 4, 53% of overstocked stands are treated with 9.6 million board feet being generated from 3,800 acres. As a result of these acres being treated the following effects would be realized in those areas within the biophysical groups as described below:

Cool Grand Fir Group

Treatments in this group would remove suppressed trees and those with poor live crown ratios (LCR), generally trees with less than 30-40% LCR, and reduce basal area to the appropriate level based on alternative. Individual stand information about stocking and management zone levels can be found in the analysis file. Reducing stand densities would enhance stand and landscape health,

while helping to create conditions that would allow a healthy understory to develop. Treated stands would provide for large structure multistory canopy across the landscape. Shelterwood cuttings in this group, would remove poor growing, less vigorous trees while maintaining most of the larger component (trees greater than 18" DBH). Overstory densities would be between 30-50 trees per acre between 7" and 21+" DBH and help to provide site conditions for a healthy understory of mixed species to develop and provide for multistory late/old structure (MSLT) in 15 to 25 years. Commercial thinnings and improvement cuttings will remove less vigorous trees and reduce densities and would provide for MSLT structure in 10-30 years. Treatments will reduce the risk of insect/disease problems and overstocking for 20-30 years.

In Alternative 3, those stands that have been designated as connective corridors or where maintaining additional canopy closure is important would be managed to higher density levels. Stand information and density levels are located in the analysis file. Managing to higher density levels would reduce the risk of insects/disease problems and overstocking for 10-15 years.

Fuels Reduction Units (HFU) in this group would cause an immediate change in fire behavior. Reducing down and standing dead, ladder fuels and trees with <20% live crown ratio would help to reduce rates of spread and fire intensity. This treatment would reduce the risk of a fire consuming a healthy, residual understory that currently exists by reducing rates of spread, decreasing intensity and flame length and making control easier. Removing the dead, ladder fuels and suppressed green trees would provide reduce fire risk for over 50 years.

Warm Grand Fir/Douglas-fir Groups

Treatments in this type would provide more disease resistance and structures more consistent with natural disturbance regimes (Schmidt 1994; Scott 1996; Schowalter and Withgott 2001). Many of these stands would begin to provide more open conditions dominated by ponderosa pine, Douglas-fir and western larch. Post harvest burning of these stands would play an important role in maintaining them. Density levels, as well as, the amount of grand fir in the stands would be reduced as long as burning is conducted.

Summary: In general the differences between direct and indirect effects of implementing all three action alternatives are relatively minor in relation to the scale of the project area over the short (1-5 years) term. However over time, the acres deferred from treatment in these alternatives will be less and less likely to receive treatment in the future due to the difficulties associated with accessing large portions of this project area. Therefore, these acres are more likely to continue under the failing forest health conditions described in Alternative One for a much longer (50+ years) period of time. More of these acres would be realized under Alternative 4 followed by Alternative 3 and 2 in that order.

Cumulative Effects for Vegetative Health

ALTERNATIVE 1 – NO ACTION

Past management activities that affected overstocking were primarily historic timber harvests. Intermediate treatments, such as thinnings, partial removals, salvage and sanitation cuttings have reduced densities and removed dead or damage trees. These activities are identified in Appendix D of this EA. Of those activities, regeneration harvest such as clearcuts, seed tree, and shelterwood cuts have removed older, mature stands and allowed for younger healthy stands to develop. Regeneration harvests have helped to alter species composition to more seral, disease resistant species. Past selective harvesting along with fire exclusion have produced excessive disturbance by pathogens and insects (Hessburg, Mitchell and Filip 1994) and has increased the amount of shade tolerant species which are more susceptible to insects and diseases. Past release treatments have helped to maintain appropriate stocking levels.

Stand structure is a function of the disturbance regimes operating within the biophysical groups. Single storied structures are generally found on sites experiencing frequent disturbance regimes

whereas multi-layered structures dominate on more mesic sites experiencing infrequent disturbance regimes. Structural distributions outside of HRV are likely to result in an increased risk of undesirable ecological change (Swanson and others 1994). It would require excessive resource protection measures to maintain a multi-layered structure within an environment historically experiencing frequent fires. Warm-dry stands in multi-layered late/old conditions that are more typical of cool environments would be treated to convert to single storied condition. Existing single storied LOS is nonexistent in the warm dry type of the project area. Manipulation of stands within the overstocked mid-seral structural stages (SECC and UR) would provide the best opportunity to begin the process of increasing the representation of SSLT structures on warm/dry sites. In the absence of density management, these stands would continue to exhibit poor growth rates when compared to site potential. This delay would lengthen the period of time that would be necessary to achieve the "large tree" component of old-growth structure and these stands would be highly susceptible to stand replacement fire.

A list of past harvest activities and their prescriptions is located in Appendix D of the EA. There have been no large fires (greater than 100 acres) in the planning area since 1963. Harvest activities have occurred in on 5,500 acres since 1990 and the effects of these are described above.

ALTERNATIVES TWO THREE and FOUR

Forested stands will continue through successional stage development. Previous harvest reduced the amount of LOS within the area. Proposed treatments will accelerate stands toward LOS and would begin to provide late/old structure within the next 20-30 years converting warm/dry MSLT stands to SSLT which will move the area toward HRV across the landscape reflecting past and present management activities. LOS treatments in this assessment are described in depth under the Wildlife section in this Chapter.

Of the other stand structures, the past and reasonably foreseeable future activities in combination with Bald Angel have a negligible effect on stand structure without a major disturbance. Understory Reinitiation stands will stay that way until they reach late and old. Some stem exclusion stands will progress to understory reinitiation when density is above the upper management zone and competition mortality opens the stand and new regeneration becomes established. Some stand initiation stands will move into stem exclusion. Hall (1993) discusses the length of time stands remain in a structural stage. In all but the lodgepole plant associations, stands remain in the early structural classes for 80 years and in the mid-structural groups 60 to 80 years before developing into late and old structure. In the lodgepole groups stands remain in the early structure for 30 years and in the mid-structure for 35 years.

Grazing has had little effect on the structural aspects of the timbered stands being considered within this project area. Grazing has utilized the forage within the earlier seral structures and it is expected that forage should be enhanced across the area over the long term from prescribed burning and stand treatments (opening of crown densities), however, there will be no cumulative incremental impact on the stand structures within the project area with grazing.

B. Other Activities Common to the Action Alternatives 2-4

Direct, Indirect, and Cumulative Effects for Vegetative Health

Common to most harvest units are "INFISH" buffers, which are 50 feet for intermittent streams and 150 feet for other streams. Many of the no harvest buffers have adequate regeneration, healthy trees and minimum amounts of mortality. Long-term implications of these no harvest buffers are minimized by the above site conditions. However, some density related mortality is expected and should provide for riparian needs.

Other actions that will occur under this environmental assessment:

1. Subsoiling: this activity would have positive silviculture effects. Areas that have had detrimental impacts would be treated which would increase the overall productivity of the sites (Howes 1997).
2. Release Treatments (Non-commercial Thinning): would have positive silvicultural effects by reducing competition, increasing growth rates and helping to maintain species composition (Streeby 1979; Powell 1999).
3. Road Closure/Rehabilitation: no adverse silvicultural effect. Rehabilitation or obliteration would reduce compaction in the analysis area which would allow for better long term site productivity, increased water holding capacity, and increased root penetration (Adams and Froehlich 1984).
4. Prescribed Burning and Mechanical Fuels Reductions: burning and fuels reduction treatments would provide for some additional openings within stands to assist natural and artificial regeneration and reduce the possibility of a wildfire damaging the residual stand. Previous prescribed fire treatments began the reintroduction of fire into areas outside historic fire return intervals, but, were primarily focused in grassy timbered stringers. Prescribed fire in this project will continue the treatments started in earlier burns, reduce fuel loadings, improve forage, and reduce encroachment into meadows and reduce the amount of grand fir in timbered stands which would have historically been Douglas-fir and, ponderosa pine. This, in combination with previous burns, would accelerate movement towards desired stand conditions to create healthier stands more resilient to effects from wildfire.
5. Planting: would have positive silvicultural effects by providing: regeneration in stands that have few viable seedlings or saplings, structural component that is lacking in some stands, and tree densities at appropriate numbers.
6. Aspen Restoration: no adverse silvicultural effect. Aspen restoration would improve biodiversity and maintain soil quality and nutrient cycling. This project will increase acres of aspen stands which are being protected in order to keep them from browsing and conifer tree encroachment. Enhancement and protection of these areas will increase the vegetative diversity within the area and allow aspen to persist where it is at risk of disappearing.
7. Noxious Weed Treatment: would have a positive silvicultural effect. By reducing weed components there would be more available resources (water, nutrients) for native plants (Sheley and others 2001).

Wildlife Effects

Introduction

The following is a wildlife effects analysis and a comparison of the project alternatives. A Wildlife Inventory describing the existing condition of habitat within the analysis area is in the analysis file. The complete Wildlife Effects Analysis and a Biological Assessment/Evaluation addressing effects to Endangered, Threatened, and Sensitive species reside in the Bald Angel Analysis File.

The analysis area is located in the Powder River/Pondosa watershed (17050203-13), subwatersheds 13D, 13E, and 13F, and the Powder River/Keating watershed (1705023-29), subwatersheds 29E, 29F, 29H, and a portion of 29D.

Two key issues concerning wildlife were identified for this project: 1) Late/Old structure (LOS) is below the historical range of variability, and 2) a deficiency in security habitat for big game. These key issues will be analyzed in terms of key indicators as a means of quantifying effects of alternatives.

Key Indicators are as follows:

- **Late/Old Structure (LOS)**
 - 1) acres of UR accelerated toward LOS;
 - 2) acres of MSLT converted to SSLT, and
 - 3) acres treated within connective corridors.

- **Big Game Cover**
 - 1) acres of satisfactory thermal cover that will be converted to marginal thermal cover or forage;
 - 2) acres of marginal thermal cover converted to forage; and
 - 3) percent of analysis area further than 0.90 km (moderate quality security habitat) from a motorized route.

Analysis Assumptions - Temporal Considerations

The duration of effects are discussed when relevant or practical to predict. The following timeframes will apply for the purpose of this analysis. I feel these timeframes are appropriate given the scale of this analysis and the duration of effects expected from the prescribed treatments.

Short term	0 – 20 years
Mid term	20 – 80 years
Long term	Greater than 80 years

Analysis Assumptions - Historical Range of Variability and Old Growth (LOS Structure)

The analysis area for LOS dependent wildlife species (including marten, goshawk, and pileated woodpecker) is the subwatersheds that comprise the HRV analysis area. The reason HRV is important to wildlife populations is because the distribution, quality and quantity of habitat largely determines the potential for a wildlife species to exist at viable levels. Therefore, by managing habitat within the historical range of variability it is assumed that adequate habitat will be provided because species survived under those conditions previously. The further current conditions depart from HRV the less likely adequate habitat is being provided to sustain those species associated with the habitat. American marten, northern goshawk and pileated woodpecker are management indicator species that represent old growth and mature forest habitat. These species are closely associated with old growth and mature forest habitat which equates to “multi-strata large trees common (MSLT)” and “single-strata large trees common (SSLT)” structural stages.

An analysis of the historical range of variability (HRV) was done to assess how current forest conditions compare to pre-settlement conditions. Key issue #1 is that LOS habitat is below the HRV. Forest Plan amendment #2 (formerly referred to as Screens) contains standards and guidelines (S&Gs) that address HRV. Structural stages referred to in this document are from "Recommended Definitions for New Structural Stages Per Amendment #2", 11/09/95. “Biogroups” is an abbreviated term for biophysical environments, groupings of forest stands based on moisture regime, temperature, and disturbance regime. Table 2 contains abbreviations for structural stages. Late/old forest structure (LOS) is synonymous with SSLT and MSLT combined.

Structural Stage Abbreviations

Structural Stage	Abbreviation
Stand Initiation	SI
Stem Exclusion Open Canopy	SEOC
Stem Exclusion Closed Canopy	SECC
Understory Reinitiation	UR
Multi Strata Large Trees Uncommon	MSLTU
Multi Strata Large Trees Common	MSLT
Single Strata Large Trees Common	SSLT

The northwest, north central, and north eastern portions of this analysis area are dominated by mixed conifer forests and are highly fragmented by created openings. The term “created opening” is used relevant to wildlife species that require or prefer closed canopy forest habitat, which is not consistent with the definition used when discussing the regeneration status of stands. Many of these created openings are regenerating to the point where they can provide hiding cover for some species, but have not developed the large trees, snags, logs, and canopy closure necessary to support old growth associated wildlife species. To species such as marten, pileated woodpecker, and goshawk these openings are inhospitable environments that will generally be avoided. This has led to these wildlife species being restricted to smaller parcels of habitat, which decreases distribution across their available habitat. This in turn increases the probability of local extirpations when disturbances (natural or anthropogenic) impact remnant habitat patches.

The components of MSLT and SSLT that are particularly important to pileated woodpecker and marten are large diameter live trees, large diameter snags and logs, multiple canopy layers, and contiguous forested habitat with low fragmentation. Goshawks share similar habitat needs, but is more of a forest generalist that does best when an old growth component is present (DeStefano pers com 1995). Goshawk is covered in more detail later in this report.

The concept of source habitats was utilized to assess the risks associated with departure from HRV for late/old forest habitat. “Source habitats are those characteristics of macrovegetation that contribute to stationary or positive population growth for a species in a specified area and time” (Wisdom 2000). Wisdom et. al. refers to “groups”, and the relevant groups for this late/old forest habitat discussion are groups 1, 5 and 6. Group 1 includes pygmy nuthatch, white-breasted nuthatch, and white-headed woodpecker. Group 5 includes American marten, fisher, flammulated owl, and summer habitat for northern goshawk. Group 6 includes pileated woodpecker, Vaux’s swift, Williamson’s sapsucker, Hammond’s flycatcher, chestnut-backed chickadee, brown creeper, winter wren, golden-crowned kinglet, varied thrush, silver-haired bat, and hoary bat.

Generally source habitat had experienced dramatic decreases for groups 1, 5 and 6 across much of the Interior Columbia Basin. More than 40% of the watersheds within the Blue Mountains ecological reporting unit (which contains the Bald Angel analysis area) have experienced a decrease of $\geq 60\%$ in source habitats for groups 1, 5 and 6. The watershed that contains the Bald Angel analysis area has seen a reduction of source habitat for group 1 of $\geq 60\%$, a reduction of source habitat for group 5 of $\geq 20\%$, and an increase in source habitat for group 6 of $\geq 60\%$. Wisdom et. al. offers potential strategies for reversing the broad-scale declines in source habitats and associated wildlife populations for group 1:

- 1) Retain stands of interior and Pacific ponderosa pine where old-forest conditions are present, and actively manage to promote their long-term sustainability;
- 2) Restore dominance of ponderosa pine to sites where transition to other cover types has occurred;
- 3) Accelerate development of late-seral conditions, including snag recruitment, within stands that are currently in mid-seral stages;
- 4) Include provisions for snag retention and snag recruitment where needed in all management plans involving forests used as source habitats for group 1;
- 5) Reduce risk of stand-replacing fires in late-seral ponderosa pine; and

- 6) Maintain existing old cottonwood-willow stands, and identify younger stands for eventual development of old-forest structural conditions.

Potential strategies for group 5:

- 1) Increase the representation of late-seral forests in all cover types used as source habitats;
- 2) Increase connectivity of disjunct habitat patches and prevent further reduction of large blocks of contiguous habitat patches;
- 3) Identify potential species strongholds for long-term management of marten and fisher;
- 4) Reduce human disturbances in source habitats;
- 5) Restore aspen and cottonwood-willow forests;
- 6) Reduce the risk of loss of habitat by focusing old-forest retention and restoration efforts on areas where fire regimes are either non-lethal or mixed;
- 7) Maintain stands with active goshawk nests in old-forest condition; and
- 8) Embed the conservation of old forests within a larger, ecosystem context that considers historical fire regimes and landscape patterns and the habitat needs of species that are prey of the members of this group (essentially an HRV approach).

Potential strategies for group 6 include:

- 1) Accelerate development of late-seral conditions in lower montane, montane, and subalpine forest types and retain large snags and logs in all forest seral stages;
- 2) Restore forest conditions that are more resistant to catastrophic fire, insects, and disease problems, while retaining sufficient habitat to support species in this group;
- 3) Maintain and improve riparian shrubland and riparian woodland communities;
- 4) Protect known and potential bat roosts;
- 5) Minimize direct physiological effects on bats, as well as indirect effects on their insect prey (insecticides and pesticides); and
- 6) Modify management practices as appropriate to enhance the insect prey base for bats.

Tables 5 and 6 in the Wildlife Inventory contain HRV figures for late/old structural stages. Figures in these tables do not provide information on patch size, distribution or connectedness, so their utility is limited.

The largest deficiencies are in SSLT and MSLT structural stages. There are only 17 acres identified as SSLT in the entire analysis area where there should be somewhere between 1,133 and 4,144 acres (all biogroups combined). MSLT structure is most lacking in biogroup G4 where the HRV is 2,212-4,423 acres, but only 422 acres currently exist. UR stands can be accelerated toward LOS structure through intermediate prescriptions that remove poor quality, smaller diameter trees, and retain the largest, best condition trees. Therefore, one of the key indicators for this issue is acres of UR treated to accelerate development of LOS.

Connective corridors between MA-15 areas and LOS habitat patches were delineated according to criteria from the Forest Plan Amendment #2. Corridors range in quality from highly functional to practically non-functional, but they represent the best options available. Harvest activities in Alternatives 3 and 4 within identified corridors were designed to at least meet the minimum criteria of connective corridors as described in Forest Plan Amendment #2, but a reduction in the quality of these corridors will result, and will persist through the short-term. Specific modifications were made to address connective corridors in Alternatives 3 and 4. This reduction in quality results from reduced canopy closure, reduced structural complexity, and reduced log and snag numbers. A key indicator is acres treated within connective corridors. The more acres treated, the greater the negative effect, at least during the short-term. Mid and long-term effects from treatments in these corridors are likely negligible.

Effects Analysis

No Direct, Indirect, or Cumulative Effects

The following restoration activities associated with the Bald Angel project are of such limited and constrained nature due to their small scale and shortness in duration that they would produce negligible effects on big game habitat or old growth.

- Stand Cleaning
- Tree Planting
- Site Preparation Burning
- Road Maintenance

These activities and their effects will not be discussed further in this Wildlife section.

A. Late/Old Structure

Direct and Indirect Effects on LOS

Comparison of Key Indicators by alternative for LOS.

Key Indicators	Alternative			
	1	2	3	4
Acres of UR accelerated toward MSLT/SSLT	0	2,811	2,501	2,251
Acres of MSLT converted to SSLT (warmer/drier biogroup types)	0	1,107	997	997
Acres of treatments within connective corridors	0	937	604	516

ALTERNATIVE 1 - NO ACTION

Alternative 1 will result in no direct effects to wildlife. The existing level of old growth habitat will contribute modestly to the old growth associated wildlife community into the long term in the absence of large scale disturbances. This analysis area will continue to function as a sink for old growth associated wildlife species well into the mid-term. See source/sink discussion on pages 4 and 5 of the Wildlife Inventory.

No new specified, reconstructed, or temporary roads occur with this alternative. Additionally, up to 80 miles of road planned for decommissioning or promulgated closure would not occur. The promulgated area closure that would eliminate cross country motorized travel would also not occur. Therefore, the negative effects associated with road construction (loss of snags) and the positive effects of road/area decommissioning/closure would not be realized. A road density of about 3.8 miles per square mile would exist with this alternative.

Stands within drier biogroups G5, G6 and G7 would continue to function as MSLT, predisposing the larger trees to threats of fire, insects and diseases. This alternative would be inconsistent with strategies #1 and 2 for group 6, and strategies #1, 2, 3, and 5 for group 1.

Perpetuating MSLT structure in drier (G5 biogroups) stands would benefit species like pileated woodpeckers that are currently using them, but there are risks associated with retaining this structure that could result in long-term loss of large diameter trees, namely ponderosa pine and Douglas-fir. In the event that large overstory ponderosa pine is lost to fire or insects, species such as white-headed woodpecker, flammulated owl, and pygmy nuthatch could suffer setbacks, as well as pileateds and

other species using these stands. These species are already poorly represented due to low levels of their source habitat (SSLT).

This alternative will not affect the allocated old growth (MA 15) network established by the Wallowa-Whitman LRMP to meet management requirements for marten and pileated woodpecker. The forested habitat between MA 15 areas will progress toward LOS habitat slower under the no action alternative than under the action alternatives.

ALTERNATIVE 2

Alternative 2 would accelerate development of MSLT structure by treating 1,169 acres of UR (and lesser amounts of SECC & SEOC) stands in biogroups G3-G4. Generally biogroups 3 and 4 represent cooler, moister plant associations capable of developing and persisting in an MSLT condition. Intermediate prescriptions (HTH, HSA, HIM, HFU) applied to UR stands are expected to set these stands up for development of MSLT structure in the mid and long-term. This is consistent with potential strategies #1, 6 and 8 for group 5 (Wisdom 2000). Regeneration treatments (HSH, HOR, HCR) will return UR stands back to an earlier structural stage before they can begin progressing toward late/old forest structure. The regeneration stands would experience a set back, but the quality and species composition of trees in these stands would not respond to intermediate treatments in a manner that would accelerate development of late/old forest structure.

Biogroups 5-8 represent warmer, drier plant associations that typically develop into SSLT. Intermediate treatments will accelerate 4,606 acres of UR, SECC and SEOC stands in biogroups 5-8 toward SSLT. Additionally, 1,107 acres of existing LOS structure would receive maintenance type treatments aimed at restoring SSLT character and reducing fuel loading that resulted from fire exclusion. These treatments will not result in a net decrease in LOS habitat, but will reduce structural complexity in the short-term at the stand scale. These treatments are consistent with potential strategies #1 and 2 for group 6 and strategies #1, 2, 3, and 5 for group 1 (Wisdom 2000).

This alternative involves 2.25 miles of new road construction and 8.88 miles of temporary road, 5 miles more than Alternative 3. Any new roads, even temporary roads can lead to easier access into timbered stands for the removal of firewood and recreational off highway vehicle riding. Unless these temporary roads are made impassable following logging, increased loss of structure is expected from a reduction in sound logs and snags by firewood cutters, and the potential for disturbance increases from motorized access. A promulgated area closure that restricts motorized vehicles to specified roads would largely mitigate the potential for increased disturbance and loss of snags.

This alternative includes 80 miles of road for promulgated closure and decommissioning and a promulgated area closure that would essentially decrease the open road density to approximately 2.33/miles per square mile. The effect of these roads being decommissioned and the area closure is reduced potential for disturbance from motorized vehicles, and increased retention of snags and logs important to the function of LOS habitat.

Alternative 2 would have a greater negative impact on habitat used by old growth associated wildlife than Alternatives 3 and 4 in the short and mid-term since it reduces canopy closure and structural complexity on more acres, and includes more road construction. Alternative 2 accelerates more acres toward old growth in the future, while reducing already limited habitat values on more acres in the short and mid-term.

Prescribed fire burn blocks encompass 24,367 acres in Alternative 2. These represent logical burn boundaries defined by roads or other features that could serve as boundaries. Not all acres within these burn blocks would actually be burned, and it is difficult to accurately assess the actual acres that are to be burned. Effects to LOS from burning are reduced snags and logs, particularly those in the later stages of decay. New snags and logs are typically created from burning, but they are usually sound and not easily excavated. Burning creates a period of reduced "soft snag" habitat that

persists into the early mid-term. This can cause wildlife species that depend on such structures to move to other areas in search of suitable habitat, resulting in lower productivity and reduced local populations.

ALTERNATIVE 3

Alternative 3 would accelerate development of MSLT structure through intermediate treatments in 717 acres of UR (and lesser amounts of SECC & SEOC) stands in biogroups G3-G4. Intermediate treatments will accelerate 2,656 acres of UR, SECC and SEOC stands in biogroups G5-G8 toward SSLT. These treatments would benefit the MA 15 network established by the Wallowa-Whitman LRMP to meet management requirements for pileated woodpecker and marten. Although the allocated old growth areas would not be directly affected, a trend toward increased LOS structure would enhance the MA 15 network by increasing connectivity and providing more habitats for reproduction and foraging for both marten and pileated woodpeckers.

Additionally, 997 acres of existing MSLT would receive maintenance type treatments aimed at restoring SSLT character and reducing fuel loading that resulted from fire exclusion. These treatments will not result in a net decrease in LOS, but will reduce structural complexity in the short-term at the stand scale.

This alternative includes 1.42 miles of new road construction and 3.94 miles of temporary road, 5 fewer miles than Alternative 2. The quality of LOS could be reduced due to easier access into or nearer to LOS stands, facilitating firewood removal and disturbance to wildlife from motorized vehicles. These effects could be reduced to very short duration (during project implementation) if temporary roads are made impassable following logging. The area closure included in this alternative would largely ameliorate the effects of temporary roads by reducing access for firewood cutting off of open roads.

This alternative includes 80 miles of road for closure/decommissioning and a promulgated area closure that would essentially decrease the open road density to approximately 2.32/miles per square mile. The effect of these roads being decommissioned and the area closure is reduced potential for disturbance from motorized vehicles, and increased retention of snags and logs important to the function of LOS habitat.

Alternative 3 would have less of a negative effect on habitat used by old growth associated wildlife than Alternative 2 in the short and mid-term. Alternative 3 accelerates fewer acres toward late/old structure than Alternative 2, but maintains more wildlife habitat values in the interim than Alternative 2. Considering the number of acres that have been previously thinned, and the acres being proposed in Alternative 3, ample acres will be in a condition to meet HRV objectives in the later part of the mid-term.

Prescribed fire burn blocks encompass 23,460 acres in Alternative 3. These represent logical burn boundaries defined by roads or other features that could serve as boundaries. Not all acres within these burn blocks would actually be burned, and it is difficult to accurately assess the actual acres that are to be burned. However, site-specific exclusions have been agreed to between wildlife and fire personnel to keep fire out of high quality LOS stands and big game cover stands where fire could negatively affect habitat values. Approximately 1,200 acres will be excluded from burning in Alternative 3 to retain habitat values in LOS and big game cover stands. More site-specific modifications are likely to occur to protect areas with high quality LOS habitat, and that cannot be safely burned without high risk of killing overstory trees.

ALTERNATIVE 4

Alternative 4 would have very similar effects as Alternative 3, with the following exceptions. No new roads, specified or temporary, would occur in this alternative. This reduces the level to which LOS is exposed to increased removal of snags and logs from fire wood gathering. No new roads also

reduces the level of fragmentation of forested stands at a scale that is meaningful to small mammals, some bird species, amphibians and reptiles.

From the analysis area scale, the difference between Alternatives 3 and 4 is negligible in regard to HRV and LOS forest structure.

Cumulative Effects on LOS

No fewer than 37 timber sales or portions thereof, have occurred within the analysis area between 1970 and the present. These projects have included combinations of intermediate and regeneration harvests that have fragmented and changed the structure of several thousand acres of forested stands, particularly LOS. The extensive road networks built to facilitate these logging operations has left a long-term imprint on the area that continues to provide access for recreationists, permittees, and Forest Service personnel. About 3,345 acres of prescribed burning has taken place in the area from 1986-1997. The Bald Angel project is considered in combination with these past management activities to assess cumulative effects.

ALTERNATIVE 1 - NO ACTION

Alternative 1 does not represent an incremental effect to LOS habitat that would contribute to other past, present and reasonably foreseeable future actions. Indirectly this alternative will not contribute to restoration of overstocked forested stands, resulting in increased time (approximately 40 years longer) to achieve LOS structure in many UR stands. This alternative would perpetuate the current level of disturbance and loss of snags and logs from firewood cutting since no restrictions on motorized access would be implemented. This effect is expected to increase over time and is likely to lead to reduced capacity of the area to support snag dependent wildlife species and species that avoid areas affected by motorized traffic.

Connectivity between MA 15 areas and LOS patches would not change in the short-term under the no action alternative. Structural complexity and canopy closure would only change as natural succession or disturbances dictate. This alternative would have the least negative effect to connectivity during the short-term. It is not known what effects this alternative could have on connectivity in the long-term.

ALTERNATIVE 2

Alternative 2 would contribute to cumulative effects by reducing canopy closure and structural complexity on 5,168 acres in addition to past regeneration harvest units that have not recovered to support LOS associated wildlife species. This represents a positive effect for some species and a negative effect for others, and the effect varies between the drier stands in the south and the moister stands in the north. Wildlife species adapted to LOS in biogroups G5-G8 in the southern portion of the analysis area are likely to benefit from these treatments as more open ponderosa pine stands are restored. Pygmy nuthatches, flammulated owl, and white-headed woodpeckers are examples of species that would benefit from treatments that restore or accelerate development of SSLT. Conversely, in the central and northern portions of the analysis area where biogroup G4 predominates, simplifying structure and reducing canopy closure represents a decrease in habitat quality for many wildlife species. Northern goshawk, pileated woodpecker, American marten, and elk are examples of species that show a preference for higher canopy closure and generally more complex forest stands for at least parts of their life histories.

The negative effects of reduced canopy closure and structural complexity could result in poor distribution of some species across available habitat, or could reduce prey base for predator species like the goshawk. Reduced prey base and poor distribution can lead to reduced reproductive rates, reduced juvenile survival rates, and in some cases local extirpations.

There would be a reduction in the number and quality of connective corridors that facilitate movement of animals between MA 15 areas and LOS patches. The units or portions of units

described in Chapter 2 (p. 35), occur within connective corridors, and their quality would be reduced under Alternative 2. In many cases the corridors would be rendered unsuitable into the mid-term as prescriptions take basal area to the lower management zone. These effects are likely to persist through the short-term, but would neutralize some time during the mid-term. These effects combined with past roading and logging have necessitated addressing connectivity between specific stands. Eventually (long-term) stand conditions will recover to a point where all species of wildlife will have multiple options for moving between habitat patches without the need for corridors to be identified and managed.

ALTERNATIVE 3

Alternative 3 would contribute to cumulative effects by reducing canopy closure and structural complexity on 4,453 acres in addition to past regeneration harvest acres that have not recovered to support LOS associated wildlife species. Alternative 3 moves stands toward HRV while retaining more habitat values in the interim than alternative 2. As SSLT structure becomes more common in the long-term, source habitats for species in group 1 will develop.

The potential negative effects of reducing canopy closure and structural complexity are the same as described for cumulative effects for Alternative 2, but would occur on 715 fewer acres. One notable difference between these alternatives is that Alternative 3 would have less of a negative effect on connective corridors between MA 15 areas and LOS patches. Mitigations were built into Alternative 3 to ensure the function of connective corridors. Some units were modified in shape; some prescriptions were changed to retain basal area in the upper half of the management zone; and some were deferred altogether. Details of these modifications are described in the Wildlife Analysis of Effects in the Bald Angel Analysis File. Alternative 3 would have less of an effect on connectivity than Alternative 2, but more than Alternatives 1 and 4. Cumulatively these unit modifications will lessen the negative effects to the limited connectivity network created by past regeneration harvests.

ALTERNATIVE 4

Alternative 4 would have very similar cumulative effects to LOS habitat as Alternative 3, except there would be no new roads, 88 fewer acres treated in connectivity corridors, and structural complexity and overstory would be reduced on 412 fewer acres. Alternative 4 represents the least negative incremental effect to LOS associated wildlife species in the short and mid-term. The difference between the action alternatives is negligible in the long-term relative to LOS.

B. Rocky Mountain Elk

Rocky Mountain elk, mule deer, white-tailed deer, black bear and cougar are the big game species that occur in the analysis area. However, elk is recognized in the LRMP as an indicator species and will be the focus of this big game habitat analysis. Historically many biologists believed that managing for quality elk habitat would also provide well for mule deer. This thinking has been challenged as researchers uncover more information on mule deer habitat selection and how elk and deer distribute themselves in relation to one another. Currently the most meaningful management standards exist for elk habitat, and it is commonly accepted that the other big game species are at least partially accommodated when high quality elk habitat is present. The analysis area for elk is the subwatersheds that overlap the project area. For further discussion of this resource refer to the Wildlife Reports in the Bald Angel Analysis File.

Comparison of key indicators for big game security habitat.

Key Indicators	Alternatives			
	1	2	3	4
Acres of satisfactory cover converted to marginal cover	0	1,796	1,357	1,162
Acres of satisfactory cover converted to forage	0	47	25	25
Acres of marginal cover converted to forage	0	3,118	2,771	2,596
HEI r value using road density	0.36	0.36	0.36	0.36
HEI r value using distance bands	0.17	0.19	0.19	0.20
Total HEI using road density*	0.55	0.56	0.56	0.56
Total HEI using distance bands*	0.43	0.45	0.45	0.46
Percent of area >0.90 km from open motorized route	.05%	17.25%	17.25%	>17.25%

*HEI calculations do not include a forage variable because current, reliable forage data are not available.

In addition to the key indicators above, other means of comparing alternatives include road densities and HEI values were used. A distance band analysis was used to assess security habitat by calculating the percent of the analysis area that is further than certain distances from open motorized routes. A visual depiction of the existing condition (before any new roads, or road closures) distance band analysis is provided in Appendix A of the Wildlife Effects Analysis in the Bald Angel Analysis File.

The table above is a comparison of key indicators for big game habitat quality. The model is relatively insensitive to minor differences between alternatives, and particularly at such a large scale.

Direct and Indirect Effects Elk Habitat

ALTERNATIVE ONE

Alternative 1 will not result in direct effects to big game security habitat, but will forego some opportunities to improve habitat conditions in the short and long-term. This alternative would be the least impacting to big game populations in the short-term. Current levels of cover will remain and continue to positively influence the distribution of elk and deer across available habitat. The areas that are poor to fair quality cover (marginal thermal cover) today are important to the elk population while created openings are growing back into a cover condition.

Unregulated ATV and full-sized vehicle use will continue to increase and compromise security habitat for elk. The lack of secure habitat patches will continue to push elk onto adjacent private lands making them unavailable for wildlife viewing and hunting. Some elk may also respond to disturbance by moving into the adjacent Eagle Cap Wilderness where low to moderate densities of elk already exist. The current densities of roads open to motorized access results in 0.5% of the analysis area further than 0.9km from a road. This means that only a half of a percent of the area meets the criteria for moderate quality security habitat, and the remaining 99.5% is low or poor quality security habitat.

Forage enhancement through prescribed burning would not occur in this alternative. Decadent shrubs and grasses that have been absent of fire for several decades will continue to provide marginal quantities and quality of forage.

ALTERNATIVE 2

Alternative 2 would result in the greatest negative effect to elk habitat and populations in the short and mid-term. Long-term effects from this alternative would likely be negligible in the absence of large disturbances. This alternative would convert 1,796 acres of satisfactory cover to marginal cover and 3,118 acres of marginal cover to forage. Forty-six percent of the analysis area would remain in a thermal cover condition (33% marginal and 13% satisfactory). This reduction in cover would persist through the short-term, but many of these acres would recover to at least a marginal cover condition by the early part of the mid-term.

Alternative 2 includes 614 acres of cover (marginal and satisfactory combined) in units 19, 64, 101, 117, 120, 65, 32, 94, 99, 2, 9, 16, 42, 43, 85, 114, 115, 17 and 18. Treatment of these units would fragment or reduce cover quality in areas that are lacking cover. Although intermediate treatments are proposed in these units, the resulting reduction in cover will persist for ten to twenty years. This would worsen the cover/ forage patch arrangement in specific areas where cover has already been severely reduced by past logging.

Prescribed burning on over 24,000 acres would likely improve forage quality and persistence later into the summer. Low level cover provided by shrubs and small trees would be set back in the short-term, but would return in three to ten years, depending on the species. The benefits to big game habitat from burning often outweigh the negatives in relatively open timber and grasslands like those found in the southern half of this analysis area. Effects of burning would not differ between the action alternatives.

This alternative includes an area closure that would reduce unregulated motorized travel, thereby improving security habitat for big game. Approximately 17.25% of the analysis area would be further than 0.90 km from an open motorized route, which represents marginal quality security habitat. This represents a notable improvement from the current condition and would likely improve the distribution of elk on spring, summer and fall ranges.

ALTERNATIVE 3

Alternative 3 would have a greater negative effect to elk habitat than Alternatives 1 and 4 in the short-term, but less than Alternative 2. This alternative would convert 1,357 acres of satisfactory cover to marginal cover and 2,771 acres of marginal cover to forage. The effects of setting stands back to marginal cover would persist through the short-term, but would recover to a cover condition by the early part of the mid-term. Forty-seven percent of this analysis area would remain in a thermal cover condition (32% marginal and 15% satisfactory). This alternative retains at least 614 acres of important cover for the short-term that would be converted to forage or reduced to marginal cover with Alternative 2.

This alternative proposes to burn approximately 900 fewer acres than Alternative 2. This difference is likely negligible when considering the large scale of the burning. Prescribed fire on over 23,000 acres would improve forage quality and quantity, and persistence later into the summer months.

Like Alternative 2, this alternative also includes an area closure that would effectively create areas of low human disturbance, positively influencing the distribution of elk. Approximately 17.25% of the analysis area would be further than 0.90 km from an open motorized route, which represents marginal quality security habitat. This represents a notable improvement from the current condition and would likely improve the distribution of elk on spring, summer and fall ranges. Improved distribution of elk herds can alleviate private land complaints, provide more elk on public lands for hunting and viewing, and contribute to improved herd conditions (body fat, cow:calf ratios, bull escapement, etc.) Although 17.25% of the area being restored to security habitat does not address the scale of the elk distribution problems in this area, it initiates a positive trend.

ALTERNATIVE 4

Alternative 4 effects would be very similar to Alternative 3 except 175 fewer acres of marginal cover would be converted to forage, 195 fewer acres would be converted from satisfactory cover to marginal cover, and no new roads would be constructed. See the table above for a comparison of how alternatives will affect elk habitat effectiveness and security habitat. This alternative would have the least negative effect on elk distribution, and herd condition of all the action alternatives.

Cumulative Effects for Elk Habitat

ALTERNATIVE ONE

Alternative 1 will not contribute to the cumulative effects of past management in this analysis area. Ample acres have been treated through regeneration harvest, site prep burning, planting and non-commercial thinning to provide adequate cover in the long-term. No roads will be obliterated or closed and promulgated, and unregulated cross country motorized travel will continue to increase. Prescribed fire will not be used to promote higher forage quality and persistence later into the summer as with the action alternatives. Ponderosa pine stands in biogroups G5-G8 will continue to be overstocked and susceptible to stress and mortality from insects and wildfire. Grazing by cattle will continue in six allotments that occur at least partially in this analysis area. Grazing by cattle throughout August, September, and part of October reduces available forage for elk and deer prior to going into the rut. These effects can lead to elk and deer going into breeding and winter seasons with less body fat than necessary to survive or successfully reproduce. These effects will persist and will not change as a result of Alternative 1.

ALTERNATIVES 2, 3, and 4

Cumulative effects from Alternative 2 would be greater than Alternatives 3 and 4 in regard to elk and their habitat; however the significance of the difference is difficult to determine. The primary difference is that Alternative 4 retains more cover and some specific cover stands that are important to elk and deer. A better interspersion and juxtaposition of cover to forage will be attained by Alternative 4.

All action alternatives include an area closure that would eliminate unregulated cross country motorized travel. This would create some sizable patches of security habitat with low levels of human intrusion. The presence of security areas would have a positive effect on elk distribution and bull escapement during hunting seasons.

Prescribed burning in all action alternatives will generally benefit big game through forage enhancement. Periodically burned grasslands typically provide higher quality forage later into the year than stagnant grasslands that have missed some fire returns. Fire would also regenerate some shrub communities that are decadent and currently functioning only as low cover. Fire would create a mosaic of cover and forage that closer represents historical conditions. Effects to forage from prescribed fire would not differ between action alternatives since there is less than 1,000 acres difference between them. Prescribed fire would be scheduled out over multiple years to avoid depleting forage over such a large area at one time.

Grazing by cattle will continue in six allotments that occur at least partially in this analysis area. Grazing by cattle throughout August, September, and part of October reduces available forage for elk and deer prior to going into the rut. This can lead to elk and deer going into breeding and winter seasons with less body fat than necessary to survive or successfully reproduce. These effects will persist and will not change as a result of any of the action alternatives.

Release thinning included in all action alternatives would result in a short-term reduction in hiding cover, but hiding cover would be restored in these stands within 10 years. The nature and scale of this activity is negligible in terms of habitat effectiveness for big game, but does change hiding cover

which can influence how elk use an area at a localized scale. Approximately 1,374 acres of release thinning (release and cleaning inside and outside of commercial harvest units) would occur with Alternative 2 and 1,060 acres under Alternatives 3 and 4. Slightly more hiding cover would be retained with Alternatives 3 and 4 than Alternative 2.

Effects to big game habitat are similar between the action alternatives, but Alternatives 3 and 4 retains some specific cover patches that are locally important to elk. By deferring these key cover stands, negative effects on elk distribution will be reduced. The differences between the action alternatives are negligible in terms of HEI. The HEI model is not sensitive enough to reflect the difference between the action alternatives. If calculated, the HEI value for Alternative 4 would be slightly higher than for Alternatives 2 and 3. However, the specific cover stands retained in Alternatives 3 and 4 when considered with the proposed area closure combine to improve conditions for elk to a much greater degree than indicated by the HEI model.

The proposed road obliterations and promulgated area closure will result in improvements to big game habitat. The road obliterations and promulgations, if successful in discouraging off highway vehicle access, could improve habitat effectiveness for deer and elk through a reduction in disturbance and an increase in bull and buck escapement. Alternative 4 provides for more security habitat than Alternatives 2 and 3 by retaining more cover stands and building no new roads.

Fire and Fuels Management

Introduction

This resource area will address the key issue related to the "Area being outside of historic fire return intervals and some areas are above desired fuel loading with dense ladder fuel arrangements".

The Wallowa-Whitman NF uses two separate models, Ecological Fire Risk Assessment, and the Fire Hazard Assessment Process to describe landscape composition in relationship to fire risk. Each process is described below and evaluates fuel and fire conditions within the 5th HUC watershed (sub-watersheds). The models use the key indicators mentioned below to analyze the effects of alternatives related to the key issue. There are approximately 28,741 acres within the analysis area for this project. Of those acres, 24,367 acres are at high or moderate fire risk due to their fire regime rating (1 and 3) and their condition class rating (2 and 3). The remaining 4,374 acres within the project area are in light grassy fuel types, which are scattered throughout the project area and are at a low risk in the event of a fire. This analysis will focus on the 24,367 acres of mod-high risk acres within the project area and not include the low risk acres as this project will have the same effect on these acres across all action alternatives.

Environmental effects of an action can be expressed as direct, indirect, or cumulative. Direct and indirect effects will be those that generally occur within 1-10 years following implementation. Cumulative effects would be those actions that include past, present, proposed in the reasonably foreseeable future (up to 5 years) following implementation.

The analysis area for direct, indirect, and cumulative effects is the same as the project area shown on the maps in the appendices and incorporates information on activities described in Appendix D of this EA.

Key Indicators used to compare the alternatives are as follows:

Fire Regime Departure

- Acres treated within fire regimes of high departure from historical fire return intervals
- Acres treated within fire regimes of moderate departure from historical fire return intervals

Wildfire Risk

- Acres treated with high or moderate risk to wildfire damage due to heavy fuel loadings

Mechanical treatments offer solutions of pre-treating areas that are overstocked, have a ladder fuel component of shade tolerant fir, and/or have heavy concentrations of standing dead and down fuels. The mechanical treatment options can include tree removal (harvest), non-commercial thinning, stand cleaning, grapple piling, slash busting, and hand piling. These pre-treatment applications help re-introduce low intensity fire in fire regimes 1 and some of 3 within action alternatives.

Ecological Risk Assessment

The *Ecological Fire Risk Assessment* exhibits; by each fire regime, stand conditions that have transitioned to density and complexity uncharacteristic of historical patterns. The model inputs contain data based on dense canopy closure, stand structure layers, and tree densities that represent deviation from historic fire return intervals. Due to the infrequent fire return intervals in the Bald Angel analysis area condition classes are contributing to higher fire risk potential; (see chapter one of EA for condition class definitions).

Table 1 - shows existing condition of the area by fire regime (FR), condition class (CC), and mechanical treatment by alternatives:

Fire Regime/ Condition Class	Total Existing Acres	Mechanically Treated Acres (% of total)			
		Alternative 1	Alternative 2	Alternative 3	Alternative 4
FR 1/CC 2	2,120	0	106 (5%)	106 (5%)	106 (5%)
FR 1/CC 3	10,577	0	1,769 (17%)	1,682 (16%)	1,493 (14%)
FR 3/CC 2	2,254	0	468 (21%)	265 (12%)	265 (12%)
FR 3/CC 3	9,416	0	2,311 (25%)	2,103 (22%)	1,906 (20%)
Totals	24,367	0	4,654 (19%)	4,156 (17%)	3,770 (15%)

Table 2 - shows existing condition of the area by fire regime, condition class, and prescribed burning by alternatives. The percent reduction is related to: (Condition A-E in Prescribed Fire Description under Common Elements in Chapter 2).

Fire Regime/ Condition Class	Total Existing Acres	Acres of Re-introduction of Fire (Conditions A-E)			
		Alternative 1	Alternative 2	Alternative 3	Alternative 4
FR 1/CC 2	2,120	0	1,060 (50%)	860 (41%)	860 (41%)
FR 1/CC 3	10,577	0	7,933 (75%)	7,635 (72%)	7,446 (70%)
FR 3/CC 2	2,254	0	1361 (50%)	1061 (47%)	1061 (47%)
FR 3/CC 3	9,416	0	4,708 (50%)	4,306 (46%)	4,018 (43%)
Totals	24,367	0	15,062 (62%)	13,862 (57%)	13,385 (55%)

Note: Condition D (as described on page 29) can be a component of any Fire Regime containing a pre-commercial or stand cleaning within the last 5 years consisting of mixed conifer regeneration. These areas would be excluded from under burning for approximately 10 years after the activity. Burning could occur around the edges, however the goal would be to minimize impact to these plantations and stands.

Fire Hazard Assessment

The *Fire Hazard Assessment* evaluates three critical elements: fire occurrence, hazard, and consequence. Fire Occurrence is the total number of fire ignitions during a selected timeframe, within a determined location. Hazard is assigned a value derived from the existing fuel model; the hazard value also considers percent slope, aspect, elevation, and stand structure. Consequence is assigned a value based on resources or areas of concern if exposed to high intensity fire. For example, a high numeric value would be mapped old growth, municipal watersheds, and private lands. Risk is the summary value of the three inputs. Risk is defined as the potential for resource loss or “damage” due to high intensity fires.

Seventy-three percent of the analysis area is in a moderate or high risk category as described by level of risk. The charts below show existing condition of the area by risk and acres proposed for mechanical treatment and prescribed burning by alternative.

Table 3 - Mechanical and Prescribed Fire treatment acres by alternative.

Mechanical Treatments

Level of Risk	Fire Hazard Risk (Total Acres)	Mechanically Treated Acres by Alternative			
		Alternative 1	Alternative 2	Alternative 3	Alternative 4
High	19,993	0	4,080	3,785	3,308
Moderate	4,374	0	574	371	371
Level of Risk	Fire Hazard Risk (% of Total Acres)	Percent of Need Mechanically Treated by Alternative			
		Alternative 1	Alternative 2	Alternative 3	Alternative 4
High	82%	0	20%	19%	17%
Moderate	18%	0	13%	8%	8%

Prescribed Fire Treatments

Level of Risk	Fire Hazard Risk (Total Acres)	Prescribed Fire Treated Acres by Alternative			
		Alternative 1	Alternative 2	Alternative 3	Alternative 4
High	19,993	0	12,641	11,941	11,464
Moderate	4,374	0	2,186	1,687	1,687
Level of Risk	Fire Hazard Risk (Percent of Total Acres)	Percent of Risk Treated with Prescribed Fire by Alternative			
		Alternative 1	Alternative 2	Alternative 3	Alternative 4
High	82%	0	63%	60%	57%
Moderate	18%	0	50%	39%	39%
Totals	24,367 ac		14,827 (61%)	13,628 (56%)	13,151 (54%)

Effects Analysis

No Direct, Indirect, or Cumulative Effects

The following activities associated with the Bald Angel project are of such limited and constrained nature that they would have no effect on Fire or Fuels Management resources or activities.

- Hand planting
- Road Reconstruction
- Area Closure

These activities and their effects will not be discussed further in the Fire/Fuels section.

A. Fire Regime Departure

Direct/Indirect Effects on Fire Regime Departure

ALTERNATIVE ONE

The analysis has approximately 24,367 acres identified as having high departures from historical fire return intervals – condition class three; and approximately 4,374 acres as having moderate departures from historical fire return intervals – condition class two (see chapter one for definition of condition class and fire regimes.) Approximately 28,741 acres would continue to experience fire exclusion either at high or moderate departure from historic return intervals. Fire exclusion would continue to increase the fire return interval farther from historic ranges, increase fuel loadings, change vegetation profiles, and increase the gap between historic (desired) and current conditions.

Of the above acres, there would be no treatment in fire regimes 1 and 3 (approximately 24,367 acres). The direct effects of no treatment in fire adapted plant communities is a continued increase of ladder fuels, overstocked stands, and the potential recruitment of concentrations of standing and down dead. True fir encroachment and further ladder fuel development will continue in the absence of low intensity “thinning fires.” These areas could currently support intense, stand replacing fire events. Such high intensity fires would result in the loss of wildlife habitat (cover and structure), and consumption of large woody material in riparian and upland areas.

This alternative does not address the purpose and need of safely re-introducing prescribed fire and a desired condition of moving toward the more historic fire frequency. Precluding pre-treatment in condition classes two and three would remove prescribed fire options as a safe management tool resulting in high intensity crown fire, and the risk of fire spreading to private or more fire prone adjacent lands. To postpone or eliminate the reintroduction of prescribed fire, return interval departures will be extended even longer from the preferred historic levels under current management of fire suppression.

ALTERNATIVE TWO

This alternative proposes approximately 4,654 acres of mechanical fuels reduction in fire regimes one and three in condition classes two and three. These fire regimes are present in warm/dry biophysical group; i.e., fire-adapted plant communities.

Mechanical treatment in these fire-adapted plant communities will improve site conditions prior to the re-introduction of low intensity fire. This improved site condition will be obtained through removal of ladder fuels, reductions in concentrations of standing and down dead, and by increasing open space between trees to reduce crown closure.

Condition class three areas are significantly altered from their historic range. Alternative two provides for 17% of mechanical treatment in condition class three, fire regime one, and 25% treatment in condition class three, fire regime three (see above charts). A total of approximately 21% of the analysis area (fire regimes one and three) would be mechanically treated to return to historic fire return intervals and address the purpose and need.

Condition class two areas have been moderately altered from their historic range. Alternative two provides for 5% of mechanical treatment in condition class two, fire regime one, and 21% treatment in

condition class two, fire regime three. On a weighted average, this equates to 13% of the analysis area (fire regimes one and three) mechanically treated to return historic fire return intervals and address the purpose and need.

Alternative two further attempts to bring a return to historic fire return intervals by treating 62% of condition class three (fire regimes one and three) and 50% of condition class two (fire regimes one and three) with prescribed fire. This is a weighted average of 54%. Since the acres burned include the same acres mechanically treated, alternative two's total treatment of condition class two and three, fire regimes one and three at the very least 54% of the project will receive condition class changes.

The 4,654 acres with high and moderate departures from historical fire return intervals (condition class 2 and 3) treated in Alternative 2 provides an opportunity to successfully re-introduce prescribed fire. This equates to approximately 20% of the analysis area over a 20-year period with improved condition classes. This effort would meet the purpose and need to re-introduce fire as a disturbance factor and move toward a more historic fire frequency. It would also meet the purpose and need to mitigate the negative impacts of wildfire suppression with the positive benefits of prescribed fire.

Alternative two applies landscape scale prescribed fire to approximately 15,062 acres in blocks of 200 to 1,500 acres within fire regimes one and three (table 1 on page 76). These acres also have high and moderate departures from historical fire return intervals (condition class 2 and 3). The analysis area has 24,367 acres of identified fire reintroduction need in fire regimes one and three (fire-adapted plant communities). This alternative would use prescribed burns in approximately 62% of these fire-adapted plant communities. This would begin to meet the purpose and need of moving the analysis area closer to historic fire intervals. To move 62% of the analysis area (spread out over a ten year implementation period) would require an annual burn target of approximately 1,500 acres. Low to moderate intensity prescribed fire would thin suppressed overstocked regeneration and reduce fuel accumulations that could then be maintained over a 20-year period.

Reintroduction of fire on these acres would assist in moving toward the desired condition. (See desired condition under purpose and need, chapter one). To continue meeting desired conditions on a landscape level it would be beneficial to implement maintenance burning cycles over 5-10 year intervals. (See cumulative effects for known additional treatment.)

Within the stands identified for harvest treatment, there is an additional 881 acres that would be non-commercially thinned (release thinning) or cleaned under this alternative. Non-commercial thinning (including thinning in RHCA's) and cleaning prescriptions increase the fire hazard in the short term (approximately 3 years), but reduce the fire hazard in the long term (10 – 20 years).

ALTERNATIVE THREE

This alternative proposes to defer a total of 676 acres (of which 498 acres are in fire regimes 1 and 3 described in table one) of harvest treatment and 1200 acres prescribed burning treatments in comparison to alternative two.

Deferring treatment on 343 acres of primarily condition class 3 could maintain short-term cover needs for wildlife. However, the risk of high intensity crown fire increases on these acres (due to crown densities and ladder fuels). These acres are warm/dry biophysical environments, which would not usually support crown fires under historic conditions, however, due to fire exclusion within the area they diverged from their historic stand structures and exhibit higher levels of stand densities and subsequent ladder fuels putting the stands at a higher risk for crown fires in the event of a wildfire.

The direct and indirect effects of implementation of alternative three are similar to those described above in alternative two. This alternative would mechanically treat a total of 17% of the area and burn approximately 57% of the area with moderate to high departure from historic fire return intervals. Approximately 1,698 (mechanical and prescribed burn) fewer acres are being treated in alternative three compared to alternative two. The difference in acres being treated between both action

alternatives is minimal from a landscape scale perspective, but provides for short-term wildlife needs and MA-15 habitat protection and enhancement. The gap between current and historical fire return intervals continues to extend on acres not treated.

ALTERNATIVE FOUR

This alternative proposes to defer approximately 477 acres of harvest treatment and 400 acres prescribed burning treatments in comparison to alternative two. Alternative four treats 2% fewer acres than those proposed for treatment in alternative three. Due to this minimal difference in alternative acres the difference in effects from implementation of these alternatives are negligible.

Deferring treatment on 477 acres of condition class 3 would maintain short-term cover needs for wildlife. However, the risk of high intensity crown fire increases on these acres (due to crown densities and ladder fuels). These acres are warm/dry biophysical environments and would not support crown fires under historic conditions.

The direct and indirect effects of implementation of alternative four are similar to those described above in Alternatives 2 and 3. This alternative would mechanically treat a total of 15% of the area and burn approximately 55% of the area with moderate to high departure from historic fire return intervals. Approximately 2,561 (burn and mechanical) fewer acres than Alternative 2 and 863 (burn and mechanical) fewer acres than Alternative 3 are being treated in this alternative. The difference in acres being treated between the action alternatives is minimal from a landscape scale perspective because of their scattered nature, but they provide for short-term wildlife needs and MA-15 habitat protection and enhancement. The gap between current and historical fire return intervals continues to extend on acres not treated.

Alternative 4 limits access and reduces mechanical treatment on 477 acres in the highest fire risk areas all containing a condition class 3. Approximately 400 acres will be removed from the proposed burn blocks for prescribed burning and 77 acres will be burned during cooler prescriptive burning periods. The acres that would be removed from treatment consideration in Alternative 4 are a small percentage of the overall proposed treatment in the area and would achieve the fire reintroduction and fuels reduction goals on 55% of the need identified within in the area. The fewer acres treated in this alternative in comparison to Alternatives 2 and 3 would not impact the effectiveness of the total fuels landscape restoration.

Cumulative Effects on Fire Regime Departure

ALTERNATIVE ONE

Within the Bald Angel analysis area, 4,374 acres identified as having moderate departures from historical fire return intervals (condition class 2, all fire regimes) would transition into high-risk conditions over the next 15 to 30 years. The 24,367 acres identified as having high departures from historical fire return intervals (condition class 3, all fire regimes) would continue to be mostly at a high risk with only 18% of the area having a moderate risk. Of these high-risk acres, 82% of the area is identified as fire regimes 1 and 3 containing condition class 3 characteristics.

Other projects exist within the analysis area that would address the purpose and need and desired condition. Prescribed burning (Angel Point) and pre-commercial thinning (TSI 2001, 2002) projects will occur on 1,500 acres within the analysis area. These projects provide some measure of restoration that trend toward historic levels on about 10% of the analysis area.

Four other large restoration/vegetative treatment projects (Sandy Bottle, Little Bear, and South Fork of Catherine Creek) are located immediately adjacent to, but outside of, the Bald Angel project. Sandy Bottle and Little Bear activities are approaching the implementation stage. The South Fork of Catherine Creek is a Categorical Exclusion (CE) project currently in the planning stages. Another project, Angel Point, is embedded within the Bald Angel area containing approximately 1,000 acres of past prescribed

burning Angel Point had no associated mechanical treatment. These projects are in various stages of planning, some are closer than others of being implemented to reduce fuel loading and re-introduce prescribed fire. The treatments identified within or surrounding these areas would benefit the purpose and need and desired condition on a landscape level within the respective watersheds.

Table 4 – Past prescribed burn activities within Bald Angel Sub watersheds.

Past RX Burns			
Project Name	SWS	Year	Activity
Angel Point	13F	1997	1500 ac prescribed burning
DSE	29F/H	1995	25 ac prescribed burning
Velvet Creek	13F	1995	95 ac prescribed burning
Sufferin Smith	13E	1996	170 ac prescribed burning
Lost Goose	29D/E	1990	57 ac prescribed burning
Sawtooth Springs	29D/E/F/H	1994	226 ac prescribed burning
Huckleberry DS	13C/F	1988	127 ac prescribed burning
Huckleberry LGRD	13C/F	1986	530 ac prescribed burning
Burn Creek	13C	1987	597 ac prescribed burning
Gravel Flat	13D/F	1995	18 ac prescribed burning
TOTAL			3,345 acres

The Keating/Pondosa watershed is ranked a high risk in terms of departure from historical fire return intervals. Alternative One would delay, for approximately 20 to 30 years, the potential to move towards historic conditions on 24,367 acres.

ALTERNATIVE TWO

Alternative two would return the area to historic fire return intervals by treating 62% of condition class three (fire regimes one and three) and 50% of condition class two (fire regimes one and three) with prescribed fire. This is a weighted average of 54%. Since the acres burned include the same acres mechanically treated, alternative two's total treatment of condition class two and three, fire regimes one and three at the very least 54% of the project will receive condition class changes.

Other projects within the analysis area that would affect fire return intervals to address purpose and need and move toward the desired condition include prescribed burning and release thinning. Angel Point prescribed natural fire project would treat an additional 2500 acres, approximately nine percent of the analysis area. TSI 2001 and 2002 would release thin (non-commercial) another 800 acres, or approximately three percent of the analysis area. The release thinning and prescribed burning in these projects would occur primarily within condition class three and would assist in moving these acres closer to historic fire return intervals.

The cumulative effects of alternative two include a total of 69% of the analysis area in condition class two or three being treated to return the area to historic fire return intervals.

Grazing livestock from seven allotments would reduce the grass component in predominantly natural openings. Overstocked forested areas are generally not heavily grazed by livestock. Due to the grazing standards on stubble height livestock grazing is not expected to reduce fire carrying capacity or increase tree reproduction. As a result, livestock grazing is not expected to impede progression toward historic fire return intervals.

Three projects adjacent to the analysis area are at various stages of implementation and/or planning. These three restoration projects are (Sandy Bottle, Little Bear, and South Fork of Catherine WUI Fuels Reduction project). A fourth project called Angel Point is inside the north portion of the Bald Angel analysis area.

The restoration projects have very similar treatments to Bald Angel. Thinning (commercial and non-commercial), improvement cuts, and fuels reduction are prescribed. Prescribe fire would occur in natural openings and in forested areas following mechanical treatment. The cumulative effects of all four projects, combined with Bald Angel, provide for several thousand acres (approximately 15,000-20,000) of fire adapted plant communities (fire regimes 1 and some of 3) to return to historic fire return intervals of 1 to 35 years. These treated acres are approximately 82% of the 24,367 acres of fire regimes 1 and 3 within the Keating / Pongosa watershed.

ALTERNATIVE THREE

Cumulative effects in alternative three are very similar to alternative two. One minor difference is 676 fewer acres of mechanical treatment. No treatment on these acres would continue to increase the risk of a stand replacement event (insect/disease or fire). This reduction in mechanically pre-treated acres would prevent re-introduction of prescribed fire in 676 acres slightly extending the gap between current and historical fire return intervals. Overall, re-introduction of prescribed fire following mechanical treatment would decrease under alternative three by 676 acres.

Statistically, there is a 6% difference of acres treated in alternative three when compared to alternative two. The cumulative effects of alternative three is slightly reduced, and include a total of 63% of the analysis area in condition class two or three being treated to return the area to historic fire return intervals. There would be no change from alternative two cumulative effects (as described above) when comparing and including other projects within and adjacent to the analysis area.

ALTERNATIVE FOUR

Cumulative effects in alternative four are very similar to alternative two and three. One minor difference is 477 fewer acres of mechanical treatment. No treatment on these acres would continue to increase the risk of a stand replacement event (insect/disease or fire). This reduction in mechanically pre-treated acres would prevent re-introduction of prescribed fire in 400 acres slightly extending the gap between current and historical fire return intervals. Overall, re-introduction of prescribed fire following mechanical treatment would decrease under alternative four by 400 acres.

Statistically, there is a 3% difference of acres treated in alternative four when compared to alternative two and only a 1% change between Alternatives 3 and 4. The cumulative effects of alternative four still include a total of 60% of the analysis area in condition class two or three being treated to return the area to historic fire return intervals. There would be no change from alternative three cumulative effects (as described above) when comparing and including other projects within and adjacent to the analysis area.

Summary - In summary, the other past/present projects within the project area have very similar treatments to those in Bald Angel (commercial and non-commercial thinning, improvement cuts, and fuels reduction). Prescribe fire would occur in natural openings and in forested areas following mechanical treatment. The cumulative effects of all four previous burn projects, combined with Bald Angel, provide for several thousand acres (approximately 15,000-20,000) of fire adapted plant communities (fire regimes 1 and some of 3) to return to historic fire return intervals of 1 to 35 years. These treated acres are approximately 82% of the 24,367 acres of fire regimes 1 and 3 within the Keating/Pongosa watershed.

Mechanical pre-treatment under each action alternatives would allow for more opportunities to re-introduce low intensity prescribed fire during late summer and fall (when historical fires would have occurred). Resources could be better protected from high intensity crown fires, including riparian areas, late/old structure, and regeneration. The action alternatives provide management the opportunity to manipulate fuels prior to burning. The purpose and need, and desired condition would more likely be met than when compared to alternative one.

Since weather and topography can not be manipulated, alternatives two, three, and four manipulate the one component (fuels) that could assist management to re-introduce frequent intervals of low intensity fires and

steer away from potentially damaging high intensity wildfires.

B. Wildfire Risk

Fine fuel loadings (3 inch minus size classes) in harvest units in the action alternatives are expected to experience a short-term increase immediately following harvest activities. In general, these fuel loadings are expected to range in the 15-20 tons per acre which are slightly above the desired ranges for fuels reduction activities and the minimum levels required for site productivity. In all of these stands, post harvest burning is planned with a landscape prescribed burn to follow. Fire hazards immediately following harvest activities are not severely elevated due to the green nature of the slash. Depending on the weather, the slash could cure rapidly and present a short-term (several months) elevated hazard risk in the late summer before fall rains/snows arrive. A curing period is required to achieve desired fuel consumption when prescribed burning. Fuel loadings generally are crushed closer to the ground by winter snows (reducing the potential for the fire to get up into the reserve tree crowns) and after a period of drying in the late spring/early summer they are generally ready for prescribed burning.

Therefore, if the prescribed burning takes place in the fall of the year following harvest as planned, there is a short term (3 months) period of elevated potential for high intensity burning conditions in the event of a wildfire during this period. This occurrence depends largely on weather conditions and the relatively low potential for a lightning strike in that exact same area. This risk would be immediately removed following the completion of the burning activities. Should burning be delayed – this risk would remain in place for the hottest four months each summer for a 2 year period after which the fine fuels will be on the ground and decomposed to the point that they are no longer a flash fire hazard.

These effects are the same for each action alternative and will not be discussed further on an individual basis.

In relation to wildfire risk, there are minimal differences in alternative acres treated between Alternative 3 and 4. The difference in effects from implementation of these alternatives are negligible therefore, the discussion of the effects of these alternatives on Wildfire Risk have been combined.

Direct/Indirect Effects on Wildfire Risk

ALTERNATIVE ONE

The analysis area currently contains 19,993 acres identified as high-risk and 4,374 acres as moderate risk of high intensity fire behavior and associated damage in the event of a wildfire.

This alternative does nothing to prevent the transition of moderate risk acres to a high-risk problem. The direct effects of no action would result in a trend toward more complex high-risk acres over the next 10-20 years. It is estimated that another 0-25% in the moderate risk rating would move into the high-risk category. (Zero to twenty-five percent represents the lost opportunity to treat acres proposed in the action alternatives). This would be measured by excessive fuel loading from insect and disease mortality, dense stand conditions, and a multi-layered ladder fuel structure. Stand densities and heavy surface fuel loadings contribute to an increase in both surface and crown fire intensity. Multi-layered stands provide a fuels arrangement that aids the vertical movement of fire from a surface level to a potential crown fire stage. In fire-adapted environments (warm/dry ponderosa pine and some Douglas-fir sites), multi-layered stand conditions are not sustainable, nor will these conditions represent a historic characteristic.

The possibility of damaging natural resources by considering alternative one would keep high risk acres and move moderate risk acres to a high risk status. Resource damage would likely include loss of riparian habitat, old growth, and big game cover (see fish and wildlife sections). Soil damage could also occur from high intensity fires (see soils section). This type of damage was not experienced under historical regimes to the extent observed in recent wildfires. Alternative one will not reduce the

potential impacts of expected resource damage in the event of a wildfire. This alternative would not address the potential threat of resource damage recognizing that a total of 24,367 moderate to high risk acres would not receive any form of vegetation treatment.

In the 19,993 high-risk acres, to have no action would immediately jeopardize resources just as would be expected by fire regime departures being extended. Overstocked riparian areas and MA-15 areas that would be trending toward increased mortality are particularly at risk of losing habitat. Under story reinitiating stands are at risk of losing the developing under story, due to the recruitment of dense dead over story and heavy down fuel accumulations. The developing under story is at high risk to an intense ground and crown fire that would burn through with heavy mortality to the regeneration.

The following pictures display high-risk situations that the Bald Angel area is beginning to experience, and will continue to trend toward without vegetation treatments. These fuel compositions are classified as high risk under the fire hazard assessment model:



Applying the fire hazard assessment model, fire occurrence would remain constant, as would consequences. It could be suggested that consequence would decrease as more stands move toward Single stratum Late Old Structure (LOS); however, Multi-stratum LOS would remain vulnerable to a risk from wildfire, so the stand could actually be severely burned before the LOS character is established. Hazard would increase as a direct result of more fuels, overstocking, and multi-layered stands. As hazard increases, risk becomes greater.

ALTERNATIVE TWO

Alternative two proposes approximately 4,869 acres of stand classified moderate or high fire hazard risk to be mechanically treated. 4,080 acres are high risk and 574 acres moderate. Mechanical treatment (described under introduction of this section) would reduce fire hazard risk on these acres. As a result, 4,869 acres would likely convert to low or moderate.

When compared to historical conditions, crown fire risk in the area is high; however it is neither sustainable nor desired in fire-adapted plant communities (fire regimes 1 and some of 3).

Mechanical treatment would reduce surface and ladder fuels. Removal of dead down material would reduce fire intensity minimizing potential for radiant heat to pre-heat and ignite crowns. Thinning and/or removal of overstocked (live and/or dead) under stories of smaller diameter stems would reduce ladder fuels and minimize ground fire potential to move upward into crowns. Thinning of dense over stories will open up crown densities in a stand, reducing potential for isolated torching or crown fire behavior.

As a result of minimizing crown fire potential, the risk of damage to natural resources would decrease. Riparian habitat would be less likely to lose a valuable shade component or recruitment for woody debris. Trees and shrubs that stabilize banks would more likely survive a ground fire than a crown fire. LOS habitat would be less likely to lose valuable structure such as snags and logs. Upland stands (particularly in warm/dry plant communities) that have been mechanically treated would more likely

benefit from low-intensity ground fires moving through. There would be less chance of stand replacing events in these biophysical environments.

This alternative decreases potential resource damage in 19,993 high-risk acres (current) to 15,913 acres. 20% of the high-risk acres are proposed to mechanically treat. This alternative also decreases potential resource damage in 4,374 moderate risk acres to 3,800 acres. 13% of the moderate risk acres are proposed to mechanically treat.

Alternative two also treats high and moderate risk acres with prescribed fire treatment. 12,641 acres in the high-risk category would be treated. This equates to 63% of the 19,993 acres in high-risk status. 2,421 acres would be treated in the moderate risk category (55% of 4,374 moderate risk acres). The highest density stands in a high-risk status would be mechanically treated prior to prescribe burning. Mechanical treatment would reduce the risk of resource damage and spread to adjacent areas.

Prescribed burning would provide maintenance level results in terms of fire risk. Prescribed fire is ignited under conditions that have desired and somewhat predictable results. Prescribed fire would aid in reducing ground and ladder fuels with minimal crown torching and over story mortality. Burning would maintain a low to moderate risk category on these 15,062 acres. This equates to 62% of the analysis area that would be maintained in a low/moderate risk category for approximately 10-20 years.

Considering prescribed burning and mechanical treatment under this alternative, fire occurrence would remain the same, as would consequences, under the fire hazard assessment model. (It could be argued that consequence would increase slightly as more stands move toward LOS conditions). Hazard would decrease as a direct result of fewer fuels, reduced stocking and fewer multi-layered stands. Because hazard decreases, risk decreases as well. Risk would be decreased on the treated acres for approximately 10-20 years.

ALTERNATIVES THREE and FOUR

Alternative three proposes approximately 4,126 acres of stands classified moderate or high fire hazard risk to be mechanically treated. 3,785 acres are high risk, and 341 are a moderate risk. Alternative 4 would treat 3,679 acres (3,308ac high risk, 371ac moderate risk).

Mechanical treatment (described under introduction of this section) would reduce fire hazard risk on these acres. As a result the acres treated in Alternative 3, 19% of the high risk acres and 8% of the moderate risk would likely convert to low or moderate risk condition classes while in Alternative 4, 15% of the high risk and 8% of the moderate risk would be converted to low or moderate risk condition classes.

Effects of reducing crown fire potential are similar to those described under alternative two. Overall, treatment would reduce crown fire potential and lower fire risk, particularly in fire regimes one and some of three. Resources would benefit, as described above.

Alternatives 3 and 4 also treat high and moderate risk acres with prescribed fire. Alternative 3 would treat approximately 60% (11,941 ac) of the high-risk acres identified while Alternative 4 would treat approximately 57% (11,464 ac) of the high-risk acres. In Alternatives 3 and 4, approximately 1,687 acres are treated in each Alternative (39% of the total moderate risk identified) in the moderate risk category.

Prescribed burning would provide maintenance level results in terms of fire risk. Prescribed fire is ignited under conditions that have desired and somewhat predictable results. Prescribed fire would aid in reducing ground and ladder fuels with minimal crown torching and over story mortality. Burning would maintain a low to moderate risk category on these 13, 628 (Alternative 3) and 13,151 (Alternative 4) acres. This equates to 56% (Alternative 3) and 54% (Alternative 4) of the analysis area that would be maintained in a low/moderate risk category for approximately 10-20 years.

Considering prescribed burning and mechanical treatment under this alternative, fire occurrence would remain the same, as would consequences, under the fire hazard assessment model. (It could be argued that consequence would increase slightly as more stands move toward LOS conditions). Hazard would decrease as a direct result of fewer fuels, reduced stocking and fewer multi-layered stands. Because hazard decreases, risk decreases as well. Risk would be decreased on the treated acres for approximately 10-20 years.

Cumulative Effects on Wildfire Risk

ALTERNATIVE ONE

The cumulative effects of alternative one will increase fire risk. In 50 years it is estimated that a high percentage of current “moderate” risk stands would move into “high” risk, and the already high risk areas will have an over abundance of uncharacteristic fuel conditions within all fire regimes. This is based on expected overstocking and mortality. The effects to resource damage would be the same as described above.

The potential for high risk stands would increase from 19,993 acres (current) by approximately 3,000 – 6,000 additional acres. Due to the fact that some level management activity is still occurring with other existing or planned projects, it is likely some level of treatment would reduce wildfire risk.

Release thinning is planned on approximately 881 acres, and prescribed burning would occur on approximately 2,500 acres in the Angel Point fuels reduction project.

District records show that over the past 30 years there has been approximately 20,000 acres that have had forest management; primarily in the form of salvage, shelter wood, and selection harvest cuts. The acres have been fairly evenly distributed throughout the sub-watersheds found within the analysis area. Post harvest fuel treatments such as prescribed burning and leave tops attached have been largely successful in limiting fuels build up in managed areas. Shelterwoods, salvage and over story removals, have, however, opened canopies up to sunlight and encouraged under story development. Combined with management’s direction to suppress wildfire in this area, un-managed regeneration with alternative one would result in overstocked conditions, again, leading to potential for insect mortality, high fuel loading and loss of riparian and wildlife habitat. Fire hazard would increase over the next 50 years on those acres of stand initiation or under story reinitiating that have been identified as overstocked with young trees.

ALTERNATIVE TWO

The cumulative effects of alternative two trend toward a decrease in fire risk. Following mechanical treatment under alternative two, the analysis area would contain high-risk stands in 65% of the area, as compared to the current 82% total need. Moderate risk stands would be reduced from the current 18% to 16%. Treatment is expected to reduce fire risk for approximately 20 years.

Beyond 20 years the trend would begin to increase. It is estimated that 20-30% of the stands in the moderate category would move into the high-risk category, increasing high risk from 56 percent to 76-86%. It is estimated that 10-20% of stands in the low risk category would move into the moderate category, increasing moderate risk from 13% to 23-33%. Given that some management activity would occur with other projects, it would likely be in the middle of this range.

Other management activity occurring in the analysis area includes release thinning on approximately 881 acres and prescribed burning on approximately 2,500 acres. This treatment would compliment activity under alternative two and assist the downward trend in fire risk by treating a total of 80% of the entire project area.

ALTERNATIVES THREE and FOUR

The cumulative effects of alternative three trend toward a decrease in fire risk. Following mechanical treatment under these alternatives, the analysis area would contain high-risk stands in 67% (Alternative 3) and 68% (Alternative 4) of the area, as compared to the current level of 82%. This is slightly less than alternative two. Moderate risk stands would be reduced from the current 18% to 16%, this is slightly less than Alternative two. Treatment is expected to reduce fire risk for approximately 20 years.

Beyond 20 years the trend would begin to move upward by 20-30% in high risk status. The low and moderate risk could increase by 10-20% over the same period. The current high-risk areas will have greater amounts of mortality due to increased insect and disease potential. These areas would over time without treatment be more susceptible to uncharacteristic wildfire behavior. The prescribed fire activities combined with mechanical removal can prepare the area for less intense stand replacement fires.

Other management activity occurring in the analysis area includes release thinning on approximately 881 acres and prescribed burning on approximately 2,500 acres this would not change from alternative two. This treatment would compliment activity under alternative three and assist the downward trend in fire risk treating a total of 74% (Alternative 3) and 70% (Alternative 4) of the entire project area.

In summary - The effects of the Bald Angel alternatives contribute to the trend toward a decrease in fire risk begun by previous treatments in the area. Following mechanical treatments, the analysis area would contain high-risk stands in 65-68% of the area, as compared to the current 82% total need. Moderate risk stands would be reduced from the current 18% to 16%. Treatment is expected to reduce fire risk for approximately 20 years. Beyond 20 years the trend would begin to increase. It is estimated that 20-30% of the stands in the moderate category would move into the high-risk category. It is estimated that 10-20% of stands in the low risk category would move into the moderate category.

The area closure will maintain access options for fire suppression activities and may reduce the access for people in OHV's and vehicles for dispersed camping, thus reducing the potential for fire starts from vehicles, campfires, and smoking.

Grazing livestock from seven allotments would reduce the grass component in predominantly natural openings. Overstocked forested areas are generally not heavily grazed by livestock. Due to the grazing standards on stubble height livestock grazing is not expected to reduce fire carrying capacity or increase tree reproduction. As a result, livestock grazing is not expected to impede progression toward historic fire return intervals.

C. Other Fire Issues – Direct/Indirect and Cumulative Effects

- **Fire-fighter and public safety** – All action Alternatives Two through Four would increase fire-fighter and public safety by reducing potential for high intensity fast moving crown fires on treated acres on high risk acres and maintaining low to moderate crown fire risk on other acres. While the analysis area is overall a low risk for loss or damage due to high intensity fire, Alternative one would do nothing to prevent the area from moving into a higher risk category for safety. Alternative 2 would accomplish the most followed by Alternatives 3 and 4 respectively. The area closure will maintain access options for fire suppression activities and reduce the access for people in OHV's and vehicles, thus reducing the potential for fire starts from vehicles and smoking.
- **Cost of suppression** – All action alternatives would decrease the cost of wildfire suppression. Treatments would reduce the likelihood of high intensity crown fires, allowing for more direct attack with hand crews and tools. Alternative one provides no treatment and potential reduction of crown fires. Fire intensity levels in areas with heavy fuel loading would exceed the level of safe direct attack with hand tools. Indirect attack would require more costly mechanized equipment such as caterpillars and air support. Alternative 2 would accomplish the most followed by Alternatives 3 and 4 respectively.

- **Air quality** - Huff, Ottmar, et al (1995) found PM10 smoke production was twice as high for wildfires as for prescribed fire. This is because wildfires generally occur during drought periods in which there are low fuel moistures. Alternatives two, three, and four would produce smoke through prescribed burning that may impact nearby sensitive areas (see chapter one for list of areas). However, smoke emissions could be managed to stay under the 15,000 tons PM10 per year agreed to under the Memorandum of Understanding (October 27, 1994). The action alternatives would meet the Clean Air Act. Alternative one would result in a higher risk of wildfire smoke emissions, which would be more difficult to manage.

C. Alternative Evaluation as They Respond to the Other Issues

Economic Effects

Introduction

The Bald Angel timber sale will produce a quantifiable product that will be used to determine the “net value” of this project in terms of dollars and cents. Benefits in terms of dollars and cents especially in natural resource management where the benefit may be increased resiliency to pathogens, increased mean annual increment, and reduced fire hazard on acres that are pre-commercial thinned, are hard to define, and outside the scope of this economic analysis, though the ecological effects of this project are analyzed for soils watershed, silviculture and wildlife impacts, as part of the NEPA document for this project. Work items that show as a cost with no monetary benefit in the economic analysis includes spot planting, sub-soiling, thinning, broadcast burning, road closures, road reconstruction and maintenance. These short term costs for un-quantified long term benefits, results in the cost to benefit ratio for this project to be less than “1” or “below cost” (see table top of page 3).

This analysis will assess how the alternatives relate to timber sale viability, economic efficiency and socio-economic impacts to communities on a relative basis between alternatives. The analysis area for these assessments will be the project area as described in Chapter One and on the maps in the Appendices for Direct and Indirect Effects and Union County for the socio-economic cumulative impact to communities. It should also be emphasized that the values used here represent a “snap shot” in time of a constantly fluctuating lumber market, therefore the values represent relative values to provide a basis for comparison of the alternatives and are by no means meant to be considered as absolutes.

Timber sale contracts are commonly used to achieve vegetation management objectives identified as part of the project. In this case it will be the tool used in addressing these key issues: Overstocked stands, moving more acres into late old structure, promoting satisfactory wildlife cover. This work will also provide revenue to the county and jobs to the local work force. Service work will account for the remainder of the key issues: Fuel loadings outside harvest units, stalking levels in non-commercial stands, road relocation, and road densities (obliteration and closures). All action alternatives address these issues to different degrees that will be assessed by the same criteria.

The socioeconomic issues and effects of the alternatives are assessed in terms of:

- Timber Sale Viability – Predicted high bid
- Economic Efficiency – Present net value
- Socioeconomic Impacts to Communities – Payments to counties, and number of jobs.

Direct/Indirect Economic Effects

Timber Sale Viability

The timber sale portion of this project (harvest units) was analyzed to determine the value that can be used to help offset the cost of work in other units and to help determine the economic viability of the harvest units based on projected hundred cubic feet (CCF) volumes at current market conditions. There is potential to accomplish a large portion of vegetation management needs of any given project through a timber sale contract. In this case projected volumes of sawlog by species, and non saw log with in the harvest units were valued. The true value was netted by costing out estimated stump to truck work, haul and other contractual obligations. The valuation, costing and predicted advertised, bid and base rates per CCF were determined using the Region 6 TEAECON economics program and experienced local costs for sale planning, preparation and administration.

Timber value was determined by species/product from a compilation and averaging of all species from all timber sales sold with in our appraisal zone 3 during the last year. All aspects of costing are derived the same way and averaged and used to make the adjustments to the base period prices that determine predicted bid rate.

The following table displays the predicted bid rates, advertised rates, and base rates by alternative

Appraisal Entries	Alt 2	Alt 3	Alt 4
Volume (CCF Sawlog Volume)	21,324	18,454	16,604
Acres (harvest)	4,869	4,193	3,800
Predicted High bid	60.74	61.99	62.58
Advertised Rate	54.67	55.79	56.32
Base Rate	15.26	15.26	15.23

Economic Efficiency

Efficiencies by alternative must be analyzed to determine which alternative best maximizes public net benefits (36CFR219.12(f)). The timber sale portion of the project proposal was used in part because that is where the “quantifiable” value resides but also because it represents the mechanism by which a large portion of the proposed vegetation management is implemented. All alternatives are projected to produce non-deficit timber sales, with little variation in the predicted high bid rates. A non-deficit sale is a sale where the appraised timber value is greater than its estimated logging and KV costs.

This analysis also evaluates and compares alternatives in regard to “below cost” timber sale implementation and describes the benefits and costs as well as present net value (PNV) of each alternative. A “below cost” timber sale/project describes the difference between *all* associated costs (NEPA thru Administration overhead costs etc..) and the projects *quantifiable* values that are being used.

There is very little difference in acres treated between Alternatives 2 - 4. Because of this, all alternatives share almost the same values and costs and have little variance in benefit to cost ratios (.65 - .67). Anything less than one is considered a “below cost” timber sale/project (see Appraisal Entries table below).

Benefits/value includes priced and non-priced outputs. Priced outputs are those that can be exchanged in the market place (sawlogs). Non-priced outputs are those for which there is no reasonable basis for estimating value comparable to the market values associated with priced outputs. Dollars of benefits for this analysis are the revenue from timber volume harvested. Total

value is calculated by multiplying the advertised bid rate/CCF by the total estimated CCF sale volume.

There are other benefits such as water, recreation, fish and wildlife that may be dollar quantified in an economic analysis: but were not in this analysis because they were not expected to vary significantly among alternatives, or values are not available for the local area.

Costs include those associated with timber sale support budget estimations, which include project planning, preparation, and administration. Overall anticipated costs are based on Forest-wide historical averages. Post sale costs represent those activities that are required as either post-harvest mitigation, or to complete the management goals and objectives for each stand (stand cleaning, under burning harvest units, sub soiling and inter planting). The following table illustrates to what extent the harvest related revenues offset expected costs by alternative.

Appraisal Entries	Alt 2	Alt 3	Alt 4
Total Timber Value	1,026,610	926,330	844,850
FS Costs - Prep/Admin	1,126,800	996,240	900,040
FS Costs – Post-Sale	326,000	298,845	284,144
Net Sale Value	-330,782	-269,534	-243,292
Total Costs	1,452,800	1,295,085	1,184,184
Total Benefits (discounted timber value)	860,509	776,454	708,157
Net Present Value (NPV)	-460,221	-387,429	-350,201
Benefit Cost Ratio	.65	.67	.67
NPV with burn blocks	-1,251,751	-1,261,386	-1,141,731
BC ratio w/burn blocks	.41	.40	.38

The Benefit/Cost (B/C) ratio indicates the amount of present value revenue per unit of present value cost. This is an index of the relative productivity of dollars spent. A B/C ratio greater than 1 indicates that revenues will exceed the invested costs in the project. Ratios less than 1 indicate that costs will exceed revenues. Present day planning requirements/costs increase the probability that a majority of large projects will be below cost.

Resource values that may be achieved as a result of the implementation of an alternative (non-priced outputs) are not included since dollar values cannot be quantified. Timber value to cost comparison can be made to give a relative efficiency of the alternative. The benefit to cost ratio value line in the above table provides a similar comparison, the higher the B/C ratio, the more efficient the alternative. Based on the B/C ratio Alternatives 3 and 4 are equal and both are more efficient than Alternative 2 due to reductions in costs, with the primary difference being in road construction miles in each alternative where Alternative 3 has fewer miles than Alternative 2 and Alternative 4 has the lowest with no miles of road construction.

Cost for planned activities that are over and above revenues collected from the timber sale portion of the project would require appropriated dollars to implement and carry out all of the objectives of the Bald Angel project. Historically, balances in the trust fund accounts (SSF, K-V) and from budget appropriations were available to use as projects occurred. Forest trust fund deposits have diminished significantly over time, leaving appropriated funds as the only available option to cover project costs not covered by the bid premium. How much funding will be available for any given project is generally not known during the planning process. It is up to the ID team to prioritize projects by need for when funding becomes available, but not to the extent needed to cover all costs.

Project work identified that is not associated with a timber sale, would be accomplished through appropriated funds and could provide work via service contracts. Cost estimates for the non-timber

sale activities listed in the table below were derived from Forest and District estimates and program manager's estimates.

Non-Timber Sale Work Costs by Alternative

Indicator	Alt 1	Alt 2	Alt 3	Alt 4
Prescribed burn non-harvest units	0	\$1.0mm	\$1.0mm	\$1.0mm
Fire-line construction	0	\$3,600	\$3,600	\$3,600
Precommercial thinning	0	\$170,000	\$163,000	\$163,000
Road closures	0	\$5,000	\$5,000	\$5,000
Totals	0	\$1,178,600	\$1,171,600	\$1,171,600

Cumulative Socio-Economic Effects

The socio-economic effects were analyzed in terms of payments to counties and jobs and income. Payment to counties is based upon receipts obtained through stumpage payments. Payments are 25 percent of the stumpage paid to the U.S. Treasury. Employment and income generated as a result of timber harvest is based upon the amount of timber harvested by product, either saw timber or non-saw timber.

These calculations are based upon the Wallowa-Whitman National Forest FEIS, Appendix B, updated by TSPIRS 1994.

The following table helps summarize the projected receipts, jobs and income from this project. (2001 W-W)

Indicators	Alt 1	Alt 2	Alt 3	Alt 4
County receipts	0	\$256,652	\$231,583	\$211,212
Employment (# of jobs)	0	117	102	90
Income generated	0	\$1.9 million	\$1.7 million	\$1.5 million

The cumulative effects of this project are very similar between alternatives, they all will provide the county with receipts which otherwise would be dollars out of the taxpayers pocket. They all will provide a similar number of jobs related to harvesting, transporting, processing, marketing and distributing a valuable product. The income generated by this project contributes to family wage earners and local industries which in turn support other local businesses, hospitals, and services contributing to the overall economic vitality of the County. The products produced from this project would not support the local mills alone, however, when added to the wood products being removed from other private and corporate lands, it contributes to the overall viability and sustainability of local mills and businesses.

Each of the action alternatives reduce fuel loadings and promote forest health over a similar number of acres, acres that will be treated and provide seasonal work/benefits for a projected 8-10 year period. However, Alternative 4 produces the lowest benefit to the community in terms of county receipts, jobs and income generated. This is primarily due to the value of the acres not treated versus the relatively low cost of temporary road access. The need for temporary roads in most of the acres not treated in Alternative 4 were to ensure that roads used in these areas would only be in low impact locations versus draw-bottom locations used by previous entries into these areas. The difference between Alternatives 2 and 3 is that acres were deferred from treatment until the next entry or beyond. The acreage treated in Alternative 3 and not Alternative 4 (385 acres) can also be

considered deferred from an economic standpoint, as there is no economically practical way to treat these acres without access at this time.

Fisheries and Watershed Management

Introduction

The following analysis is for fisheries and watershed resource conditions for the Bald Angel analysis area which is within NFS watersheds 17050203-13 (Powder River-Pondosa) and 17050203-29 (Powder River-Keating); includes subwatersheds 13D, 13E, 13F, 29D, 29E, 29F and 29H and serves as the scale of analysis for fisheries and watershed resources.

The description of watershed/fisheries resources, along with the analysis of the expected and potential effects for each alternative were assessed using field surveys, water quality databases, and professional judgment.

Several management directives/recommendations apply to this project. Management directives from the Wallowa-Whitman Land and Resource Management Plan (LRMP) 1990, the Interim Strategies for Managing Inland Native Fish producing Watersheds in Intermountain, Northern and Pacific Northwest Regions (INFISH 1995); and the LRMP Biological Opinion (1995 and 1998) will be followed. In addition, the LRMP INFISH amendments add further interim management direction in the form of Riparian Management Objectives (RMOs), Riparian Habitat Conservation Areas (RHCA) and standards and guidelines for Non-Priority Watersheds. The Bald Angel Project is located in a non-Priority Watershed because the Watersheds do not contain bull trout, however, the INFISH standards and guidelines still apply and will be followed. The effects outlined below are based on all fisheries and watershed protection and mitigation measures being implemented in full.

Four alternatives were analyzed for this project, Alternative 1 (no action), Alternative 2 (proposed action), Alternative 3, and Alternative 4 to determine the magnitude of direct, indirect and cumulative effects on the following resources:

1. Water Quality
2. Fish Habitat and Populations

EFFECTS ANALYSIS

No Direct, Indirect, or Cumulative Effects

The following restoration activities associated with the Bald Angel project have been analyzed and are of such limited context and constrained nature that they would have little to no measurable effect on watershed and fisheries resources.

- Precommercial Thinning

These activities and their effects will not be discussed further in the Watershed and Fisheries section.

1. Watershed Resources

Direct Effects on Water Quality

ALTERNATIVE 1 - NO ACTION

There are no direct effects on water quality as a result of the No Action Alternative. Effects related to

this alternative on water quality are primarily indirect in nature, however, there is an increased risk of high severity fire on soil and water resources if treatment is not done, such as increased sediment yield, flooding, debris flow, soil displacement, and erosion. These indirect effects relate to suppression of conifers in the riparian area, which may reduce the effectiveness of the conifers in producing shade and large wood for recruitment to the stream channel. This indirect effect will retard attainment of Riparian Management Objectives.

ALTERNATIVES 2, 3 and 4

No direct effects on water quality are expected from the implementation of any action alternative described with this project.

The location of activity away from perennial stream channels, adequate riparian buffers (RHCAs), and timing of activities in relation to soil and moisture conditions will prevent direct adverse effects to stream channels, fish habitat, and fish populations. Potential adverse effects such as increased sediment yield and direct channel sedimentation, removal of large woody material from the channel, disturbance of fish habitat, and any instream impacts are not expected due to the protection and mitigation measures being implemented in full.

Indirect Effects on Water Quality

The primary effects to water quality that could arise as a result of the Bald Angel Project are increases in sediment delivery rates.

Sediment Delivery Rates: The definition of accelerated sediment delivery for the Bald Angel Project includes any increase over and above the natural sediment rates sediment eroded from the watershed and delivered to channels. Soil erosion may lead to accelerated sediment delivery to stream channels, although with implementation of RHCA's and erosion control BMP's, as prescribed by INFISH, this is not expected.

It is difficult to equate soil erosion directly to sedimentation rates. Obstructions in the path (i.e. downed wood, grass/forb cover) between the sediment source and the stream reduce the risk of direct sediment inputs to the stream. Therefore, adequate filter strips (in terms of size, ground cover and downed material) are necessary to slow or prevent sediment movement downslope of disturbed areas.

Sediment delivery may be increased through the use of:

- Roads and Recreation Trails
- Logging Systems

A. Roads and Trails:

ALTERNATIVE 1 - NO ACTION

Sediment delivery rates would remain at existing levels, including the effects of poorly drained and designed roads and user built trails, under this alternative. This alternative would provide no opportunity to perform restoration activities to correct recreational trail problems or decommission/rehabilitate road system problem areas.

ALTERNATIVES 2, 3 and 4

Alternatives 2 and 3 would construct 1.52 and 1.42 miles, respectively, of new specified road for log haul and 8.88 and 3.94 miles, respectively, of temporary road. The new road construction in Alternative 2 and 3 primarily involves road segments for access to a harvest unit and temporary roads to access locations within harvest units. These road segments would be located away from riparian areas to minimize effects to water quality. The new road construction would not adversely

affect water quality, riparian habitat, or fisheries since the segment is located away from fish bearing streams, no segment parallels or crosses any stream, and all are located on ridgetops and outside RHCAs. Temporary roads would be subsoiled, seeded and restabilized in the same season of use to prevent any adverse affects to water quality. Watershed Best Management Practices (BMP's) would also be implemented to reduce any potential risks to water quality. Log haul will be restricted to dry or frozen ground, and would be monitored by the timber sale administrator and/or watershed and fisheries specialists. Since new road and temporary road construction would be located outside of RHCAs there is negligible impact to the fish and water resources.

There would be no new or temporary road constructed under Alternative 4. This would ensure no adverse affect on water quality, but would reduce the amount of acres accessible to manage and enhance the vegetation in the watershed.

Alternatives 2, 3 and 4 would reconstruct 2.25 miles of road for log haul. The road reconstruction would address inadequate drainage problems on existing roads. The reconstruction would not adversely affect water quality, riparian habitat, or fisheries since all sections would improve areas of inadequate drainage along the roadways.

Approximately 29.1 miles of road would be decommissioned under alternative 2, 3 and 4. These miles of decommissioning would be accomplished under an area closure and the roads would stabilize naturally, from a hydrologic stand point, over the long term. Many of these roads are either within RHCAs, which parallel stream channels, or cross one or more stream channels or wet areas. The use of roads within RHCAs increases the potential for sediment delivery, which poses risks to water quality. Preventing full size and all terrain vehicle access should severely limit the number of forest users accessing these sites and minimize risks to the water resources.

Long-term (2 years and beyond) sediment delivery rates are expected to decrease from decommissioned roads through an area closure. All three action alternatives would decommission an equivalent of 62.7 acres through the area closure. The amount of decrease in sediment delivery rate is relative to the miles of road closed. The action alternatives would close 29.1 miles of road.

Decommissioning roads through an area closure, especially in RHCAs, will help offset any negative impacts to water quality that may be caused by the temporary and specified road construction discussed above. See transportation document for specific location of roads to be decommissioned or closed.

B. Logging Systems:

All action alternatives propose the use of ground based tractor skidding or forwarder harvester, on ground with slopes of less than 30% and skyline yarding on 30% and greater slopes. The following table displays the acres of tractor skidding/forwarder harvester and skyline yarding per alternative.

Summary of the Commercial Timber Harvest Acres and the Logging System Acres per Alternative

Action	Alternative 2	Alternative 3	Alternative 4
Total Commercial Harvest	4869	4193	3800
Tractor Logging	3885	3514	3300
Skyline Logging	618	570	391
Helicopter Logging	359	109	109

Soil erosion may be initiated by soil disturbance and/or soil compaction. Repeated soil disturbance (through dragging of logs) can lead to soil compaction (Froelich 1978). Mitigation measures would include designated skid trails, skyline corridors, and directional felling techniques and would be incorporated to keep soil

disturbance and detrimental compaction below 20% of the area. See soils effects documentation for further discussion.

Sediment delivery rates to stream channels are not expected to increase due to logging system impacts because of the implementation of BMP's, RHCA's, and other mitigations designed to reduce sediment. The greatest potential to increase sediment delivery rates during timber harvest activities is to the intermittent and perennial tributaries of Units 6, 8, 13, 14, 60, 84, 97, 98, 129, 131, and 132 in alternative 2 and intermittent tributaries of Unit 13 in Alternative 3 and 4, where RHCA buffer widths are proposed for modification. As discussed above site characteristics such as gentle terrain, abundant grass/forb cover throughout the buffers and sufficient downed wood in the channel, along the streambank, and in the RHCA, should minimize sediment delivery to channels.

Stream Temperature: Trees and shrubs provide shade that helps maintain cool stream temperatures. Adequate streamside vegetation including trees, shrubs, grasses, grass-like and forbs are necessary for precipitation and overland flow to be captured, stored and slowly filtered through the soils and released to the streams at cool temperatures that benefit fisheries resources. This also requires a healthy tree stand in and adjacent to actual riparian areas for long-term maintenance. The baseline maximum 7-day running average stream temperatures in Big Creek as it leaves forest service is 67 °F. This stream temperature in Big Creek, that contains redband trout, meets the INFISH RMO for water temperature requirement to comply with state water quality standards, or a maximum 7-day running average of less than 68 °F for surface waters that contain redband trout.

ALTERNATIVE 1 - NO ACTION

No change in existing stream temperatures will take place under this alternative in the short term. In the long term, in those areas where the streamside shade is primarily made up of dead and dying trees, stream temperatures are anticipated to either remain at the current levels or increase as the trees die out and reduce existing shade. Without active restoration (partial removal of dead and dying materials and planting) within these areas, the potential for future streamside shade from regeneration would be delayed approximately 20 years (pers. communication with Bob Clements, District Silviculturist). In the event of a large scale high intensity wildfire in the short term (1 to 2 years) the water temperature in the streams in the project area will potentially increase due to loss of vegetation that blocks solar radiation, traps sediment, encourages infiltration and reduces runoff, however in the long term (3 to 5 years) stream temperatures should stabilize as vegetation is restored.

ALTERNATIVES 2, 3 and 4

Adequate streamside vegetation to maintain stream temperatures will be left through the implementation of standard INFISH buffers (refer to buffer widths on page 45 of Chapter 2). In the instances of RHCA buffer modification and prescribed fire common to all three action alternatives, adequate streamside vegetation will be left within buffers to maintain stream temperatures in existing condition. No shade producing trees will be removed. Long-term shade will be enhanced through accelerating the growth of trees treated in these alternatives, as well as accelerating regeneration in areas of extreme tree mortality, which will accelerate long-term shade production for approximately 20 years.

Flow Regimes: The Matrix of Diagnostics, Pathways and Indicators used in consultation with United States Fish and Wildlife Service (USFWS) use an Equivalent Clearcut Acres (ECAs) recommended value of >15% to indicate potential changes in peak and base flows. ECAs will be used only as an indicator of overall disturbance in the Bald Angel project area, and will not be used to describe hydrologic response. The following table displays the changes in ECA values that would occur from the implementation of each of the action alternatives for the Bald Angel Project. All of the subwatershed's ECA values would be at or below 15%, except 29H for all action alternatives.

Alternative 4 would result in the least amount of overall disturbance in the project area, but only slightly greater than Alternative 2 and 3.

Summary of the Percent Change in ECAs for each Subwatershed per Alternative

SWS	Existing ECA %	Alternative 2 ECA %	Alternative 3 ECA %	Alternative 4 ECA %
13D	3.7	9.6	8.6	6.5
13E	10.0	14.8	14.2	13.9
13F	7.3	11.8	11.1	10.8
29D	9.6	11.9	11.7	11.7
29E	7.3	11.4	10.9	10.7
29F	8.8	15.0	13.7	12.5
29H	11.5	21.0	19.0	18.9

Water Quality Summary: Alternative 2 poses a slightly greater risk to water quality than Alternative 3 and 4 due to the additional miles of new and temporary road construction and the additional acres of stand treatment (676 and 1,069 acres, respectively). The additional activity proposed in Alternative 2 would result in more overall ground disturbance than Alternatives 3 and 4.

All three action alternatives may cause short-term (0-2 years) impacts to water quality because of ground disturbing activities and the use of roads within RHCAs. However, long-term decreases in sediment delivery rates should occur due to the decommissioning, closure, or relocation/reconstruction of roads in general, and especially of those roads within RHCAs.

2. Fish Habitat and Populations

Direct Effects on Fish Habitat and Populations

ALTERNATIVE 1 - NO ACTION

There are no direct effects on instream fish habitat or populations as a result of the No Action alternative. Effects related to this alternative on fish habitat and populations are primarily indirect in nature.

ALTERNATIVES 2, 3 and 4

No direct effects on fish habitat are expected from the implementation of any action alternative described with this project. The location of activity away from perennial stream channels, adequate riparian buffers (RHCAs), and timing of activities in relation to soil moisture conditions will prevent direct adverse effects to stream channels, fish habitat, and fish populations. Potential adverse effects such as increased sediment yield and direct channel sedimentation, removal of large woody material from the channel, disturbance of spawning areas, and any instream impacts are not expected.

Indirect Effects on Fish/Riparian Habitat and Fish Populations

ALTERNATIVE 1 - NO ACTION

Riparian habitat will be maintained in its current condition. Restoration of healthy riparian conditions would not occur. Properly functioning stream conditions depend on healthy RHCAs. Overstocked stand conditions resulting in stand density indexes that are up to 50% above the upper management zone within RHCAs may reduce the ability of these areas to maintain water quality, reduce sediment transport, and put these areas at risk to loss in the event of a wildfire. Retaining dead trees, does

not promote new tree growth or acceleration of tree growth through stocking control, which would promote healthier RHCA's, reduce the likelihood of a damaging wildfire, and promote future shade.

ALTERNATIVES 2, 3 and 4

RHCA's within the project area are at moderate risk of an intense wildfire in some drainages due to the high fuel loads and overstocked understories. Overstocking in the understory creates a situation where trees are susceptible to mortality through infestation of insects and competition for water and nutrients. Under INFISH, in non-priority watersheds, a watershed analysis is not required to modify RHCA if a site-specific analysis has determined an ecological need to maintain or enhance RMO's. INFISH defines the RHCA's as having a standard width of 300 feet for Class I and II, 150 feet for Class III, and 50 feet for Class IV streams in non-priority watersheds. These buffers can be entered into as long as the stipulations under the Timber Management section are met. These state that harvest can take place where catastrophic events resulted in degraded riparian conditions and "...where present and future woody debris needs are met, where cutting would not retard or prevent attainment of other Riparian Management Objectives (RMO's), and where adverse effects on listed anadromous fish can be avoided." Harvest can also take place in RHCA's when silvicultural practices are applied to acquire desired vegetation characteristics in order to meet RMO's.

Modified RHCA's along intermittent and perennial stream channels are proposed for Units 6, 8, 13, 14, 60, 84, 97, 98, 129, 131, and 132 in Alternative 2 and along intermittent tributaries within Unit 13 in Alternatives 3 and 4, and would be treated using a commercial or non commercial thinning within the riparian area as described in Chapter 2 of this EA. In each of these units, achievement of riparian management objectives for shade and large wood recruitment would be accelerated approximately 20 years with the restorative treatments prescribed.

The specific modifications of RHCA widths on a case-by-case basis are designed to improve riparian conifer stand conditions. The removal of standing and down dead trees within RHCA's will aid in reducing the risk of intense wildfire and provide opportunities for regeneration. Thinning overstocked stands will improve residual tree vigor and take advantage of site productivity. Treatment will favor and promote tree species best suited for the site. Best suited tree species will be more resistant to insect infestation and disease as well as catastrophic fire.

There will be no measurable changes to sediment delivery rates as well as no direct impacts on stream shade and bank stability due to site specific marking and layout of units with proposed harvest. The parameters considered for treatment prescriptions in RHCA's includes existing levels of large woody debris in the riparian area and stream channel, existing condition of the riparian vegetation, location of primary and secondary terraces, side slopes, soil type and depth, ground cover and stability, and proximity of the RHCA to natural openings.

The change in these specific RHCA's would not increase the potential for impacts. Supporting criteria include gentle terrain (5-25%), abundant grass/forb cover throughout the buffer, and sufficient downed wood in the channel and along the bank. There will be no measurable changes in sediment delivery rates and no direct impacts on stream shade or bank stability due to site specific marking and layout of modified RHCA's by watershed specialists and fisheries biologists. All other stream channels within the project area would have INFISH RHCA's.

Direct ignition would not be permitted within 150 feet of Class I or III streams and generally within 50 feet of Class IV streams. Low intensity fire would be allowed to back into all stream Classes. All RHCA's within prescribed fire areas have high departures from historical low fire return intervals and prescribed fire would aid in their recovery. Prescribed fire would be designed to reintroduce low intensity burning to sustain the historic fire regime of low probability and small fires.

Removal of trees and burning of small fuels within the RHCA's will not prevent the attainment of RMO's. The removal and burning of standing dead and down trees within RHCA's will accelerate tree

growth (by 20 years), aid in conifer regeneration, and reduce the risk of intense wildfire. Standard INFISH buffers implemented in all other units should maintain riparian habitat in its existing condition. Implementation of any of the action alternatives should improve riparian habitat.

Burning in these specific units would not increase the potential for impacts. Supporting criteria include timing of prescribed burns during periods when weather is cool and relative humidity is high (spring and fall), wind speeds are low, and fuel moisture conditions are appropriate to meet project objectives and prescriptions for each unit. There would be no measurable changes in sediment delivery rates and no direct impacts on stream shade or bank stability due to site specific igniting location and firing techniques by fuels, watershed and fisheries specialists.

Encroaching conifers are hindering regeneration of approximately 25 acres of two quaking aspen stands located in the Balm Creek subwatershed (29E) of the Bald Angel Project on the La Grande Ranger District. Aspen historically was estimated to be in higher numbers than today. The reduction at this site is primarily due to reduced fire occurrences. Aspen is a disturbance dependent species that is highly shade intolerant that regenerates through both seed germination and root suckers. Succession is converting these stands from aspen to conifers. The objectives for this project are to set back succession by removing or killing most conifers within the aspen stands, and introducing some disturbance to the soil and vegetation. This will reduce competition and stimulate suckering. Wildlife will benefit from this project through the creation of heterogeneity in the forested landscape, and perpetuation of an uncommon tree species that is very valuable to wildlife.

Cumulative Effects for Water Quality, Fish Habitat and Populations

Potential cumulative effects are analyzed by considering the proposed activities in the context of past, present and reasonably foreseeable actions. For the Bald Angel project, activities are considered in the following sixth field subwatersheds (SWS):

SWS	SWS Name
13D	Big Creek – Medical Springs
13E	Big Creek – Big Creek Ditch
13F	Upper Big Creek
29D	Upper Goose Creek
29E	Balm Creek
29F	Clover Creek
29H	Tucker-Houghton Creeks

These are the areas where cumulative effects have occurred or may occur. In addition, some activities have an influence that may extend downstream in the subwatershed within the project area boundary through the Medical Springs and Keating drainage systems as far as the Powder River. This broad area is referred to as the “cumulative effects analysis area” and in general all alternatives are considered in the context of relevant past, present and reasonably foreseeable activities in this area.

The tables in Appendix D of this EA summarize the past management activities that have occurred in the cumulative effects analysis area.

ALTERNATIVE ONE (No Action)

While the potential impacts described above from the Bald Angel Project would not occur under this alternative, neither would the restoration activities, which would reduce sediment delivery, rehabilitate problem areas in roads, reduce access and potential impacts to sensitive riparian areas and fisheries, no acceleration of large wood recruitment and shade would occur. As the area continues to be at risk to wildfire, and increases susceptibility to insect infestation it would be considered again for entry long before the 20 years described as the objective under the action alternatives.

ALTERNATIVES 2, 3 and 4

The highest potential for cumulative effects on the watershed and fisheries resources in the subwatersheds included in the Bald Angel Project for Alternative 2, 3 and 4 is from the modifications of the ECA value from timber harvest (see ECA analysis). Restrictions on harvest prescriptions, on location, and timing of harvest due to the implementation of INFISH standards and guidelines would reduce impacts to riparian areas and stream channels.

Present and future prescribed burning (over the next 5 years) within the analysis area would reduce impacts to water and fisheries resources by preventing large catastrophic wildfires that could result in overstory mortality and severe soil damage resulting in sedimentation of stream channels. Enhancement of 25 acres of aspen would also reduce impacts to water and fisheries by improving the functionality of the drainage through improved riparian habitat.

Improved management (primarily fencing and grazing strategies) on domestic livestock grazing have reduced impacts to riparian areas and stream channels due to the implementation of INFISH standards and guidelines.

Recreation activity has remained consistent in the project area primarily centering on big and small game hunting and camping around Balm Creek Reservoir. Restrictions on location of all types of user trails and ATV use would be reduced, under the proposed area closure, and impacts to riparian areas and stream channels would continue to be reduced. Continued implementation of these forest management activities are not expected to cause adverse effects on water, riparian and fish resources.

Of the remaining past activities, past and future aspen enhancement activities also reduce impacts to water and fisheries by improving the functionality of the drainage through improved riparian habitat, although, this is at such a small scale that cumulatively it would not be measurable at the landscape level. Only minor amounts of lode mining has historically occurred within the project area, all of which are well away from water and very minor in nature, therefore, there will be no cumulative effects from this project in relation to the historic mining activity within the project area.

Road Density

Road densities on both private and public ground in the analysis area have decreased in the last 10 years and the Bald Angel Project would further reduce road densities through and area closure. Road densities within the analysis area have decreased, due to road closures and decommissioning in recent years. Overall, there is a strong effort to reduce the magnitude of cumulative effects due to road surface erosion. Closing roads reduces sediment yields by allowing adequate road drainage to be installed, decreasing maintenance needs and traffic, and allowing natural regeneration of many of the roadbeds to begin. The following table shows the reduction in open road densities under each action alternative within the project area in each subwatershed. Post project open and closed road densities would be the same in each alternative, as all new road construction would be closed at the completion of the project. Alternative 4 would result in the least amount of ground disturbance due to no new and temporary road construction. The overriding effect of the proposed decommissioning would be beneficial to water quality, fisheries habitat and riparian habitat.

Summary of Forest Service Open Road Densities for each Subwatershed per Alternative in the Bald Angel Project Area

SWS/WA	Drainage Area (m ²)	FS Open Road (mi)	Forest Service Open Road Densities (mi/mi ²)	
			Existing	Alt 2, 3 and 4
13D	2.6	4.7	1.8	1.2
13E	7.5	22.4	3.0	2.3
13F	22.9	65.6	2.9	2.4
29D	6.5	34.2	5.3	4.6
29E	8.9	32.2	3.6	3.1
29F	2.7	8.8	3.3	3.3
29H	2.5	7.8	3.1	2.6
13	33.0	92.7	2.8	2.2
29	20.6	83.0	4.0	3.5
Total	53.6	175.7	3.3	2.7

Project implementation would not add to cumulative effects in any of the subwatersheds due to INFISH protection and mitigation measures being implemented in full.

Summary: There are no listed fish species or designated critical habitat within the project area or analysis area. The fish species of concern within this project area is USDA Forest Service Regional Forester's (Region 6) candidate 2 sensitive species redband trout (*Oncorhynchus mykiss gibbsi*). There are no expected adverse effects to fish habitat and populations from the proposed action alternatives due to the implementation of activities away from perennial streams, adequate riparian buffers (RHCAs), and timing of activities in relation to soil and moisture conditions. The primary indirect effects to fish populations that could occur as a result of the Bald Angel Project are effects to water quality from sediment delivery, as described above. Any potential increases to sediment delivery rates as a result of the Bald Angel Project are expected to be negligible and pose no risk to redband trout.

Soil Quality and Productivity

Introduction

The following displays the effects on soil resources for the proposed 34,270 acre Bald Angel Vegetation Management project (herein referred to as Bald Angel) located within the 74,582 acre analysis area. The Bald Angel analysis area is within NFS watersheds 17050203-13 (Powder River-Pondosa) and 17050203-29 (Powder River-Keating); includes subwatersheds 13D, 13E, 13F, 29D, 29E, 29F and 29H and serves as the scale of analysis for soils.

Specific analysis of effects to soil resources is further detailed to the treatment unit (e.g. Unit 72 for thinning or fuels reduction) as necessary in order to provide site specificity. Treatment units are used for analysis since these are the areas where measurable effects to soil resources occur, including cumulative effects. Unit of measure is typically by the acre, a percentage of the unit in question and miles of road.

Effects to soils can be short-lived (one to three years) in the case of erosion hazard; soil exposure depends on revegetation processes to determine how long risk of erosion is a concern. Erosion control measures and/or revegetation normally occur immediately with full effectiveness of new vegetation occurring in the first

year or two. Other effects to soils such as compaction, rutting and displacement tend to be longer term impacts that are cumulative in nature if these types of impacts have not fully recovered when new activity occurs in the same location.

Management activities can result in direct, indirect and cumulative effects on soil productivity and soil stability (WWNF 1990, Soils S&G #1). Effects may be positive or negative. Effects may include alteration of physical, chemical, and/or biological characteristics or properties of soils. Many standard and guidelines in the Forest Plan, in addition to the five in the soils section, relate to soil function, soil productivity and soil stability.

The most adverse effects of management activities on soils are described as detrimental compaction, detrimental puddling, detrimental displacement, detrimental burning, detrimental erosion, and detrimental mass wasting; other concerns include adverse changes in vegetation and organic matter on the soil surface, and adverse changes in water table (USFS 1998). Soil compaction, puddling, displacement, severe burning, and impacts to ground cover (vegetation and organic matter) are direct effects; soil erosion, mass wasting, and changes in water table are indirect effects. Cumulative effects are the sum of incremental changes in past, present, and reasonably foreseeable future direct/indirect effects on the soil resource that overlap both in time and space.

The *magnitude* of the effects of an activity on soil function, soil productivity and soil stability are described by the *speed*, *direction* (upward/downward), *extent*, and *duration* of change. Minimizing productivity losses associated with any action can be accomplished by managing the magnitude of detrimental soil conditions within activity areas through prescription and/or mitigation.

Planned management activities must minimize new soil damage and must provide for restoration measures when and where they are appropriate (WWNF 1990, Soils S&Gs).

Cumulative effects are rated as negligible, minor, moderate or major based on professional judgment. Negligible means the effect of an activity on an indicator was so small it was not measurable, or caused a change of less than 1%, or less than 1% of an area was affected. Minor means the effect was a change equal to less than one-half of the flexibility for a standard, or 1-10% of an area was affected. Moderate means the effect was a change equal to more than one-half of the flexibility for a standard, or 11-20% of an area was affected. Major means a standard was exceeded or more than 20% of an area or resource was affected; e.g. the detrimental soil condition threshold is 20% (USFS 1998).

In the following discussion, the degree of impact, of compaction, puddling, displacement, severe burning, erosion, mass wasting, organic matter loss and drainage class change is severe enough to classify effects as detrimental soil conditions (DSCs). Extent is described generally as affected area and duration is noted as years. The effects outlined below are based on soil mitigation measures being implemented in full.

It is important to keep in mind that DSCs naturally change over time. Certain DSCs recover in a few years to decades, while other DSCs require recovery times of 100 or more years without restoration treatments. DSCs with long recovery rates are often considered for restoration treatments, where environmentally and economically feasible.

Description of Soils

Soils in the Bald Angel project area developed over layers of basalt, Andesite and Columbia River bedrock. In the majority of the area the soil is buried under a layer of volcanic ash deposited from the eruption of Mount Mazama approximately 6000 years ago. Soil depths in the project area range from very shallow (less than 10 inches) to deep (40 to 60 inches).

The soils in the area are generally stable. The forest management practices to be used in project are not expected to precipitate mass soil movement in either mineral or ash soil types. The mantle of soil formed by the ash is usually stable and slumps are uncommon under natural conditions. 90% of the treatment acres are located on Landtype Associations (LTA) that support soils that are

generally deep, stable and are on slopes less than 30%. The following table summarizes the amount of acres proposed to be treated on each LTA. Specific characteristics of each LTA are described in the Soils Existing Conditions document for the Bald Angel project (UNF 2000).

Treatment acres proposed for each Landtype Association Soil in the Bald Angel Project

LTA	Treatment Acres		
	Alt 2	Alt 3	Alt 4
116	1710	1498	1373
117	143	104	104
166	1319	1098	1069
167	18	18	18
216	765	721	532
217	248	171	127
266	863	791	726
267	38	38	9
316	44	25	22
367	20	19	19

EFFECTS ANALYSIS

No Direct, Indirect, or Cumulative Effects on Soils

The following restoration activities associated with the Bald Angel project have been analyzed and are of such limited context and constrained nature that they would have little to no measurable effect on Soils resources.

- Precommercial Thinning

These activities and their effects will not be discussed further in the Soils section.

Direct Effects on Soil Quality

ALTERNATIVE 1 – NO ACTION

This is the no action alternative, which means that all actions authorized by current management plans, permits, easements, and contracts would continue. Authorized actions on National Forest lands in the project area include agency actions, such as, road maintenance and noxious weed treatments, and public actions, such as livestock grazing, fuelwood cutting, mining and various types of recreation.

All current detrimental soil conditions would continue to exist, with some conditions improving, others remaining static, and still others deteriorating over time. Plus some new detrimental soil conditions are likely to occur from the above listed ongoing activities.

Ongoing activities effects on soil quality would include:

Compacting and Puddling: These soil impacts are associated with skid trails, landings and non-surfaced roads, ATV trails, livestock trails and dispersed campsites. Effects include reduced water holding capacity, infiltration and permeability, reduced ability of soil to support vegetation and organisms in and on the soil, increased runoff and in extreme cases, a change in drainage class.

Reoccurring uses by livestock, wildlife, ATVs, vehicles and equipment could potentially re-compact or re-puddle these areas. Where cyclic impacts are low to non-existent, existing compaction and puddling would improve over time in the top 4 inches, due to beneficial effects of frost heaving, root establishment of vegetation and rodent activity. Compaction deeper than 4 inches could persist 20 to potentially 100+ years.

Displacement: These soil impacts are associated with roads, landings, skid trails and rock pits. Effects include reduced water holding capacity, loss of ground cover, nutrients and soil microorganisms and increased runoff due to an increased amount and condition of bare ground exposed. Duration of effects is permanent, unless soils are replaced with equipment, however some soil mixing will still occur.

Severe Burning & Organic Matter Loss: These soil impacts are associated with areas with soil displacement, discussed above, plus areas that experience prescribed fire and wildfire. Effects include short-term to long-term loss of organic ground cover (duff, litter, coarse wood, basal area of herbaceous plants) and canopy cover (herbaceous plants, shrubs, trees). Severely burned soils experience nutrient loss, microorganism mortality, increased water repellency, runoff and erosion hazard.

Organic matter would continue to accumulate and recycle in rangeland and forestland plant communities. Organic matter accumulations would be slowest in rangelands and in forestlands where the canopy has been removed, including on decommissioned roads along Big Creek, Lick Creek and Velvet Creek. In areas where the canopy cover is present, organic matter accumulations on the forest floor would equal or exceed historic accumulation rates due to current fire control activities, which would continue to maintain or improve soil productivity. Existing disturbed areas such as skid trails, landings, and decommissioned roads would continue to have lower than normal accumulations of organic matter on the soil surface. Moderate to severe burn effects would decrease as trees, herbaceous plants, and soil flora and fauna recolonize burned sites and organic matter accumulates.

The potential for high intensity wildfires increases every year in the absence of forest density management and surface soil organic matter management. In the event of a wildfire, the potential effects upon soil productivity, extent of post-fire soil erosion, and the length of time needed for soil recovery from those impacts would depend primarily upon the fire intensity, mosaic, and fire size. The length of time needed for soil recovery would depend upon residual post-fire surface soil organic matter, soil erosion, and the length of time needed for ground cover reestablishment. Stand replacing wildfires could reduce long-term soil productivity by removing litter, humus, and large downed woody material from the soil surface, by consuming soil organic matter, and by killing soil flora and fauna essential to the nutrient recycling process to a 9 to 16 cm soil depth. Surface soils and their associated nutrient reserves could also be lost through increased erosion due to loss of ground cover and due to soil crusting and water repellency, which reduces infiltration.

Drainage Class (Soil Moisture Regime): Changes in soil drainage class exist where rockpits store water, where water collects in puddles on native surface roads, and where road fills have covered riparian wetlands. No change in soil drainage class is expected over time under this alternative.

Commercial Timber Harvest

Table 3. Summary of the Commercial Timber Harvest Acres and the Logging System Acres per Alternative

Action	Alternative 2	Alternative 3	Alternative 4
Total Commercial Harvest	4869	4193	3800
Tractor Logging	3885	3514	3300
Skyline Logging	618	570	391
Helicopter Logging	359	109	109

Direct Effects on Soils Quality

The following models were used in analyzing potential detrimental soil compaction conditions from project activities. In addition to logging effects, roads and potential burning effects were also analyzed to determine the total potential to affect soil quality within the project area. Rationale for burn effects is discussed in the burn effects section.

Assumptions:

Tractor Logging Model:

Project design allows skid trails an average of 60 feet apart on tractor ground. At this spacing, for a processor with 2-foot wide tracks and 12-foot wide total width, one pass would disturb 4 feet of each 72 feet or 5.6%. Multiple passes, including use of a forwarder, would widen skid trails and disturb about twice that width or about 12%. For a tractor/skidder operation, soil disturbance from skid trails would be 12-14 feet wide or 14 out of 74 feet or 19%. Landings typically occupy about 1% of a unit. So, total disturbance for the above equipment would be in the 13-20% range.

As noted in the soils existing condition report, ground transects of older tractor logging impacts in the project area indicate that an average of approximately 50% of the soil disturbance found along transects (other than roads) qualifies as detrimental soil conditions (DSCs).

Using the results of this survey, 13-20% new disturbance would be equivalent to an average range of 7-10% potential DSCs. Several factors would influence actual effects, such as equipment type, operator skill, coarse woody debris, slope gradient, use of existing skid trail network and landings, and soil moisture, rockiness and density. With 60-foot skid trail spacing on volcanic ash soils, potential DSCs could be in the upper half of the 3-15% DSC range, or about 9-15% DSCs. For this analysis, 10-15% DSCs will be used for analyzing tractor units.

Skyline Logging Model:

Potential DSCs from skyline logging are lower than from tractor logging. Skyline yarding on 0-20% slope gradients produces about 7% DSCs (Mclver 1998). Effects should be less on steep slopes in the project area where deflection is better for partial to full suspension systems. 5% DSCs will be used for skyline units.

ALTERNATIVE 2

The most important direct effects of harvest activities on soils are compaction and displacement of litter, duff and topsoil by harvest equipment. Most of these effects would be in tractor yarding areas (3,885 acres); some effects would occur in skyline yarding areas (618 acres) that are in the table

above. The implementation of Alternative 2 would increase DSCs by 1.9%, which would result in 6% of the project area in a DSC that is well below the 20% allowed by the Forest Plan guidelines.

ALTERNATIVE 3

Harvest area would be reduced by 676 acres (14%) compared with Alternative 2. Tractor yarding area would be reduced by 371 acres, and skyline yarding area would be reduced by 48 acres. This would result in less potential for compaction and displacement of litter, duff and topsoil by harvest equipment and 1.74% increase in DSCs.

ALTERNATIVE 4

Harvest area proposed for Alternative 4 would be reduced by 1,069 acres (22%) compared with Alternative 2 and 393 (9%) compared to Alternative 3. Alternative 4 would reduce tractor yarding area by 585 acres and 286 acres, and skyline yarding area would be reduced by 227 acres and 179 acres, respectively, compared to Alternative 2 and 3. This would result in the least amount of potential impact to soils with a 1.58% increase in DSCs.

Summary: As a result of site-specific surveys and the above analysis, 13 units common to all alternatives (50, 67, 84, 87, 88, 100, 106, 108, 109, 111, 133, 141, and 143) were identified as a high priority for monitoring due to their current DSC levels being at or below 15% for skyline logging units and 10% for tractor logging units to ensure that project design and mitigations are properly implemented to ensure DSC levels remain below Forest Plan minimums of 20%.

Methods such as operating seasons, use of existing landings and skid trails, subsoiling, etc. are effective measures for minimizing or rehabilitating potential soil impacts. Utilizing these methods is expected to maintain DSC levels well within Forest Plan standards and guidelines for all three action alternatives.

Indirect Effects on Soils Quality

ALTERNATIVE 1

This alternative would leave the greatest amount of organic matter in the system. It also has the greatest risk of wildfire which could result in an unpredictable reduction of organic matter, increase in surface erosion and possible soil damage from heat. With this alternative, no additional compaction would occur. Selection of this alternative would reduce the opportunity to rehabilitate pre existing compaction.

ALTERNATIVE 2

Long-term soil productivity of forested ecosystems relies on a continual flux of coarse woody material. Important nutrients to the soil ecosystem, such as sulfur, phosphorus and nitrogen, are supplied by decaying coarse woody material (Graham 1994). Timber harvest, slash disposal and site preparation can reduce the amount of organic material in the forest floor to below what is needed to ensure soil productivity (Harvey et al. 1987). Recent publications have provided information on appropriate levels of coarse wood required to protect long term soil productivity (Agee 1994, Harvey et al. 1994, Graham 1994).

One indirect effect of harvest activities on soils would be the loss of nutrients by removing trees from the ecosystem that would naturally recycle into the soil over the long-term if they were left on site. However, the harvest of trees in units will reduce the N-capital by only about 1-2% because only a portion of trees will be removed from each unit and only the stems will be removed. Alternative 2 proposed to remove 12.5 MMB.

Another effect is increased soil erosion hazard in areas where ground cover is removed by

equipment over a large enough area to pose a hazard of long-term accelerated erosion.

ALTERNATIVE 3

Nutrient loss from timber harvest would be reduced by 13% (1.6 MMBF) compared with Alternative 2. Erosion hazard would also be reduced by foregoing harvest in 695 acres compared with Alternative 2.

ALTERNATIVE 4

Nutrient loss from timber harvest would be reduced by 22% (2.7 MMBF) compared with Alternative 2 and reduced 10% (1.1 MMBF) compared with Alternative 3. Erosion hazard would also be reduced by foregoing harvest in 1,078 acres compared with Alternative 2 and 383 acres compared with Alternative 3.

Cumulative Effects on Soils Quality

The combination of the past harvest activities, extensive road network built to facilitate the logging operations that provide continued access, organic matter reductions from prescribed fire and livestock and recreational use will be considered to assess cumulative effects of this project.

DSCs naturally change over time. Certain DSCs recover in a few years to decades, while other DSCs require recovery times of 100 or more years without restoration treatments. DSCs with long recovery rates are often considered for restoration treatments, where environmentally and economically feasible.

ALTERNATIVE 1

The cumulative effects of all past, present and reasonably foreseeable direct and indirect effects of detrimental soil conditions on soil quality, soil function, soil productivity, and soil stability over the next 10 years would be a static to improving trend, with potential for a downward trend due to increasing potential for wildfire or flood damage.

Analysis of the cumulative effects of detrimental soil conditions indicates that soil quality is being maintained on about 96% of the project area, in comparison to the Forest Plan guideline of maintaining at least a minimum of 80% of the project area in a non-detrimental soil condition.

On that 4% of the project area considered in a detrimental condition, ground cover, fine organic matter, and coarse woody material is below potential. The remaining 96% has adequate levels and since the project area has been protected from wildfire and rangelands appear to be properly grazed, there are satisfactory accumulations of ground cover, fine organic matter, and coarse woody materials on forestland and rangelands.

ALTERNATIVES 2, 3 and 4

Implementation of harvest treatments for Alternative 2, 3 and 4 would increase DSCs in the project area about 1.90%, 1.74% and 1.58% respectively. The effect of harvest combined with past and foreseeable future activities and the currently proposed prescribed fire treatments and new and temporary roads would result in a maximum increase in DSCs of approximately 4% for a total of 8%, which is well below the Forest Plan guidelines of 20%. There is less than one mile (2.24 acres) of road proposed for obliteration for all alternatives, which would not result in a measurable decrease in DSCs.

Prescribed Fire

Direct and Indirect Effects on Soils from Rx Fire

Prescribed fire usually results in a mosaic of low, moderate and high fire severity that would be classified mostly as low severity burn class. Low-severity burn class effects include up to 2% high fire severity, up to 15% moderate fire severity, and at least 83% low fire severity and unburned. There is potential for fall burns and for heavier fuel areas to experience the low end of the moderate-severity burn class.

High fire severity effects are what Region 6 standards define as a detrimental soil condition. The top of the mineral soil would be reddish to orange. Soil organisms would be killed to a depth of 9 to 16 cm. All organic materials in color-altered soil near the soil surface, plus all litter and humus and most woody debris on the soil surface would be consumed. There would be up to about 1% high fire severity from spring burns and about 2-3% from fall burns.

There would be an additional 2-15% moderately fire severity, with about 2-5% for spring burns, and higher percentage for fall burns. Soil organisms would be killed to a depth of 3 to 5 cm. Litter would be consumed and duff would be charred to consumption. For low severity fire areas, soil organisms would be killed to a depth of only 1 cm, and duff would be largely intact with scorching to consumption of litter.

Erosion hazard would increase in moderate and high fire severity areas due to loss of litter and duff on the soil surface. However, change in erosion hazard would be small in low-severity burn class (and low end of moderate-severity burn class) areas where a minimum of 60-70 percent total effective ground cover still exists, there is a good mosaic burn pattern, and a residual forest canopy has the potential to replace litter burned by the fire.

ALTERNATIVE 1

Implementation of the no action alternative would increase the potential for high intensity wildfires due to the absence of forest density management and surface soil organic matter management. In the event of a wildfire, the potential effects upon soil productivity, extent of post-fire soil erosion, and the length of time needed for soil recovery from those impacts would depend primarily upon the fire intensity, mosaic, and fire size. The length of time needed for soil recovery would depend upon residual post-fire surface soil organic matter, soil erosion, and the length of time needed for ground cover reestablishment. Stand replacing wildfires could reduce long-term soil productivity by removing litter, humus, and large downed woody material from the soil surface, by consuming soil organic matter, and by killing soil flora and fauna essential to the nutrient recycling process to a 9 to 16 cm soil depth. Surface soils and their associated nutrient reserves could also be lost through increased erosion due to loss of ground cover and due to soil crusting and water repellency, which reduces infiltration.

ALTERNATIVES 2, 3 and 4

In general, the estimated percent additional detrimental soil conditions that maybe be expected from prescribed fire range from 1-2% of the actual area burned. The acres of prescribed fire treatment proposed for the Bald Angel project would result in less than 1% increase in DSCs for all three alternatives. The increase in DSCs would potentially be 0.80%, 0.77% and 0.72% for Alternative 2, 3, and 4 respectively. This increase would result in the DSCs for the Bald Angel project to be approximately 5%, which is well below the Forest Plan guideline of 20%.

Cumulative Effects Soils from Rx Fire

The summary of the past management activities that have occurred in the cumulative effects analysis area described in Appendix D which includes the subwatersheds (6th field HUCs) within the Bald Angel project was used to complete this analysis. The combination of the past harvest activities, extensive road network

built to facilitate the logging operations that provide continued access, organic matter reductions from prescribed fire and livestock and recreational use will be considered to assess cumulative effects of this project.

ALTERNATIVE 1

The cumulative effects of all past, present and reasonably foreseeable direct and indirect effects of detrimental soil conditions on soil quality, soil function, soil productivity, and soil stability over the next 10 years would be a static to improving trend, with potential for a downward trend due to increasing potential for wildfire or flood damage.

Analysis of the cumulative effects of detrimental soil conditions indicates that soil quality is being maintained on about 96% of the project area, in comparison to the Forest Plan guideline of maintaining at least a minimum of 80% of the project area in a non-detrimental soil condition.

On that 4% of the project area considered in a detrimental condition, ground cover, fine organic matter, and coarse woody material is below potential. The remaining 96% has adequate levels and since the project area has been protected from wildfire and rangelands appear to be properly grazed, there are satisfactory accumulations of ground cover, fine organic matter, and coarse woody materials on forestland and rangelands.

ALTERNATIVE 2, 3 and 4

Implementation of prescribed fire treatments for Alternative 2, 3 and 4 would increase DSCs in the project area about 0.80%, 0.77% and 0.72% respectively. The effect of prescribed fire combined with past and foreseeable future activities and the currently proposed harvest treatments and road treatments would result in a maximum increase in DSCs of approximately 4% for a total of 8%, which is well below the Forest Plan guidelines of 20%. There is less than one mile (2.24 acres) of road proposed for obliteration for all three action alternatives, which would not result in a measurable decrease in DSCs.

Roads

Direct and Indirect Effects of Roads on Soils

Miles of Road Work Proposed for Alternatives 2, 3 and 4

Road Work	Alternative 2	Alternative 3	Alternative 4
Reconstruction	2.25	2.25	2.25
Decommissioning	29.1	29.1	29.1
Temporary Road Construction	8.9	3.94	0
New Road Construction	1.52	1.42	0

ALTERNATIVE 1

Soil displacement and erosion rates would remain at existing levels and/or increase, including the effects of poorly drained and designed roads and user built trails, under this alternative. This alternative would provide no opportunity to perform restoration activities to correct recreational trail problems or decommission/rehabilitate road system problem areas.

ALTERNATIVES 2 and 3

In general, the estimated percent additional detrimental soil conditions that maybe be expected from prescribed fire range from 1-2% of the actual area burned. The acres of prescribed fire treatment proposed for the Bald Angel project would result in less than 1% increase in DSCs for all three alternatives. The increase in DSCs would potentially be 0.80%, 0.77% and 0.72% for Alternative 2,

3, and 4 respectively. This increase would result in the DSCs for the Bald Angel project to be approximately 9%, which is well below the Forest Plan guideline of 20%.

The primary effect of road work on soil quality is detrimental soil displacement and soil erosion. The table above summarized the miles of road work that would occur for each alternative in the Bald Angel Project. Reconstruction would involve negligible new cuts and fills. Placement of road closure barriers would not cause new soil disturbance outside of the existing roadway. Specified and temporary road construction would cause approximately 21 and 10 acres of new soil displacement for Alternative 2 and 3 respectively and new road construction would cause approximately 5 acres of new soil displacement for both Alternatives. This would increase DSCs by 0.08% and 0.04% for Alternative 2 and 3 respectively. This increase would result in the DSCs for the Bald Angel project to be approximately 5%, which is well below the Forest Plan guideline of 20%.

Soil erosion would increase initially on proposed acres of reconstructed, specified, temporary and decommissioned roads. The drainage and stabilization of soils would improve over the next five years and as vegetation is reestablished. The amount of road work proposed for the project is relatively the same for Alternative 2 and 3. There would be a decrease in soil erosion over 3 to five years through the proposed area closure due to a decrease in use by motor vehicles on the closed roads, again, allowing vegetation to reestablish and hold soils. Temporary roads would be subsoiled, seeded and restabilized in the same season of use to prevent any immediate detrimental affects to soils.

ALTERNATIVE 4

No new road or temporary road construction miles are proposed for Alternative 4. The implementation of Alternative 4 would result in 27 less acres of soil displacement compared to Alternative 2 and 15 less acres compared to Alternative 3.

Alternative 4 proposes that no new or temporary road construction occur, but does include the area closure, which would result in no increases in soil erosion and potentially over time decrease soil erosion from the implementation and enforcement of the area closure due to the decrease in use by motor vehicles and vegetation reestablishing. The 2.25 miles of road proposed to be reconstructed would initially affect soil but over the next two years the improved drainage will allow vegetation to reestablish and stabilize the soils.

Cumulative Effects Soils from Roads

A summary of the past management activities that have occurred in the cumulative effects analysis area, which includes the subwatersheds (6th field HUCs) within the Bald Angel project area is located in the cumulative effects table above.

The combination of the past harvest activities, extensive road network built to facilitate the logging operations that provide continued access, organic matter reductions from prescribed fire and livestock and recreational use will be considered to assess cumulative effects of this project.

It is important to keep in mind that DSCs naturally change over time. Certain DSCs recover in a few years to decades, while other DSCs require recovery times of 100 or more years without restoration treatments. DSCs with long recovery rates are often considered for restoration treatments, where environmentally and economically feasible.

ALTERNATIVE 1

The cumulative effects of all past, present and reasonably foreseeable direct and indirect effects of detrimental soil conditions on soil quality, soil function, soil productivity, and soil stability over the next 10 years would be a static to improving trend, with potential for a downward trend due to increasing potential for wildfire or flood damage.

Analysis of the cumulative effects of detrimental soil conditions indicates that soil quality is being maintained on about 96% of the project area, in comparison to the Forest Plan guideline of maintaining at least a minimum of 80% of the project area in a non-detrimental soil condition.

On that 4% of the project area considered in a detrimental condition, ground cover, fine organic matter, and coarse woody material is below potential. The remaining 96% has adequate levels and since the project area has been protected from wildfire and rangelands appear to be properly grazed, there are satisfactory accumulations of ground cover, fine organic matter, and coarse woody materials on forestland and rangelands.

ALTERNATIVE 2, 3 and 4

Implementation of road treatments for Alternative 2, 3 and 4 would increase DSCs in the project area about 0.076%, 0.043% and 0.0% respectively. The effect of road treatments combined with past and foreseeable future activities and the currently proposed harvest treatments and prescribed fire treatments would result in a maximum increase in DSCs of approximately 4% for a total of 8%, which is well below the Forest Plan guidelines of 20%. There is less than one mile (2.24 acres) of road proposed for obliteration for all three action alternatives, which would not result in a measurable decrease in DSCs.

Proposed, Endangered, Threatened, and Sensitive Species (PETS)

Evaluation of effects to terrestrial PETS species is discussed below and covered in the biological evaluations for PETS wildlife and plant species, residing in the analysis file of this project. Evaluation of effects to plants and aquatic PETS species has been covered earlier under "Water Quality, Fisheries, and Riparian Habitat" and in the Plants PETS discussion below.

This project is not within a lynx analysis unit and will therefore have no effect on lynx or lynx habitat. This project will have no effect on bald eagles or their habitat. Impacts to sensitive species will be non-existent to minor in scale and duration, and will not lead to federal listing of any of these species (reference the Wildlife Biological Assessment/Evaluation in the analysis file).

Sensitive Plant Species

Introduction

The following discussion addresses the effects on Region – 6 Sensitive Plant Species for the Bald Angel project. The description of resources, along with the analysis of the expected and potential effects was assessed using field surveys, documented site information, revisits, as well as professional judgment.

The degree of disturbance to the habitat and potential impact to plants of concern varies by type of project or activity. A comparative measure of the level of disturbance is used to predict impacts. The following assumptions were made in determining the risk of impacting sensitive plants and habitat. The disturbance levels associated with a particular activity are as follows:

- Low: Planting, cleaning, and area closures are all considered to have a low level of disturbance. Disturbance to habitat and the potential impacts to sensitive plants from grazing vary, ranging from low to high.
- Moderate: Thinning, pre-commercial thinning, broadcast and under burning all result in a moderate level of habitat disturbance with regard to plant species of concern.

High: Road construction, mining, and (aerial) herbicide application can have a high level of disturbance on sensitive plant habitat. Impacts from herbicide application are reduced when manual, target-selective methods are used.

In order to determine the risk of impacting sensitive plants, it is also necessary to consider the size, density, vigor and location of a plant population; and habitat requirements and timing of the project in relation to life requirements of the individual plant species. An assessment is conducted to determine the likelihood of a project activity affecting a plant species or habitat, and the consequences of the adverse affect (from a particular activity) upon that species.

The likelihood of adverse effects from a particular activity is defined as follows:

- None: Activity will not affect habitat or population.
- Low: Activity is controllable by seasonal or spatial restrictions and not likely to affect habitat or population(s). No cumulative effects are likely.
- Moderate: Activity is not completely controllable, or intense administration (or modification) of the project would be needed to prevent adverse effects on habitat or population. Adverse effects may occur. Cumulative effects may occur.
- High: Activity is not controllable, and an adverse effect on habitat or populations is likely to occur. Cumulative effects are likely.

The consequences of adverse effects are defined below. The levels of consequences are defined as:

- Low: Minor change in habitat or population and little risk to long-term viability if change occurs. There are no cumulative effects are expected.
- Moderate: Measurable adverse effects in habitat or population but no immediate result in viability. There are no foreseeable cumulative effects.
- High: Immediate adverse effects on habitat or population, with impacts on viability or accumulative effects probable.

In this analysis, short-lived effects are considered to last from one to three years. Intermediate effects are those which last for three to ten years, and long-term effects will last for 10+ years. The current existing condition will be used as the reference baseline for the comparison of alternatives.

The Bald Angel project area is located within all or portions of seven subwatersheds within the Powder River - Pondsosa (17050203-13) and Powder River-Keating (17050203-29) National Forest System Watersheds. These seven subwatersheds will comprise the analysis area for the effects to the botanical resources of concern in this document.

Potential impacts of a project to rare plants are manifested through direct, indirect, and cumulative effects. These effects can be to plant populations or occupied habitat, and can be beneficial, detrimental, neutral or unknown. For the purposes of this discussion, effects will imply detrimental impacts unless otherwise noted. The consequences and likelihood of the effects vary somewhat by alternative. However, the primary effect is death or damage to plants or degradation of habitat. The differences will be quantified by the number of sites or locations on the ground, number of plants, acres of occupied habitat, and acres impacted. The impacts of each alternative will be compared to the present condition, and the specific differences between alternatives will be discussed.

Effects Analysis

No Direct, Indirect, or Cumulative Effects

The following activities associated with the Bald Angel project are of such limited and constrained nature that they would have no effect on PETS Plants species.

- Road Reconstruction
- Area Closure
- Road Maintenance
- Stand Cleaning
- Precommercial thinning and Planting

These activities and their effects will not be discussed further in the Plants PETS section.

There will be no impact to the two documented sites for *Phacelia minutissima* located in Subwatershed 13F. No project-associated activities will occur at the known locations. There will be no direct, indirect or cumulative effects to this species from any of the alternatives.

This project will also have no effect to any proposed, threatened or endangered plant species. There is no high potential habitat within the area for either *Mirabilis macfarlanei* or *Silene spaldingii*, both of which are documented on the northern portion of the forest. There is no known potential habitat within the analysis area for the following three federally listed species: *Spiranthes diluvialis*, *Howellia aquatilis* or *Thelypodium howellii* ssp. *spectabilis*; which could possibly occur on the forest. No plants for any of these species were located during any of the botanical surveys, and it is unlikely that they occur. Thus it is concluded that there would be no effect to any listed plant species or habitat under any of the alternatives. There would be no direct, indirect or cumulative effect to any proposed, threatened, or endangered plant species from project implementation, since no plants occur within the project analysis area. The federally listed threatened and endangered plants will not be discussed any further in this alternative comparison.

Direct and Indirect Effects on Plant PETS

Surveys within the Bald Angel project area found that habitat and/or plants for *Botrychium* and *Carex backii* were the only plant species of concern that may be impacted by this project. Therefore, they will be the only species discussed in terms of Direct, Indirect, and Cumulative effects for this project. The remaining plants would not be affected by activities proposed in Bald Angel (refer to the Analysis of Effects for Plant PETS and the Pant PETS Biological Evaluation in the project Analysis File).

ALTERNATIVE 1 - No Action

This alternative would not impact individuals or habitat and would not contribute to a trend towards federal listing, or cause a loss of viability to any plant species. There would be no direct or indirect effect to any proposed, threatened, or endangered plant species because no activities would be implemented.

Botanical field surveys were conducted and two sites for *Phacelia minutissima*, two sensitive *Botrychium* populations, as well as numerous sites for *Carex backii* have been located within the project area. However, since there are no activities implemented under Alternative 1, there would be no impact to any sensitive plant location other than the impacts that are currently occurring from activities within the area related to off road use, grazing, etc. There would be no direct, indirect or cumulative impacts to any Region - 6 Sensitive plant species from project activities.

ALTERNATIVE 2

Direct effects would be associated with physical impacts directly to the plant(s) from the actions of machinery, logging activities (falling/skidding logs, etc), and thermal impacts from fire. Generally these effects are negative although direct effects can be short-lived (species and condition dependant) and may lead to beneficial indirect effects over time (i.e., by reducing biomass, and competition from other plant species).

Indirect effects are most often associated with changes in habitat and stand characteristics or conditions, and the resulting changes in community interactions. Plant responses can occur at the individual or population level and vary greatly by species.

Essentially impacts to plant species include changes in plant vigor, biomass and reproductive capability; which are further qualified by the relative amount or percentage of change, and the expected duration of the effects. The primary activities impacting plant species in this project include fire, harvest prescriptions and road building. Information is currently available for a number of commonly occurring plant species through the Fire Effects Information System (FEIS). However, there is little to no information available for the individual plant species of concern discussed here, therefore, monitoring is scheduled to occur in Burn blocks 4 and 10 to track the effects of controlled burning through known *Carex* populations.

Snowberry is located throughout the area, has a high resistance to fire, and characteristically survives through rhizomes. It is expected to increase with low intensity burning. Other shrubs within the area including serviceberry, oceanspray and spirea may resprout readily which would provide shade and would maintain *Carex backii* habitat.

Several known locations for *Carex backii* will be impacted by activities associated with logging under Alternative 2. Activities proposed in the general location of these plants are numerous, and consist of commercial thinning harvest, temporary road construction and access roads, and noxious weed infestations (*Cardaria draba* / whitetop).

Riparian Treatment Units: Habitat exists within the project area for *Botrychium* however, no plants were found during survey activities. The potential for impacts to undiscovered sensitive *Botrychium* species is greatest under Alternative 2. Impacts from silviculture treatments within RHCA's may occur at 11 units (128 acres) under this alternative. Impacts would occur at the site level, and be highest at those locations where populations or potential habitat are destroyed. Under these conditions, it is likely that the impacts would be of long duration. Any impacts to riparian areas will be limited to those units which have been identified for RHCA treatments, RHCA areas in all other units will be buffered and no activities will occur.

An overview of the units and the anticipated consequences of the implementation of the activities proposed in Alternative 2 are described in the following table:

Unit	Species	Disturbance Levels	Likelihood of Adverse Effects	Consequence of Adverse Effects
37	Carex	Moderate	Moderate	Moderate to High
85	Carex	Moderate	Moderate	Moderate
86	Carex	Moderate	High	High
87	Carex	Moderate	Moderate	Moderate to High
88	Carex	Moderate	Moderate	Moderate
123	Carex	Moderate	Low to Moderate	Low to Moderate
124	Carex	Moderate	Low to Moderate	Low to Moderate
125	Carex	Moderate	Low to Moderate	Low to Moderate

The following unit specific information applies to these populations:

Unit 37:

Commercial thinning harvest (HTH) is proposed in this unit. This unit is located within a connective corridor, in which stocking levels will be reduced only to the upper management zone, which maintains the maximum amount of sustainable tree cover important to *Carex* habitat.

This is the only population for this species in this Watershed 13. The population consists of two subpopulations with approximately 200 plants, of which only five are located within the 40-acre unit.

Another group of plants are located outside the treatment unit and will not be impacted by harvest activities. However the entire population is within Burn Block 4. This area of the project is expected to be burned in the spring and should experience consumption of 75% of the surface fuels, leaving random patches unburned. It is likely to decrease duff, increase grasses, and will promote fire resistant species including ponderosa pine and pinegrass. Chokecherry is well adapted to disturbance by fire, and expected to increase with low intensity burning increasing cover protection for *Carex*. The area surrounding the harvest treatment unit has *Carex backii* plants growing under shrubs in the deeper soils, which are surrounded by bare dirt of biscuit scabland. The potential for fire to burn through this habitat is less likely, due to lack of ground vegetation to carry the fire.

The consequence of the adverse effects associated with impacts from the combination of silviculture and prescribed fire at this site are considered to be moderately high. This is primarily because this is the only population for this species within this watershed. The likelihood of adverse effects is expected to be moderate due to the combined effects from harvest and springtime burning.

Units 85 and 86:

A thinning harvest (HTH) prescription to stimulate growth of remaining trees is proposed for Unit 85. One hundred fifty plants have been counted on two and ½ acres (18%) of the 14 acre unit; however, the unit is not within a designated burn block. Harvest impacts are similar to fire, but may have greater impacts over a longer time period. The area has a high component of shrubs and takes place on a gentle, southerly slope. The major tree species is ponderosa pine.

Harvest activities are expected to have a moderate level of disturbance. The consequence of adverse effects is anticipated to be moderate, with measurable adverse effects but no cumulative effects. The likelihood of adverse effects is expected to be moderate for this subpopulation as all plants are within the treatment unit.

Only one *Carex backii* plant was located within the 20 acre Unit 86, although it is possible that more plants occur. The unit is not within a designated burn block

Project activities are expected to have a high level of disturbance and the consequence of adverse effects is high due to the probability of combined effects from harvest activities and noxious weed competition.

Unit 87:

Units 87 proposed for thinning harvest also supports *Carex backii* populations. Twenty three plants were located on approximately one acre within the 15 acre Unit 87 and a larger

subpopulation of 139 plants was discovered outside of the unit boundaries. The unit is not within a designated burn block.

Harvest activities are expected to have a moderate level of disturbance and the consequence of adverse effects ranges from moderate to high, due to the potential for effects from treatments and the off-road use associated with the 055 road. The likelihood of adverse effects is moderate, although it is likely that many of the plants will not be impacted under Alternative 2.

Unit 88:

There are five subpopulations of this large *Carex backii* population in the immediate and surrounding area of Unit 88, three of which are located within the treatment unit. All of these, with the exception of the largest subpopulation, are within a designated burn block (#10). Proposed activities are expected to have a moderate level of disturbance.

Impacts unique to Alternative 2 may occur due to construction of a temporary road (T-2) to access a 9-acre portion of Unit 88. The temporary road may negatively impact a small, isolated pocket of plants. The likelihood of adverse impacts under this alternative is moderate due to the cumulative effects of harvest, fire, and road activities.

The northern part of Unit 88 is within Burn Block 10. Prescribed fire is expected to consume 75% of the surface fuels from the drier sites, leaving random patches of unburned areas. Snowberry has a high resistance to fire, and characteristically survives through rhizomes. It is expected to increase with low intensity burning. Other shrubs including serviceberry, oceanspray and spirea may resprout readily which would provide shade and maintain *Carex backii* habitat. The consequences of adverse activities are considered to be moderate since activities may impact approximately one half of the plants known to occur within this Subwatershed.

Units 123, 124 & 125:

This population is located within Subwatershed 29E and consists of several subpopulations with over 1,000 plants. The plants within this population comprise approximately 23% of the plants known to occur within the project area. The entire population is associated with the treatment units and will potentially be impacted from project activities. The silviculture prescription is for a thinning harvest, but the units are not within a designated burn block. The plants of concern occur primarily within seral, fire-maintained shrub-fields. The units have been burned in the past, and support a number of fire-resistant species. Aspen enhancement which would also occur in this area would include the use of fire and may impact plants. The impacts from this type of fire are dependant on the type, quantity and distribution of fuels. Any associated pile burning may have negative impacts.

These sites have a high component of chokecherry and snowberry, both of which are well adapted to fire. Therefore, fire is expected to maintain the habitat characteristics that appear conducive to supporting *Carex backii*.

The consequence of the adverse effects associated with impacts from the combination of the silviculture treatment and aspen enhancement at this site are considered to be low to moderate. This is primarily because this is the only population for this species within this subwatershed. However, there is expected to be little risk to the long-term viability of the population due to the relatively large number of plants, not all of which will be negatively effected. The likelihood of adverse effects is expected to range from low to moderate, where the combined effects of harvest and pile burning occur.

Summary: Impacts from treatment under Alternative 2 would affect approximately 67% of the total *Carex backii* plants within the analysis area. The harvest treatment activities are likely to impact the entire 20 acres of the largest subpopulation in (Subwatershed 29F). However, there will be no impact to approximately 33% of the known occurrences for this species under any of the action alternatives and it is unlikely that the project activities will eliminate the population. Additional plants are known to occur within pre-commercial thinning units on the Pine Ranger District. In general, this alternative is expected to have measurable effects on the number of individuals, but it is not expected to contribute toward a Federal listing or cause a loss of viability of the population or species. In many cases the prescribed burning has the potential to maintain or improve sedge habitat and increase populations over time.

ALTERNATIVES 3 and 4

The potential for impacts to occur within riparian habitat and possible impact to riparian associated plant species decreases under Alternatives 3 and 4 to one 16 acre unit, from 128 acres in Alternative 2.

An overview of the units and the anticipated consequences of the implementation of the activities proposed in Alternatives 3 and 4 are described in the following table:

Unit	Species	Disturbance Levels	Likelihood of Adverse Effects	Consequence of Adverse Effects
37	Carex	Moderate	Moderate	Moderate to High
87	Carex	Moderate	Moderate	Low
88	Carex	Moderate	Moderate	Low
123	Carex	Moderate	Low to Moderate	Low to Moderate
124	Carex	Moderate	Low to Moderate	Low to Moderate
125	Carex	Moderate	Low to Moderate	Low to Moderate

The following unit specific information applies to these populations:

There will be no impacts from harvest activities to the sedge plants associated with Units 85 and 86, which have been dropped from this alternative. This accounts for less than 5% of the total occurrences.

Unit 87 has been modified to eliminate impacts from harvest activities to approximately 23 plants (less than 1% of known occurrences within the project area). However, there will be no change in any impacts which could occur from utilization of the 055 access road.

Unit 88 has been modified to protect sensitive plants under Alternatives 3 and 4 and is reduced in size from 40 to 31 acres.

Approximately one-half of the plants associated with Unit 88 are included in the nine-acre portion that has dropped out in these Alternatives and impacts from harvest activities are expected to be limited to the small subpopulations along the 049 road to the north. With the decrease in the nine-acre area below the 7040 road, and no need for the temporary access road, there is an additional decrease of potential impacts from Alternative 2 in Alternatives 3 and 4.

All but the largest subpopulation (of 1,500 plants) are within Burn Block (10), and there will no change in the potential impacts from fire.

Summary: There will be no impact to approximately 45% of the large *Carex* population within Subwatershed 29F under Alternatives 3 and 4. Impacts from treatment in these alternatives would affect approximately 28% of the total *Carex backii* plants within the analysis area, in comparison to the 67% affected under Alternative 2. There will be no impact to approximately 54% of the total individuals known to occur within the analysis area, as compared to 33% under Alternative 2. It is unlikely that the project activities will eliminate entire populations for this species and additional plants are known to occur outside of this project area (within Watershed 29) on Pine Ranger District.

In general, Alternatives 3 and 4 will have measurably less effect on the number of individual plants impacted. The alternatives would not contribute toward a Federal listing or cause a loss of viability of the population or species. As described previously, the prescribed burning has the potential to improve sedge habitat and possibly increase populations over time.

Cumulative Effects on Plant PETS

ALTERNATIVE 1 - No Action

This alternative would not impact individuals or habitat and would not contribute to a trend towards federal listing, or cause a loss of viability to any plant species. Cumulative effects are the incremental impacts of the proposed action when added to other past, ongoing or reasonably foreseeable future action. Because no management would occur and there would be no contributing potential to cumulative effects there would be no cumulative impacts to any Region - 6 Sensitive plant species from this alternative.

ALTERNATIVES 2, 3, and 4

Past management activities within the Bald Angel analysis area include timber harvest, prescribed fire, livestock grazing, road construction, aspen restoration, irrigation ditches, mining and other recreational uses and are described in Appendix D of the EA. It is likely that these actions have already led to a decrease in plant occurrences on the district. Since physical changes in habitat characteristics can last for decades, it is likely that some areas have not recovered, and that the residual effects of these past activities is a degradation in habitat and loss of occupied habitat.

Prescribed fires were implemented across 3, 345 acres under six projects during 1986 through 1987. These activities took place within Subwatersheds 13 E, F, 29 D, E, F, and H and vegetative recovery has occurred over much of the area. The majority of the acres that have received prescribed fire are located within Subwatershed 13F, with only 400 acres conducted within watershed 29. Wildfires have also occurred within the project area. There may be long-term effects from fire, especially in those areas of high burn severity. However the size and extent of high severity fire within the project appears to be limited.

Over 20 years ago, approximately 1,368 acres were treated with a combination of thinning and regeneration cuts within Subwatersheds 13E and F, and 29E, F and H. Another 5,073 acres were treated during the last 10 to 20 years (within Subwatersheds 13C, E, F, and 29C, D, E and H); with an additional 3,147 acres treated (within Subwatersheds 13E, 29 D, E F, and H) over the last 10 years. These most recent treatments included protection and mitigation measures from the Inland Native Fish Strategy (INFISH), which were designed to reduce effects to fish and water resources and accelerate recovery. Depending on the time frame since the activities occurred, there has been some level of vegetative recovery, although the residual effects of regeneration harvest may still be evident. The majority of the regeneration cuts have taken place within Subwatersheds 13F, 29D and 29E.

Livestock grazing has been ongoing over most of the project area since the 1880s. There are seven allotments within the analysis area, which have been regulated since 1995 through INFISH. Current management regimes are less impacting than historic activities.

Disturbance to habitat and the potential for impacts to sensitive plants from grazing ranges from low to high. When impacts occur at the same location as the fire and harvest activities, there are likely to be cumulative effects to plants and habitat.

Minor short term immeasurable impacts to habitat from wildlife enhancement work such as felling of conifer trees in aspen restoration areas could have resulted from past aspen restoration work, however, it is such a minor amount, given the scale of the project area, that it will not cumulatively add to measurable impacts.

Little is known about previous occurrences or distribution for *Carex backii* within the analysis area. Intensive timber management, road construction and past grazing practices may have impacted historic occurrences by reducing the overstory canopy, increasing fuel loadings, degrading habitat and limiting reproduction.

It is possible that noxious weed species are currently affecting sites for the *Carex backii* and also leading to degradation of potentially suitable habitat. This condition is likely to continue, with or without implementation of proposed project activities, and is common to all alternatives.

The proposed project will affect individual plants and habitat for sensitive sedge species (*Carex backii*). Numerous sites are associated with unit and project activities and may be impacted under the proposed action Alternative 2. However, plants are widely scattered over a large area and occur in relatively high numbers. Project modifications incorporated into Alternatives 3 and 4 reduce the potential impacts to this species from 67 % to 28 %.

While there is inherently potential for cumulative effects, the degree of impacts compared to past practices will be minimal in most cases. Although project activities under all action alternatives will impact individual plants and may influence *Carex backii* habitat, they will not likely contribute to a trend towards federal listing or cause a loss of viability to the population or species.

Access and Travel Management

Introduction

The following chart describes the outcome of the Access and Travel Management Plans developed for the action alternatives in comparison to the current condition (Alternative 1 – No Action). In general, the effects of this plan on other resources are discussed under each of the resource areas it may affect. Refer to those write-ups for a description of the effects of this plan on a particular resource. The direct and indirect effects analysis area for access and travel management is the same as the project area boundary as described in Chapter One of the EA and on the Area Closure map in the Appendix A.

Effects Analysis

No Direct, Indirect, or Cumulative Effects

The following activities associated with the Bald Angel project are of such limited and constrained nature that they would have no effect on Access and Travel Management within the project area.

- Aspen Restoration
- Precommercial thinning and Planting

- Prescribed Burning

These activities and their effects will not be discussed further in the Access and Travel section.

Direct, Indirect, and Cumulative Effects

ALTERNATIVE 1 - No Action

This alternative would retain the existing Access and Travel Management within the project area permitting access where possible to all roads, cross country OHV use, and OHV use on open and closed roads. The impacts are described in detail under specific resource areas in this Chapter. Refer to those analyses for resource-specific effects.

This alternative would not meet National direction for roads analyses to determine the minimum system of roads needed for management of National Forest System lands and for public access in order to shift emphasis and funding to maintaining needed roads and decommissioning unneeded roads.

ALTERNATIVES 2, 3, and 4

Due to the implementation of the area closure in all of the action alternatives there will be no difference between alternatives for post-project road densities. Full implementation of the area closure is expected to be completely implemented within 3 years of the project completion.

While most of the project area will be well within or below Forest Guidelines for open road densities, post project open road densities in 5 areas in the action alternatives will be reduced but will still remain above the Forest Plan Guidelines. An analysis of why densities within these areas remained above guidelines revealed that the entire project area includes several major arterial and collector roads that provide access to large portions of the National Forest, private in-holdings, and recreation/irrigation areas as well (Balm Creek Reservoir).

SWS	Management Areas	Project Area (sq. mi)	Current Open Road Density (mi./sq. mi.)	Forest Plan Road Density Guideline	Post-Project Densities (Alts 2-4)
13D	1	0.54	0.5	2.5	0.5
	3	2.99	1.8	1.5	1.3
	15	0.15	0.2	N/A	0.2
13E	1	5.89	3.1	2.5	1.1
	3	2.87	1.6	1.5	1.2
	15	0.15	0.0	N/A	0.0
13F	1	17.99	3.1	2.5	2.0
	3	4.82	2.3	1.5	1.9
	15	0.97	0.2	N/A	0.2
29D	1	6.4	5.3	2.5	3.2
	3	.001	17.5	1.5	13.0
	15	0.07	1.0	N/A	1.0
29E	1	5.76	4.1	2.5	3.1
	3	3.72	1.7	1.5	1.0
	15	0.67	3.5	N/A	3.0
29F	1	0.59	5.8	2.5	5.8
	3	2.93	1.9	1.5	1.4
29H	1	0.6	4.3	2.5	2.4
	3	2.64	2.1	1.5	1.5

Of these areas, two are obviously skewed due to the very small portion of land base within the management area and are not representative of the road densities at the landscape level. In SWS's 29D (MA3) and 29F (MA1) the road densities were calculated on significantly less than 1 square mile of land (.001 in the case of 29D) and are therefore not at an appropriate scale for comparison or to meet the intent of the Forest Plan guidelines. The MA15 densities are primarily the result of mapping errors which include road mileages of roads along the boundary of MA15 areas.

In all sub-watershed an analysis was completed for roads within the big game winter range portion (MA3) of this project which indicated that in all cases the roads were effectively closed by snow during the critical use periods which meets the intent of the guidelines in the Forest Plan.

In SWS 29D (MA1) several local interior collectors and important tie-through roads (Roads 70, 7045, 7045370, and 7000390) and in SWS 29E (MA1) arterial and collectors (roads 70, 7045, 7040, 7035, and 7000475 – Balm Creek Reservoir access) are either main roads required for area access or are needed to provide access to the outlying areas for public access, and administrative, fire and resource management. The restrictions on cross-country travel are expected to provide adequate security for big game and meet the intent of the guidelines for road densities.

The area closure associated with this project would reduce the number of dispersed recreation sites available for use and concentrate camping in other areas, diminishing the opportunity for solitude and increase the potential for resource impacts. It would also increase the potential for violations of the closure to access traditional camping areas and create potential enforcement difficulties due to the size of the project area. There may also be an increased potential for violations of the area closure by OHVs to access areas of traditional use, explore less traveled areas, game retrieval, and will contribute to enforcement difficulties due to the size of the project area.

Historic mining operations have created short access routes into mining operations. The area closure in this project may restrict some of these access routes and minimize access to future claims, however; mitigating that would be accomplished as plans of operation are analyzed on a site specific individual basis.

Road reconstruction and maintenance in all action alternatives has been designed to focus on long-term system roads to make them safe for administrative and public access. Road maintenance funding has been steadily declining for the last 10+ years while public access needs have increased. Improvement of these primary access roads in combination with road closures (both area closure and decommissioning) will reduce maintenance needs within the area and will cumulatively result in safe access to the project area and effective/efficient use of the limited road maintenance funding received on the La Grande District and the Whitman Unit immediately adjacent to the planning area to the south.

Management Indicator Species - Terrestrial

A. NORTHERN GOSHAWK

Introduction

The northern goshawk is a management indicator species on the Wallowa- Whitman National Forest, and specific management standards for this species are included in the Regional Forester's Forest Plan Amendment #2. There are seven known goshawk nests within the analysis area. Active nests require a 30 acre nest area where no logging can occur, and a 400 acre post-fledgling area (PFA) where retention and development of late/old forest structure is emphasized. An active nest is defined as a nest that has been used by goshawks within the past five years. Two scales of analysis are appropriate for this species. The

larger scale is the subwatersheds used in the HRV discussion for LOS habitat. The smaller scale is focused around known nest sites which is covered in this section.

Thirty acre nest areas and PFA's were mapped around nests that could be affected by harvest activities. Generally all intermediate harvest treatments in this project would accelerate the development of LOS, thereby rendering the direction on PFA's moot.

Nesting habitat for goshawks in this area is provided by closed canopy, multi-storied conifer forests with a large tree component (Reynolds 1983). Occasionally nests are located in smaller diameter trees, but nest stands usually contain large diameter trees and logs, and the highest canopy closure available in the area. Goshawks forage in various cover types and structural stages and the interspersion and juxtaposition of multiple habitat types may enhance the quality of foraging habitat around nests (Hargis et. al. 1994).

Studies have documented a positive relation between prey abundance and nest success, and winter survival of goshawks (Doeyl & Smith 1994, Linden & Wilkman 1983). Foraging habitat for goshawks is provided by a variety of structural stages that generally exhibit higher canopy closure and greater structural complexity. Silviculture treatments that reduce canopy closure and structural complexity can compromise the quality of habitat for prey species thereby effecting goshawk foraging habitat.

For further discussion of this resource refer to the Wildlife Reports in the Bald Angel Analysis File.

Effects Analysis

No Direct, Indirect, or Cumulative Effects

The following activities associated with the Bald Angel project are of such a limited and constrained nature that they would have no effect on Goshawks.

- Precommercial Thinning/Cleaning
- Planting
- Road Reconstruction

These activities and their effects will not be discussed further in this section.

Direct and Indirect Effects on Goshawks

ALTERNATIVE ONE

Alternative 1 would have the least negative effect on goshawks since existing levels of potential nesting and prey base habitat would be retained. However, negative effects to goshawks and their prey could result in the long-term from deferring treatments now. As overstocked stands stagnate and fire susceptible, shade tolerant trees increase, the quality of foraging habitat for goshawks decreases. Perpetuating these overstocked conditions also predisposes these stands to more severe wildfire risks in the future, which could render thousands of acres unsuitable for goshawks. This alternative is inconsistent with many of the potential strategies proposed by Wisdom et.al. (2000) for reversing a negative trend for species in group 5 (refer to group description on page 67 – LOS section).

ALTERNATIVE 2

Alternative 2 was developed prior to locating at least one new goshawk nest in 2005. A thirty acre no-harvest nest area is identified for each known nest. Effects to known nest sites would be the same for all action alternatives.

ALTERNATIVES 3 and 4

Alternatives 3 and 4 include modifications to three harvest units to accommodate goshawk nests as follows: Unit 6 – 22 acres dropped; Unit 16 – dropped entire unit, 43 acres; and Unit 98 – 20 acres dropped. These deferred acres will maintain the context and viability of three active goshawk nests. The other four known nests are not close enough to proposed harvest units to be affected.

Cumulative Effects on Goshawks

ALTERNATIVE ONE

Alternative 1 would not contribute to cumulative effects of past timber sales, roads, grazing, firewood cutting, prescribed burning and off highway vehicle use.

ALTERNATIVE 2

Alternative 2 would reduce the quality of potential nesting and foraging habitat to a greater extent than alternatives 3 and 4 based on the fact that more habitat would be treated. The duration of these effects would persist into the mid-term in intermediate treatments (HTH, HSV, HIM, HFU) and into the long-term in regeneration treatments (HSH). Overstory removal prescriptions (HOR, 60 acres) are not suitable goshawk habitat and would remain unsuitable following treatment. This alternative represents an incremental effect when considered with past regeneration harvest treatments that have not recovered to suitable goshawk habitat. See the Alternatives summary tables in Chapter 2 for the acres of intermediate and regeneration treatments proposed for this alternative. Although some goshawk habitat will be reduced in quality, this alternative would not have cumulative effects to the known nest sites since they will not receive treatments. Past intermediate and regeneration treatments combine with this alternative to create an interspersion of several structural stages that could enhance foraging habitat (Hargis et. al. 1994).

ALTERNATIVES 3 and 4

These alternatives retain more potential nesting and foraging habitat by treating fewer acres than Alternative 2. However, prescribed fire may reduce habitat for some prey species by reducing structural complexity in forest stands. These effects would persist through the short-term, and are not expected to reduce prey abundance enough to effect goshawk productivity. Alternative 4 would reduce the amount of potential foraging and nesting habitat into the mid-term by 412 fewer acres than Alternative 3. These effects are considered cumulatively with past regeneration harvest acres that have not recovered to suitable goshawk habitat. Known nests are protected the same in all action alternatives and will not experience cumulative effects from this project.

Summary Action Alternatives: Some goshawk habitat will be incrementally reduced in quality by this project in addition to that which was historically treated and has not recovered to suitable habitat yet, but there would be no effect to known next sites from this project due to project design and deferred treatment areas around nest sites. Past intermediate and regeneration treatments in combination with the treatments in this project create an interspersion of structural states that could enhance foraging habitat.

Previous prescribed burns have improved foraging habitat and the burning proposed in this project will also contribute to foraging habitat, however, there will be short term (1-3 years) reductions until the grasses and shrubs resprout. Known nest sites are being protected in all phases of project design/implementation.

Unregulated OHV use in the past has lead to the creation of unapproved trails which contribute to the potential for nest site disturbance. The area closure in this area would reduce the potential for

this disturbance. Known nest sites are being protected in project design and the area closure will add increased protection and minimize the potential for disturbance during the nesting period.

B. PRIMARY CAVITY EXCAVATORS (SNAG AND LOG HABITAT)

Introduction

Primary cavity excavators (woodpeckers, sapsuckers, flickers, nuthatches, and chickadees) are Management Indicator Species (MIS) on the Wallowa-Whitman NF. A common element in the habitat of these species is snags and down woody material. These MIS rely heavily upon decadent trees, snags, and down logs. Some cavity nesters (eg. northern flicker) do not require high canopy closure, and habitat for these species is abundant and well distributed. Other cavity nesters show a preference for closed canopy settings. The analysis area for snag and log habitat is the subwatersheds that contain the project area.

Pileated woodpecker is a MIS addressed separately in the Forest Plan from the other primary cavity excavators. This species serves as a management indicator for old growth habitat, and could equally represent large snag and log habitat. There are at least three known pileated breeding territories that could be affected by this project that were monitored by Evelyn Bull, Research Wildlife Biologist in 2005. It is important to maintain the large snag and log component within and around these nesting areas to ensure continued use by this species. Logging and prescribed burning can reduce the number and types of snags and logs available to pileated woodpeckers.

Snag Guidelines for Action Alternatives

Current Forest direction says to “maintain snags and green tree replacement trees of ≥ 21 ” dbh (or whatever is the representative dbh of the overstory layer if it is less than 21 inches), at the 100% potential population levels of primary cavity excavators. This should be determined using the best available science” (Regional Forester’s Forest Plan Amendment #2, page 11).

A La Grande Ranger District Interdisciplinary team (IDT) developed snag recommendations based on the best science available and local conditions which were adopted by the District which is reflected in Chapter 2 of this EA (see policy in Appendix E of the EA). More research and synthesis of research on the topic of snag and log habitat has been done since the district snag policy was developed, including the DecAID advisor and “Source Habitats for Terrestrial Vertebrates of Focus in the Interior Columbia Basin: Broad-Scale Trends and Management Implications”. Additionally some local, applicable research has been done on pileated woodpecker habitat by Bull and Nielsen-Pincus (2005) and subsequently incorporated into DecAID.

The habitat categories from DecAID that most closely reflect conditions in the Bald Angel area are the “Small/medium tree” structural conditions within the “Eastside Mixed Conifer Forests, East Cascades/Blue Mountains” and “Small/medium tree” structural conditions in Ponderosa Pine/Douglas-fir Forest wildlife habitat description. Effects are discussed in terms of snag densities with and without the proposed treatments, and how those densities relate to tolerance levels for wildlife species that utilize snags.

Direction from the Regional Forester's Forest Plan Amendment No. 1 requires that pre-activity levels of logs be left unless those levels exceed those shown in the following table.

Table: Large Woody Material.

Stand Type	Pieces/acre	Linear ft/acre	Dia. small end	Piece Length
Ponderosa pine	3 – 6	40'	12"	> 6'
Mixed Conifer	15 – 20	140'	12"	> 6'
Lodgepole pine	15 – 20	260'	8"	> 8'

Green Tree Replacements (GTRs)

Guidelines for logs and snags also require that green trees of adequate size be retained in harvest units to provide replacements for snags and logs through time. Generally GTRs need to be retained at a rate of 25-45 trees per acre, depending on biophysical group. All harvest prescriptions in the project will retain GTRs within or above this range. Effects to GTRs will not differ between alternatives.

Effects Analysis

No Direct, Indirect, or Cumulative Effects

The following restoration activities associated with the Bald Angel project are of such limited and constrained nature that they would not disturb any of snag and log habitat and would therefore have no effect on Snag and Log resources or activities.

- Precommercial Thinning/Cleaning
- Planting
- Road Reconstruction

These activities and their effects will not be discussed further in this section.

Direct and Indirect Effects on Snag and Log Habitat

Since snags are lost in harvest units from direct removal, skid trail and landing placement, safety reasons, and post sale treatments (burning), it stands to reason that an increase in acres harvested will result in a greater reduction in snags and logs. The indicator used to compare effects between alternatives is total acres treated by mechanical harvest and prescribed burning. All action alternatives will retain all existing snags greater than 12" d.b.h. and logs will be retained at least to the minimums stated in Table 6. The only snags that would be cut in any action alternative would be due to operational needs such as landing or skid trail placement and safety concerns. Retention of all existing snags retains current snag habitat to the greatest level possible.

Although snag densities within harvest units would not differ between action alternatives, the effectiveness of snag habitat is reduced when their context is converted from a closed canopy setting to an open setting. A few species (flicker, bluebirds, sapsuckers) seem to do well in either setting, but others (pileated woodpeckers, nuthatches, black-backed woodpeckers) generally avoid nesting in open settings.

The use of fire to prepare sites for planting after harvest or to reduce fuel loading will consume some snags and logs. Also, snags within sight distance of open roads are often lost to firewood cutters. It is important that snags and logs left to meet standards (≥ 12 " in diameter) be protected from these activities in order to realize the benefits for which they were retained. These effects are not quantifiable due to the many variables involved. However, the highest quality vulnerable snags near open roads will be marked as "no cut" for firewood, and burning conditions will be such to minimize the risk of losing larger diameter logs and snags.

The table below compares projected snag densities that would exist forty years from present for three broad habitat categories. Snag levels are estimated for a no treatment and a treatment scenario. These estimates were generated for representative stands using a Forest Vegetation Simulator.

Although the most important snags for most wildlife species are those greater than 12" d.b.h, there are also some important functions of smaller snags. Snag density estimates in the table below recognize the small diameter (< 12" d.b.h.) material that can be important as foraging substrate for many woodpecker species. These estimates recognize that silvicultural treatments that reduce tree stocking thereby increasing distance between leave trees may reduce natural snag recruitment rates. As stocking levels are reduced, so is the density related mortality factors that typically lead to snag recruitment. Likewise, by spacing trees further apart there is less chance of trees and large limbs falling and creating wounds on neighboring trees. These

wounds are entry points for heartrot fungal spores, which over time creates hollow trees and soft heartwood necessary for many woodpecker species to excavate cavities. Heartrot fungus also predisposes trees to other insects and pathogens that can kill the host tree, thereby creating snags.

Table : Snag densities at 40 years in the future.

Forest Type	Snags/Ac > 12” d.b.h.	Snags/Ac < 12” d.b.h/	Tolerance levels for Wildlife*
Cool Moist Forests			
No treatment	20	162	<80%
Commercial thin	4	65	<30%
Dry Ponderosa Pine			
No treatment	23	81	80%
Commercial thin	11	5	80%
Mixed Conifer			
No treatment	16	168	>50%
Commercial thin	9	3	>30%

*These tolerance levels represent snag densities for “where the objective is to manage for natural conditions of snag habitat” and come from “unharvested inventory plots with measurable snags” under the “Snag density and dbh” subheading (DecAID version 2.0). A greater than (>) or less than (<) sign indicates where snag densities are slightly greater or less than those documented for a particular tolerance level in DecAID.

ALTERNATIVE 1

Past intermediate timber harvests over much of this analysis area has reduced snag levels and precluded the natural recruitment of snags through spacing out trees and reducing the effects of insects and diseases. Past regeneration timber harvests generally have no or few snags and will continue to be deficit in this type of habitat into the long-term.

No new roads would be constructed with this alternative to facilitate further reductions of snags and logs. However, nearly 80 miles of road planned for promulgated closure or decommissioning in the action alternatives would remain open with Alternative 1. These roads would continue to facilitate reductions in snags and logs from firewood cutting and hazard tree removal. The effects of continued snag and log removal can result in reduced habitat for cavity nesters resulting in lower tolerance levels for several dependent species. This would be inconsistent with the intent of Forest Plan standards aimed at maintaining 100% potential population levels.

ALTERNATIVE 2

Alternative 2 would have the most deleterious effect to wildlife species associated with higher canopy cover, snags, and down logs. Snag habitat would be reduced on 4,854 acres through timber harvest and on approximately 13,500 acres (estimate of actual burn acres within the 24,000+ acres of burn blocks) by burning in this alternative.

ALTERNATIVE 3

Alternative 3 would treat 4,188 acres through timber harvest and approximately 13,500 acres (estimate of actual burn acres within the 24,000+ acres of burn blocks) by burning, resulting in a smaller reduction in snag and log habitat than Alternative 2, but slightly more of a reduction than Alternative 4. Additionally, several units have modified prescriptions that will retain higher canopy closure for connective corridors. These acres will maintain more snags in a closed canopy context than provided under Alternative 2.

ALTERNATIVE 4

Alternative 4 would have slightly less of a negative effect on snag and log habitat since 412 fewer acres would be logged and no new roads would be built. Otherwise, the effects described for Alternative 3 are very similar to Alternative 4.

Cumulative Effects on Snag and Log Habitat

ALTERNATIVE 1

Alternative 1 would not contribute to cumulative effects of other management activities in and around the analysis area. Snag habitat in past treatment units will slowly develop as these stands grow and snags are naturally recruited in the long-term. Snags would likely reflect inherent levels across the analysis area within 100 years in the absence of large scale disturbances. In the event of a stand replacing wildfire, snags would be abundant for 0-30 years, followed by a century or more of low snag densities until burned areas regenerate. This alternative retains the most snag habitat in the short-term and mid-term. The effect of this alternative on snags in the long-term would be speculative. On a landscape scale the contribution of Alternative 1 to cumulative effects to snag habitat would be minor. However, more snag and log habitat would exist under Alternative 1 than any of the other alternatives, at least in the short-term.

ALTERNATIVES 2, 3, and 4

The cumulative effects of thirty-seven past timber sales and the Bald Angel project will result in some level of logging on approximately 20,000 acres within this analysis area since the early 1980's. The past intermediate treatments have left stands in well stocked, insect resistant conditions, while some have simplified structure to conditions avoided by most wildlife except the more common generalist species. Efforts to reduce density related mortality factors combined with a history of firewood gathering have led to a deficiency in large diameter snags and logs over much of the analysis area, however total snag numbers greater than 12" dbh appear to exist to support snag dependent wildlife species between the 30% and 50% tolerance levels. The snag component is very unevenly distributed with riparian areas, MA 15 areas, and LOS stands containing higher snag densities are near the 80% tolerance level and past logging units containing few snags are at the 30% or lower tolerance level. The past timber harvest activities are pertinent to a cumulative effects discussion since the effects of reduced snag numbers overlaps the effects of Bald Angel in time and space. The silvicultural treatments in Bald Angel will indirectly perpetuate this condition by spacing trees so that natural snag recruitment, through density related mortality factors, will be reduced (see table 7). A positive effect of these treatments is that larger trees will develop, so that larger trees will be recruited as snags in the long-term.

The logging in Alternative 2 would contribute to a greater loss of snags and reduction of snags in a closed canopy context than Alternative 3 or 4. All alternatives would maintain all snags $\geq 12"$ d.b.h, except those lost for operational reasons. This would result in a minor incremental effect when considered with past, present and foreseeable future actions since the existing snag component will change very little except for the changes in context (closed canopy setting vs. open canopy setting) and the snags lost for operational reasons and to prescribed burning (assumed to be very few). Effects from prescribed burning are similar between alternatives. Snags and logs are sure to be consumed during burning, but it is not possible to predict how many and where. New snags and logs created from the burning will partially off-set the loss of snags and logs that are consumed. The primary difference is that sound live trees that are killed by fire do not contain rot and defect that exists in snags and logs that die more slowly from other causes. Rot and defect provide more usable snags and logs for a greater number of species than do sound trees recently converted to snags by fire. Snag losses to prescribed fire is assumed to be very low since burning prescriptions are aimed at retention of larger diameter woody materials.

Open roads and closed roads being re-opened for use in this project would provide access to firewood cutters into areas which were previously inaccessible. Loss of snags to firewood gatherers would contribute to localized areas of snag loss which may occur in combination with the incidental losses anticipated from harvest operations. However, this would be at very low levels across the project area and because snags $\geq 12"$ are being retained in all treatment areas; total snag loss is expected to be minimal. Successful road closures provide some measure of protection from firewood cutting.

NEOTROPICAL MIGRATORY BIRDS

Introduction

Neotropical migratory birds are those that breed in the United States and winter primarily south of the United States-Mexico border. They include a large group of species, including many hawks, shorebirds, warblers, and other song birds, with diverse habitat needs spanning nearly all successional stages of most plant community types. Of the 225 migratory birds that are known to occur in the western hemisphere, about 102 are known to breed in Oregon. Nationwide declines in population trends for neotropical migrants have developed into an international concern. Habitat loss is considered the primary factor in the decline of some of these species. Since there are so many different species in this group, it is difficult to assign an appropriate analysis area scale. Generally the subwatersheds that contain the project area would be an appropriate scale for the species in this group for the period of the year that they utilize the area.

In 2000, the Oregon-Washington Chapter of Partners in Flight published its Landbird Conservation Plan (PIF,2000). The Plan uses a "Priority Habitats and Species" approach. By managing for a group of species representative of important habitat components, many other species and elements of biodiversity will be conserved. The Bald Angel project area contains primarily mesic mixed conifer (structurally diverse) habitat in the central and north, and dry forest (ponderosa pine and ponderosa pine/Douglas-fir/grand fir) in the south. Eight focal species (in the table below) were selected based in part on their conservation need and degree of association with important habitat attributes in coniferous forests in the Blue Mountains. For further discussion of this resource refer to the Wildlife Reports in the Bald Angel Analysis File.

Forest conditions and associated habitat attributes and focal species for landbird conservation in the Bald Angel area.

Forest condition	Habitat Attribute	Focal Species
Dry Forest	Large trees and snags	White-headed woodpecker
Dry Forest	Old forest with openings	Flammulated owl
Dry Forest	Open understory with pine regen	Chipping sparrow
Mesic Mixed Conifer	Large snags	Vaux's swift
Mesic Mixed Conifer	Overstory canopy closure	Townsend's warbler**
Mesic Mixed Conifer	Structurally diverse	Varied thrush
Mesic Mixed Conifer	Dense shrub layer	MacGillivray's warbler
Mesic Mixed Conifer	Edge and openings	Olive-sided flycatcher*

*significantly declining population trends in the Central Rocky Mountain BBS physiographic region.

** significantly increasing population trends in the Central Rocky Mountain BBS physiographic region

Effects Analysis

No Direct, Indirect, or Cumulative Effects

The following restoration activities associated with the Bald Angel project are of such limited and constrained nature that they are not near any of these habitats and would therefore have no effect on NTMBS.

- Planting
- Road Reconstruction
- Road Obliterations
- Area Closure

These activities and their effects will not be discussed further in this section.

Direct and Indirect Effects on NTMBS

ALTERNATIVE ONE

In the absence of large scale disturbances, Alternative 1 will provide long-term habitat for migratory birds at the same level that exists today. Habitat for old growth associated bird species is deficient in the Bald Angle area due to past timber harvest activities. Overstocking in UR stands would lead to increased susceptibility to insect and disease outbreaks and stand replacement fires, which would be detrimental to the majority of NTMBS that use this area.

Although forest fuel levels are not severely high at this time, they would continue to accumulate as prescribed burning is deferred. Missed fire returns have created deeper duff layers than characteristic of this area. So when fires occur the shallow roots of large overstory trees are at risk of being damaged, resulting in the mortality of trees that are generally considered fire resistant. Alternative 1 would perpetuate and contribute further to increased fuel accumulations, increasing the risks to overstory trees when wildfires occur. NTMBS would experience indirect negative effects from this alternative if fire effects in the future are more severe than under the action alternative scenarios.

ALTERNATIVES 2, 3, and 4

Prescribed burning in the spring through early summer could directly affect nesting neotropical migratory bird species (NTMBS) through direct mortality of eggs and nestlings. Logging also poses risks of direct mortality or displacement during the spring and early summer. These changes can lead to some competitive bird species forcing NTMBS to nest elsewhere. Anytime habitat is changed through logging or burning, some species will benefit while other species are negatively affected.

Effects of fire vary depending on its intensity and extent. It is generally accepted that the effects of prescribed fire are less severe than for wildfire. The differences are that prescribed burning is done under specific prescriptive parameters that are more likely to result in a favorable outcome, whereas wildfires (and associated suppression activities) generally occur when fuels are dry, temperatures are high, and relative humidity is low. These conditions often lead to greater reductions in forest structure, changes in all vegetation layers, and sometimes detrimental effects to soils. Although a few species of birds benefit from high intensity wildfires, a greater number of NTMBS experience detrimental effects from these events.

For most upper forest canopy birds, large stand replacement fires will have long-term negative effects. Wildfire results in loss of habitat for many species requiring young, mature and old growth forest stand conditions. If burns are smaller and of lower intensity, they will tend to have a positive

effect on the majority of NTMBS. Shrub levels will increase in the 10 years following burning which would favor NTMBS (olive-sided flycatcher) that prefer early-seral forest conditions.

Intermediate silvicultural treatments and prescribed burning would increase the amount of habitat available for species that prefer more open forest conditions. Reductions in snag habitat will be minor (only those cut down for safety and operational needs) and will not result in measurable effects to habitat for NTMBS. In the long term, effects of reduced snag recruitment via natural mechanisms could result in reduced perch sites and nesting substrate for some NTMBS. This effect is expected to be offset at the landscape scale since a variety of snag densities and diameters will exist in riparian areas, allocated old growth areas, and various managed forest conditions. Alternative 2, which treats more acres (prescribed burning and logging) would create the greatest direct benefit to those NTMBS that prefer more open stand conditions such as the chipping sparrow and flammulated owl, but would negatively effect species that prefer more closed canopies such as the varied thrush. The combination of various logging and burning treatments and untreated areas in Alternatives 2, 3 and 4 would assure that habitat is provided for a variety of NTMBS species.

Logging between April and July could have direct effects on nesting NTMBS. Although little is known about the effects of logging on NTMBS, it is expected that removal of snags under these alternatives could have a negative effect on potential population numbers of cavity nesting birds. Snag retention levels are assumed to be adequate to meet the needs of cavity excavators, but reductions in overall snag numbers reduces options available to cavity nesting birds (flamulated owl, white-headed woodpecker, Vaux's swift).

NTMBS associated with riparian areas are not expected to be affected by this project due to the no-treatment buffers. Prescribed burning would be allowed to back into the riparian areas; however this is not expected to affect habitat for NTMBS. This is based on the limited area of reduced grasses and shrubs within riparian habitat conservation areas (RHCA) and the relatively short recovery period for these vegetative components (1 to 5 years). The few modified stream buffers along select intermittent streams would be negligible to NTMBS.

Cumulative Effects on NTMBS

Past timber sales, roads, and prescribed burning have modified and converted habitat for NTMBS across this analysis area. The effects of roads are long lasting in that roads replace habitat with non-habitat and influence adjacent habitat by changing the microenvironment and by introducing disturbances through use of roads by people.

Other man-made features that have likely had long-term negative effects to NTMBS are the four irrigation ditches that exist in the area. Big Creek, Trout Creek, South Catherine Creek and Jacobs Ditch are all at least partially within this analysis area. These ditches have diverted water from its natural course thereby rendering hundreds of smaller stream channels waterless throughout the year. Class three and four streams that run perpendicular to these ditches historically supported surface water (for at least part of the year in the case of class four streams) that promoted a diverse shrub component in these narrow landscape features. Additionally these small streams served as a source of water for many species of wildlife, particularly birds. The ditches have converted hundreds of miles of small streams to mere topographical divots that support no different habitat values than the surrounding landscape. These are long-term negative effects that have likely reduced populations of NTMBS in this area.

ALTERNATIVE ONE

Alternative 1 will not contribute to the cumulative effects of these past and present activities.

ALTERNATIVES 2, 3, and 4

Alternatives 2, 3 and 4 will have similar cumulative effects by reducing snag recruitment rates in the long-term, creating more open stand structure, and setting back shrubs for one to three years. When

considered with past timber sales, roads, ditches, and prescribed burning, these alternatives will further change the arrangement and patch sizes that determine habitat selection by NTMBS. Given the large size of this analysis area, and the relatively small difference between alternatives, there is not an appreciable difference between the action alternatives in terms of effects to NTMBS. A mosaic of forest and rangeland conditions will exist under any of the alternatives capable of supporting nesting populations of NTMBS. There is no indication that habitat changes from any of the action alternatives would result in reduced populations of NTMBS that would be meaningful at the local population scale or larger.

Past, planned, and future prescribed burning reduces habitat over the short term for NTMB but in many areas will enhance long term habitat as shrubs, forbs, and grasses regenerate/sprout. There is a potential to affect snags while burning as well, however, this affect will be minor in contrast to past harvest and firewood cutting.

In combination with the past and proposed vegetation management and road building in the area, irrigation ditches have diverted water from small streams and converted the previously diverse habitat to that of the surrounding area. However, a mosaic of forest and rangeland conditions will exist after this project that could support nesting populations of NTMB and would not result in habitat changes that would be meaningful at local and regional population scales.

Existing roads have replaced habitat with non-habitat and influence adjacent habitat by changing the microenvironment and by introducing disturbances from people. This project in combination with existing roads would further change the patch size and arrangement that determine habitat selection by NTMB. A mosaic of forest and rangeland conditions would exist after this project that could support nesting populations of NTMB and would not result in habitat changes that would be meaningful at local and regional population scales.

Closed roads have modified habitat for NTMB. However, in many cases successful road closures are allowing roadbeds to return to resource/habitat production. Roads being re-opened for use in this project would contribute cumulatively in a very minor way to the continued retarding of shrub growth and create a minor reduction of available habitat (because these areas are not yet fully recovered).

The enhancement work planned in this project, in combination with the aspen work done in the past would add to the amount of aspen habitat available for NTMB species that forage, roost, and nest in aspen habitat.

UNIQUE & SENSITIVE HABITATS

Introduction

This analysis area contains numerous unique and sensitive habitats in the form of rock features, ponds, springs, seeps, and shrub patches. All action alternatives will protect these features in the same manner. No harvest buffers or retention of higher basal area will be used to maintain the context of these features. The project area is the analysis area for unique and sensitive wildlife habitats. For further discussion of this resource refer to the Wildlife Reports in the Bald Angel Analysis File.

Effects Analysis

No Direct, Indirect, or Cumulative Effects

The following restoration activities associated with the Bald Angel project are of such limited and constrained nature that they are not near any of these habitats and would therefore have no effect on Unique and Sensitive Habitats.

- Precommercial Thinning/Cleaning
- Planting
- Road Reconstruction
- Road Obliterations
- Area Closure
- Specified Road Construction
- Temporary Road Construction

These activities and their effects will not be discussed further in this section.

Direct and Indirect Effects for Unique Habitats

ALTERNATIVE ONE

Alternative one would retain unique and sensitive habitats in their current condition and context, having the least effect to wildlife in the short and mid-term. Aspen clones would likely disappear by the long-term since no restoration work would occur under alternative one.

ALTERNATIVES 2, 3 and 4

Effects to the way wildlife uses these features will be similar on a site specific scale, but alternatives that treat more acres would potentially have greater negative effects at larger scales. These effects include severing or reducing the connective value of forested stands between unique and sensitive habitats. For example, the habitat value of larger rock features can be reduced when logging or road building fragments or reduces vegetative cover along travel routes between these features. Generally larger, wide ranging species like bobcat, bear, and cougar would be negatively affected by these landscape scale changes. Other species that are associated with rock features and could be effected by this project include: bushy-tailed woodrat (*Neotoma cinerea*), several bat species, yellow-bellied marmot (*Marmota flaviventris*), weasels (*Mustela erminea* & *frenata*), raven (*Corvus corax*), turkey vulture (*Cathartes aura*), band-tailed pigeon (*Columba fasciata*) and prairie (*Falco mexicanus*) and peregrine (*Falco peregrinus*) falcons.

Aspen is one of the uncommon tree species that receives a disproportionately high amount of wildlife use. There are two aspen stands that will receive restoration work in this project to regenerate a new layer of suckers. These restoration efforts will likely ensure that aspen persists on these sites for at least another generation of aspen (80-120 years). There is no difference in effects between action alternatives in regard to aspen.

Ponds, springs, seeps, and possibly wallows exist in the area, providing essential water for amphibians and upland wildlife species. Limited or deferred harvest buffers prescribed to protect fisheries and water quality usually maintain the context of these special habitats within logging areas. There will be no difference in effects between action alternatives (2, 3 and 4).

Cumulative Effects for Unique Habitats

ALTERNATIVE ONE

There are no measurable cumulative effects on sensitive and unique habitats from the no action alternative.

ALTERNATIVES 2, 3 & 4

Past road construction, regeneration logging, firewood gathering, unauthorized motorized trials, and unregulated off highway vehicles use have isolated and had detrimental effects to some of the

unique and sensitive habitats in this area. The Bald Angel action alternatives would represent a minor incremental negative effect to these past and ongoing activities. All alternatives would address the small scale, or immediate context of these features in the same way, but the larger landscape scale effects would vary slightly by alternative. More acres treated would increase the potential for severing connectivity between major rock features and other unique habitat features. Alternative 4 would have the least potential for negative effects to unique and sensitive habitats followed by alternative 3 and 2.

Unregulated OHV use in the past has led to the creation of unapproved trails which contribute to the isolation and interruption of connectivity between habitat patches in the project area. The area closure would reduce the potential for this isolation, impacts on vegetation in the area, and the disturbance of species using these habitat features.

Past road building to facilitate timber harvest, recreation and administrative access has isolated some unique habitats and contributed to the severing of connectivity between major rock features and other unique habitats. The area closure would reduce the potential for this isolation and the disturbance of species using these habitats.

Re-opening closed roads also has the short term potential to create a minor incremental negative effect contributing to the isolation between major rock features and other unique habitat features. These roads will all be closed following the completion of harvest activities and the area closure would reduce the potential for this isolation and the disturbance of species using these habitats.

Rangeland Resources and Noxious Weeds

Introduction

The following is an analysis of the effects on rangeland resources and noxious weed for the Bald Angel Vegetation Management project (herein referred to as Bald Angel) located within the 74,582 acre analysis area. The Bald Angel analysis area is within NFS watersheds 17050203-13 (Powder River-Pondosa) and 17050203-29 (Powder River-Keating); includes subwatersheds 13D, 13E, 13F, 29D, 29E, 29F and 29H and serves as the scale of analysis for rangeland resources and noxious weeds.

The description of rangeland resources and noxious weeds, along with the analysis of the expected and potential effects for each alternative were assessed using field surveys, noxious weed databases, and professional judgment.

Several management directives/recommendations apply to this project. Management directives from the Wallowa-Whitman Land and Resource Management Plan (LRMP) 1990, and the 1989 FEIS (for Managing Competing and Unwanted Vegetation), its associated "Mediated Agreement" and the Wallowa-Whitman Integrated Noxious Weed Management Plan (INWMP). The effects outlined below are based on all rangeland resources and noxious weeds protection and mitigation measures being implemented in full.

For the complete analysis of these resources refer to the Rangeland and Noxious Weed documents in the Bald Angel Analysis File.

EFFECTS ANALYSIS

No Direct, Indirect, or Cumulative Effects

The following restoration activities associated with the Bald Angel project are of such limited and constrained nature that they would not create introduction sites and would therefore have no effect on noxious weed prevention resources or activities.

- Precommercial Thinning/Cleaning
- Planting
- Prescription Modifications
- LOS Conversion

These activities and their effects will not be discussed further in this section.

A. Rangeland Resources

Direct Effects on Range Resources/Range Management

ALTERNATIVE 1 - NO ACTION

There are no known direct effects on range resources as a result of the No Action Alternative. Effects related to this alternative on range resources are primarily indirect in nature.

ALTERNATIVES 2, 3 and 4

Vegetation Management

Fuels Reduction—Direct effects from the implementation of any action alternative described with this project include an immediate reduction in available forage where burning occurs. This would be short term (1 year) until the following growing season. If prescribed fire is implemented during the normal grazing season some displacement of livestock is expected.

Timber Harvest— Direct effects due to timber harvest include disturbance to livestock during harvest activities, hazards created by livestock on roads during log haul and other related activities. Disturbance to rangeland plants and soils may occur if landings are placed in sensitive areas such as scabs or moist meadows.

Access and Travel Management

Area Closure—Disruption of livestock distribution by ORV users and gates left open by ORV users would be reduced by the area closure. It is expected that some level of use would still occur however it would be reduced.

Road Closure/Decommissioning—Livestock distribution may be directly affected by the road decommissioning for a short period by blocked trails and equipment use in the pastures where cattle are stocked. The roads proposed for decommissioning are short in length however and not generally used for moving livestock in or off of the area.

Indirect Effects on Range Resources/Range Management

ALTERNATIVE 1 - NO ACTION

Vegetation Management

Fuels Reduction-- Indirect effects relate to the potential lack of improvement to forage conditions from not implementing the prescribed burning. Livestock distribution would remain unchanged

Timber Harvest— Indirect effects relate to lack of potential transitory range creation through timber harvest activities. Livestock distribution would remain unchanged.

Access and Travel Management

Area Closure—Indirect effects of not implementing the proposed area closure on range resources or range management activities would be the continued disruption of livestock distribution and problems with gates left open by ORV users.

Road Closure/Decommissioning—Roads that have been historically used for livestock movement would remain open. Livestock disruption due to ORV use and gates being left open would continue.

ALTERNATIVES 2, 3 and 4

Vegetation Management

Fuels Reduction-- Indirect effects from the implementation of any action alternative described with this project include a potential short term (3-5 years) increase in available forage due to crown release in some species and a potential decrease in others. Forb, shrub and understory grass and grass-like forage will likely see a long term (5-15 years) increase in density and production following harvest and prescribed burning. This increase is due to created openings by timber harvest and prescribed burning. Livestock distribution may change due to the creation of transitory range and the increased production in forage following burning.

Timber Harvest— Indirect effects due to timber harvest include a long term increase in transitory range (5-15 years) unless tree regeneration reduces access and reduces forage production. This could occur mainly in areas with lodgepole pine regeneration.

Access and Travel Management

Area Closure—Disruption of livestock distribution by ORV users and gates left open by ORV users would be reduced by the area closure. It is expected that some level of use would still occur however it would be reduced.

Road Closure/Decommissioning—Livestock distribution may be indirectly affected by the road decommissioning for a short period until new trails are created. The roads proposed for decommissioning are short in length and not generally used for moving livestock in or off of the area. The road closures could indirectly benefit livestock distribution by reducing harassment of livestock by vehicles.

Cumulative Effects Rangeland Resources

Potential cumulative effects are analyzed by considering the proposed activities in the context of past, present and reasonably foreseeable actions. For the Bald Angel project, activities are considered in the following sixth field subwatersheds (SWS):

SWS	SWS Name
13D	Big Creek – Medical Springs
13E	Big Creek – Big Creek Ditch
13F	Upper Big Creek
29D	Upper Goose Creek
29E	Balm Creek
29F	Clover Creek
29H	Tucker-Houghton Creeks

These are the areas where cumulative effects have occurred or may occur. In addition, some activities have an influence that may extend downstream in the subwatershed within the project area boundary through the

Medical Springs and Keating drainage systems as far as the Powder River. This broad area is referred to as the “cumulative effects analysis area” and in general all alternatives are considered in the context of relevant past, present and reasonably foreseeable activities in this area. A summary table of the past management activities that have occurred in the cumulative effects analysis area is located in Appendix D of the EA and has been used to assess the cumulative effects of implementing this project on Rangeland Resources.

ALTERNATIVE ONE

Wildlife and livestock disturbance attributed to ORV use has increased in recent years and will likely continue. This could lead to reductions in livestock stocking if proper distribution is disrupted causing elevated use in areas where grazing may be retarding achievement of Forest Plan goals, objectives and RMO's.

Areas where burning would have occurred in the action alternatives will remain untreated for the foreseeable future. The potential for uncontrolled wildfire may increase in the absence of controlled burning. This could lead to reductions in livestock grazing if destructive wildfire occurred on a large scale.

ALTERNATIVES 2, 3 and 4

Forage quality and quantity would be increased short and long term by opening stands and through prescribed burning. Opening areas not previously accessible to livestock may provide opportunities for livestock to access previously treated stands and trespass into restricted/recreation areas. However, it would be immediately mitigated by permittee. Opening areas not previously accessible to livestock would also provide opportunities for livestock to access previously treated stands and better utilize forage throughout the allotment.

Improved management (primarily fencing and grazing strategies) on domestic livestock grazing have reduced impacts to riparian areas and stream channels due to the implementation of INFISH standards and guidelines.

OHV use has remained consistent in the project area primarily centering on big and small game hunting and camping throughout the project area. Restrictions on location of all types of user trails and OHV use would be reduced, under the proposed area closure, and impacts to rangeland resources/range management would continue to be reduced. The area closure will limit OHV access within the project area and minimize conflicts between grazing/allotment management and OHV use in terms of safety and harassment of livestock.

Opening closed roads and treatment areas not previously accessible to livestock may provide opportunities for livestock to trespass into restricted/recreation areas. However, it would be immediately mitigated.

B. Noxious Weeds

Direct and Indirect Effects Noxious Weeds

ALTERNATIVE 1 - NO ACTION

Vegetation Management

Fuels Reduction/Timber Harvest—There are no known direct or indirect effects from the no action alternative on noxious weeds.

Access and Travel Management

Area Closure— Potential direct effects on noxious weed populations the no action alternative would include the continued use of the area by ORV users and full size vehicles. This continued use increases the potential for spread of noxious weeds along roads and trails or the general landscape by ORV's. Unregulated ORV use has one of the highest potential direct effects on noxious weed spread via contaminated vehicles.

Road Closure/Decommissioning— Potential direct effects on noxious weed populations the no action alternative would include the continued use of the area by ORV users and full size vehicles. This continued use increases the potential for spread of noxious weeds along roads and trails or the general landscape by ORV's.

ALTERNATIVES 2, 3 and 4

Vegetation Management

Fuels Reduction--Direct effects resulting from prescribed burning may include exposed patches of mineral soil where down logs and duff is consumed. These may be sites for noxious weed inoculation via a variety of vectors. A reduction in competitive vegetation for a short period of time (1-2 years) increases the potential for establishment of noxious weeds. Alternatives three and four have slightly less acres of prescribed burning than alternative two. This will have a negligible reduction in the potential for noxious weed spread. The proposed burn blocks do not include areas that have larger populations of *Cardaria draba* (white top). Avoiding these populations will reduce the potential for spread of weed propagules during burning operations and reduce exposed soil which could lead to colonization by noxious weeds following prescribed burning.

Timber Harvest— Potential direct effects such as the spread of noxious weeds from logging and road maintenance equipment will be mitigated through contract provisions prohibiting use of known infestations for landings or equipment staging. Pre-treatment for noxious weeds on roadways prior to maintenance will reduce the potential for noxious weed spread.

Alternative three has two units with known noxious weed populations (119-whitetop and 144-diffuse knapweed) which are deferred for treatment. Alternative four has two additional units including 119 and 144 which are deferred for treatment (85-whitetop/scotch thistle and 86-whitetop/scotch thistle). Deferring treatment of these units reduces the potential for spread with harvest activities as well as reducing disturbance which will increase the potential for spread of noxious weeds.

Access and Travel Management

Area Closure— Potential direct effects on noxious weed populations of any action alternative described with this project include the reduction or elimination of noxious weed spread via motor vehicles within the proposed area closure.

Road Closure/Decommissioning— Pre-treatment for noxious weed control on roadways prior to decommissioning would reduce the potential for noxious weed spread. Reducing or eliminating ORV and full size vehicle travel on roads would dramatically reduce the potential for noxious weed spread.

All action alternatives will close or decommission the same miles of roads directly affecting the potential for spread of noxious weeds by ORV's or full size vehicles by reducing the opportunity for spread by these vectors.

New Road Construction—Alternative two and three propose 1.52 and 1.42 miles of new specified road construction. Neither alternative will construct specified road through any known noxious weed

sites reducing the potential for spread of noxious weeds. The disturbance from road construction will increase the potential for noxious weed establishment by other vectors if competitive vegetation is not established within the first year following construction. Alternative four has no new specified road construction which will have no affect on known noxious weed sites.

Temporary Road Construction—Alternative two and three propose 8.88 and 3.94 miles of temporary road construction. Alternative two and three have two units where temporary road construction would pass through or adjacent to two units with inventoried noxious weed infestations (units 119 and 144). This could directly affect noxious weeds through spread of propagules during road construction and related activities. Alternative four would eliminate temporary road construction from these units and eliminate the potential for noxious weed spread.

Cumulative Effects Noxious Weeds

Potential cumulative effects are analyzed by considering the proposed activities in the context of past, present and reasonably foreseeable actions. For the Bald Angel project, activities are considered in the following sixth field subwatersheds (SWS):

SWS	SWS Name
13D	Big Creek – Medical Springs
13E	Big Creek – Big Creek Ditch
13F	Upper Big Creek
29D	Upper Goose Creek
29E	Balm Creek
29F	Clover Creek
29H	Tucker-Houghton Creeks

These are the areas where cumulative effects have occurred or may occur. In addition, some activities have an influence that may extend downstream in the subwatershed within the project area boundary through the Medical Springs and Keating drainage systems as far as the Powder River. This broad area is referred to as the “cumulative effects analysis area” and in general all alternatives are considered in the context of relevant past, present and reasonably foreseeable activities in this area. A summary table of the past management activities that have occurred in the cumulative effects analysis area is located in Appendix D of the EA and has been used to assess the cumulative effects of implementing this project on Noxious Weeds.

ALTERNATIVE ONE

The potential cumulative effects of implementing Alternative 1 could include increased spread and density of noxious weeds due to unrestricted OHV use. Continued ORV use in these areas would likely lead to greater occurrences of noxious weeds in areas otherwise free from weeds.

ALTERNATIVES 2, 3 and 4

The highest potential for cumulative effects related to noxious weeds in the subwatersheds included in the Bald Angel Project for Alternative 2, 3 and 4 is from the creation of openings during harvest and prescribed burning that could lead to a shift in plant composition over time. If adequate root and seed stock remains following treatment, native or naturalized domestic plants should remain dominant. If fire intensity or harvest activities expose excessive bare mineral soil in large areas, the opportunity for a long term shift to introduced undesirable plants and noxious weeds increases.

There is a potential for the transportation and spread of active noxious weed populations, however, implementation of the action alternatives is not expected to contribute to weed spread over and beyond what would be expected with typical traffic because weed control efforts are on-going, effects are limited to the treatment sites, and management requirements for prevention would be incorporated in project design.

Past, current, and the burning called for in the action alternatives in areas where there are active noxious weed populations has the potential to prepare seedbeds for spread of the existing populations. Treatment of the existing populations should keep this to a minimum and avoid known sites.

There is a remote potential for noxious weed introduction into these areas by equipment which could then be spread by campers. However, this is not highly likely because only a very few dispersed sites would be affected and project management requirements would minimize this potential (washed equipment, etc).

ORV use has remained consistent in the project area primarily centering on big and small game hunting and camping throughout the project area. Restrictions on location of all types of user trails and ATV use would be reduced, under the proposed area closure and would reduce the potential for spread of noxious weeds within the project area by unregulated OHV use.

There is a potential for the transportation and spread of active noxious weed populations along existing roads, however, implementation of the action alternatives is not expected to contribute to weed spread over and beyond what would be expected with typical traffic because weed control efforts are on-going, effects are limited to the treatment sites, and management requirements for prevention would be incorporated in project design.

Opening previously closed roads for use as temporary roads has the potential for the transportation and spread of noxious weeds, however, effects are limited to the treatment sites, and management requirements for prevention would be incorporated in project design.

Project would create more openings and disturbed soil which could create seedbeds for the remote possibility that noxious weeds could be carried into these areas by livestock and germinate until ground cover and undergrowth comes back.

Recreation/Visuals

Recreation, cultural and viewing resources are of local significance within the Bald Angel project area. Because no developed recreation facilities exist within the project area, recreation is primarily focused on day trip activities such as snowmobile riding, firewood gathering, hiking, hunting and mushroom picking during the summer months. The highest use in this area is experienced during the big game hunting seasons when hunters occupy many of the dispersed campsites within the area.

Unhealthy, overstocked stands and impacts to the recreation setting are two major impacts on the desired landscape character which are considered in this analysis in terms of the ecological and scenic integrity. Scenic integrity is moderate. Absence of fire and overstocked stands create the greatest deviation from integrity. Visual Quality Objectives in most seen areas are generally maximum modification with exception of the foreground and middle ground areas around the 77, 67, and 70 Roads which have retention and partial retention objectives.

The analysis area for the Recreation assessment will be the project area as described in Chapter One and on the maps in the Appendices and will be the seen areas for the 77, 67, and 70 roads related to the retention and partial retention objectives for direct, indirect, and cumulative effects.

Trends, or Conditions that Pose Risk to Positive attributes.

The trends or conditions that pose a risk to landscape character attributes include those that contribute to large, severe intensity, stand replacement fires and insect and disease epidemics. Conditions such as these reduce the sustainability of the scenic resources.

The Scenery Key indicators are as follows:

Unnatural Appearing Impacts

Disturbance <10% of the viewshed (Retention Foreground)

Disturbance <14% of the viewshed (Partial Retention and Retention Middleground)

The following effects analysis is based on field surveys, data review and professional judgment.

Effects Analysis

No Direct, Indirect, or Cumulative Effects

The following restoration activities associated with the Bald Angel project are of such limited and constrained nature that they would not be easily seen upon implementation and therefore have no effect on Recreation and Visual resources or activities.

- Precommercial Thinning/Cleaning
- Planting

These activities and their effects will not be discussed further in this section.

A. Recreation

Direct, Indirect and Cumulative Effects on Recreation

ALTERNATIVE ONE

Road-related recreation and off-road travel will continue to increase in an unmanaged and unrestricted manner. New off-road tracks would continue to increase and create resource impacts and affect the non-motorized recreation experience. The motorized/ non-motorized user conflicts include hunting, sightseeing, hiking, and equestrian users. The lack of enforceable motorized management is leaving very little of the area available to non-motorized activities. Currently the analysis area is in ROS- Roded Natural recreation opportunity spectrum.

ALTERNATIVES 2, 3 and 4

The area closure proposed in these alternatives would eliminate approximately 36,700 acres of off-road travel and decrease roded recreation opportunities in the project area. Road closures and promulgations will reduce approximately 80 miles of roded recreation opportunities and eliminate many dispersed camping sites in the project area. Roded recreation would be limited to open roads only. Motorized recreation opportunities would be confined to open roads. Cross country travel would be eliminated. Throughout the area the types of non-roded and non-motorized recreation opportunities will remain the same as those currently available, however there will be an increase in area not affected by motorized travel and available for those who prefer that type of experience. All alternatives would not change the ROS- Roded Natural recreation opportunity spectrum.

There is a minor potential to impact hunting opportunities during fall burning but these potential impacts would be very short (<1week) during which activities would occur within an area. Burning would improve long term available forage, huckleberries, and mushroom gathering.

Harvest and burning will occur within ¼ mile of some irrigation ditches but will avoid activities close to them or through them. There would be no effect on ditches and because there is no recreation associated with these ditches there will be no cumulative effect on recreation.

A short term minor potential to affect recreational users using the area to camp in campgrounds or cabins could occur with this project due to equipment placement, noise, and road blocks – however most of the project would not be close to the campgrounds or cabins within the project area. There could be very short (<1week) period of time when smoke is present in the area from prescribed burning.

OHV use trends have been rising significantly over the last 10-15 years. The area closure within this project will sharply curtail that access and push OHV use into other areas increasing the potential for environmental damage and disturbing non-motorized users. When harvest/burn areas are adjacent to permitted use routes there will be more opportunities to violate the closure order and create enforcement issues.

Four wheeling driving opportunities would be reduced under this project due to reduced access under the area closure. User safety of the area would be increased due to proposed road improvements or maintenance planned on those roads to be maintained as open. The area closure would also improve the long term safety and drivability of these roads due to being able to focus available funds on priority open roads.

The area closure associated with this project will reduce the number of dispersed recreation sites available for use and concentrate camping in other areas, diminishing the opportunity for solitude and increase the potential for resource impacts. The area closure will also increase the opportunities for non-motorized recreation within the area and immediately adjacent to the Wilderness.

Some people do not appreciate cattle and cow pies in campgrounds or on National Forest System lands. This project will have little to no effect on the cattle use of the area, however, a fence built on Glendenning Creek (8/2006) will stop cattle access into the Main Eagle Creek Recreation area.

B. Scenery

Direct and Indirect Effects on Scenery

ALTERNATIVE ONE

The no action alternative would make no changes to existing conditions, nor would it alter the existing trends or conditions that may pose risk to the positive attributes of the landscape character.

No action will allow the existing condition to continue, and the trend of increasingly dense stands. No visual impacts will occur, however the conditions will continue to diminish the sustainability of the long term scenery resources.

ALTERNATIVES 2, 3 and 4

Commercial thinning (HTH), fuels reduction harvest (HFU) and release (SCN) treatments will reduce tree densities, opening up the understory and letting in more light to the forest floor. Thinning to reduce tree densities and crown fuels will not be visibly apparent to the average viewer from a middleground or background distance. Close scrutiny of the stands from this distance will discern a less dense but continuous canopy.

These treatments will improve the ability to sustain the existing landscape character attributes by producing stands that are more defensible. By reducing ladder fuels, raising crown base height and crown density this area will be more defensible at the event of a fire.

Pile burning (RMP) and underburning (RPB) will create scorched and blackened underbrush, saplings, bark, grasses and forbs. These effects will continue for a period of 1 to 5 yrs. Following the first growing season after treatment, the majority of these effects would no longer be visible. New growth of forbs and shrubs would quickly sprout and flourish. The positive effects of this treatment would be the decrease of the amount of small dead material that creates an unhealthy appearance. A decrease in this material lessens the fuel load for fires that could threaten landscape character attributes.

Prescribed burning will introduce blackened soils and grasses, burned understory brush, saplings and forbs. Scorching of larger tree trunks will occur. The effects will be primarily short term (1-2 yrs). Much of the blackened understory will not be evident after a few growing seasons occur and the area begins to revegetate. There may be some minimal mid term effects such as small patches of overstory mortality, however the patches are expected to appear as a natural occurrence and not detract from the valued landscape character.

The prescribed fire will improve conditions for fire resistant species, which will indirectly improve landscape character attributes of large tree character and open stands that can withstand low intensity fires.

These effects would be noticeable with close scrutiny from middleground and background views, but the effects would appear natural and characteristic of the existing landscape. From a foreground view the effects would be limited to small, low cut stumps (< 6" in height) and blackened vegetation. The understory views would be more open with less dead and down material. The forest would visually be less cluttered and have a more "clean and healthy" appearance. Very few of the treatment units are visible from highly traveled roads. There are a few units that will change the VQO at a small scale.

Units 45 and 116 (next to the 6700 road – level 1 sensitivity) are being treated with a shelterwood (HSH) harvest of 13 and 12 acres respectively, as is suggested in the Forest Plan (page 4-43) for use rather than clearcuts. These stands are suppressed with very poor crown ratios that are stagnating slowing the restoration of the site creating a current and future fire hazard. Treatment at this would affect the scenic integrity by introducing human-caused disturbances that detract from the valued landscape character in the short term, however it would improve long term integrity as the site recovers and the planted trees become a new, healthy stands of regeneration (within 10 years). This treatment would be visible from the roadway.

The foreground views along the 7700 road and 6700 roads where treatments occur would also be affected in the short term. The views from these roads will be "cleaned up" and the appearance of the understory would be more open with less clutter. Low stumps would be visible from these roads. The effects would not be apparent from a middleground or background view. Although these units are slightly larger than the unit sizes suggested in the Forest Plan, because they are the only treatments within the project area of this type (all the rest are intermediate harvests) they will be well within the standards set by the Forest Plan for percent of any viewshed disturbed at any one time for the project area for retention and partial retention foreground.

Cumulative Effects on Scenery

The project lies in an area that has obvious effects caused by previous timber sales (as described in Appendix D of the EA). Past timber projects have created unnatural appearing stands that detract from the scenery on the ridges in this area. In areas where no management has occurred, much of the stands are overstocked and full of dead and down material. Overall action alternatives would improve the latter condition, but have no negative cumulative effects to scenery resources.

ALTERNATIVE ONE

The no action alternative would allow the conditions and trends that currently exist to continue to pose a risk of losing positive attributes of the landscape character, but would not cause cumulative effects to the scenery resource.

ALTERNATIVES 2, 3 and 4

In general, nearly all of the past harvest activity within this viewshed is approximately 10 to 20 years old. The immediate visual impacts of these treatments are primarily gone as stumps have disappeared or discolored and ground cover has grown back. Although many elements of the ecosystem affect the aesthetic experience, within the Bald Angel area the condition of vegetation and the condition of the recreational settings affect the landscape character most directly. Unhealthy, overstocked stands and impacts to the recreation setting are two major impacts that detract from the desired landscape character. Implementation of the actions in Alternatives 2, 3, and 4 would improve these conditions and improve the ecological and scenic integrity in the project area. Minor short term impacts in terms of fresh stumps would be expected, however, these would be short term in nature and not provide measurable cumulative effects.

While a mosaic of stand conditions exists it is not within the HRV. Fire suppression has led to a proliferation of shade tolerant tree species (grand fir, alpine fir, and Douglas-fir) primarily in the seedling to pole size classes. Timber harvest has occurred and the area has many roads. Western larch is a disturbance dependant tree species. Larch is disappearing in many stands as it becomes crowded by true firs. The proliferation of shade tolerant species has increased the risk of stand replacement fire. These trees provide ladder fuels and close crown contact with seral overstory trees, seriously putting these large trees at risk.

Fire suppression and some other management practices have changed tree species composition and stand structure, making the landscape less resilient to natural disturbances. The physical characteristics of the watershed and riparian systems of the area are in good shape as compared to the desired and historic conditions. There are some areas of concern including off road use of vehicles and unclassified roads that are causing adverse impacts. The biological characteristics of the aquatic ecosystems are probably in good shape as compared to the historic and desired conditions.

Projects such as this one would bring vegetation species composition and structure into the mean historical range of variability. Thinning overstocked stands in a manner that would create a spatial and structural mosaic that supports fire resistant species would move toward the desired character for vegetation and the ecological integrity should rise to high more so in Alternative 2 than in Alternatives 3 and 4 respectively.

Short-term (<1 year) visual impacts before spring greenup the following year are common with the use of prescribed fire, however, nearly all visual impacts from past burning activities within the project area are gone within 3 years. There would also be short-term (1 week) one time impacts from smoke in the area to camps and cabins. The length of potential impacts from smoke intrusion could be extended depending on the occurrence of wildfires within the project area or that might affect the project area. However, this is not a frequent occurrence due to topography and prevalent wind/weather flows.

Issue: Forest Plan Amendment for the Treatment in Old Growth Below HRV

Introduction

The purpose of this project is to provide for long-term forest health to improve wildlife habitat, reduce the likelihood and severity of future insect infestations, reduce potential damage from wildfires by reducing tree densities, developing forest structure toward historic ranges by moving promoting healthy stands toward LOS and conversion of some of the stands from MSLT to SSLT to reflect what these sites would historically have represented on the landscape, restore healthy riparian conditions, reintroduce fire as a disturbance factor, and through the use of an area closure achieve effective and economic closure of roads throughout the area.

The Wallowa-Whitman National Forest Plan was signed in 1990. Over the ensuing years, new information has come out of a variety of sources such as the Interior Columbia Basin Ecosystem Management Assessment, National Fire Plan, 10-year Comprehensive Strategy, and the Endangered Species Act, which have not been studied and integrated with the resource protection and objectives of the 15 year-old Forest plan. In order to integrate these other resource needs, a non-significant forest plan amendment has been incorporated as part of this project to address vegetation treatment needs in the project area.

The Screens direction was signed in 1994, as interim direction amending Eastside Forest Plans until the Interior Columbia Basin Ecosystem Management Project (ICBEMP) was completed which was to amend Forest Plans to reflect new scientific information related to fish habitat, wildlife habitat in terms of snags and old growth. The planning for ICBEMP was controversial and after many years the Chief made the decision to issue a proposed Decision in December 2000, which would describe the science findings and management recommendations. This did not amend the Forest Plans; therefore the Screens direction of 1994 is still in place. Over time the intent of the Screens direction has been questioned and analyzed and inconsistencies discovered. The intent of the LOS direction in the Screens is to maintain and enhance available LOS. However, as currently written the Screens direction does not allow the use of timber harvest to move stands which were historically SSLT and have over time become MSLT to back to the stand structure they would have historically been if fire had not been removed as a disturbance regime. Therefore, in order to accomplish that goal and meet the intent of the Screens direction, this project would adopt the modified LOS guideline as described in Chapter Two of this EA, Bald Angel Forest Plan amendment.

The effects of this Forest Plan amendment have the potential to affect other resources and species associated with the Bald Angel project area. The effects on old growth (LOS) and old growth dependant species have been covered under the Wildlife Effects earlier in this chapter.

The following effects analysis is for the other resources and uses within the project area and is based on data review and professional judgment.

Effects Analysis

No Direct, Indirect, or Cumulative Effects

The adoption of the LOS guideline modification for the small number of acres within the project area that are LOS (1,086 -1,445 acres) is of such a limited nature or are not physically located within a designated or allocated area that it would not have any effect on the following resources or uses:

- Inventoried Roadless Areas
- Uninventoried Roadless Areas
- Allocated Old Growth – MA15
- Proposed, Endangered, Threatened, and Sensitive Fish and Plant Species

These activities and their effects will not be discussed further in this effects analysis.

Direct, Indirect and Cumulative Effects

ALTERNATIVE 1 – NO ACTION

Because alternative 1 is the no action alternative and no activities would occur in LOS stand structures and the project area as a whole, the Forest Plan Amendment for treatment in LOS stands below HRV would not be necessary and therefore there would be no change to old growth as it currently exists in the area and the existing LOS would continue to not appear or function as they would have historically with regular fire return intervals. More stands would continue on toward MSLT structures and the SSLT structure would be diminished even further across the landscape than it already is.

ALTERNATIVES 2 – 4

Alternative 2 would mechanically treat 1,445 acres, Alternative 3 would treat 1,237 and Alternative 4 would treat 1,087 acres with commercial thinning and fuels reduction prescriptions. Some pile burning would occur on these treated acres. The effects of implementing the modified LOS guidelines in the action alternative on these acres would have no additional effects beyond those described under their specific resource areas within Chapter 3 for Alternatives 2 - 4, and see the effects for Alternative 1 for the acres not treated under the action alternative:

- Soil Quality and Productivity
- Management Indicator Species
- Neotropical Migratory Birds
- Noxious Weeds
- Old Growth – LOS
- Recreation
- Fisheries and Water Quality
- Vegetation Management and Forest Health

Actual on the ground implementation of this section of the amendment would begin in late 2006 which is 16 years after the signing of the ROD for the Forest Plan (April 1990). In general, the Forest Plans should be updated every 10-15 years. The Wallowa-Whitman Forest Plan just began its revision cycle (in year 14).

Adoption of the LOS Guideline for the acres treated in the project area does not alter the goods and services projected by Forest Plan as amended by Screens. In general, due to the small nature of the materials being removed, the small area under treatment and the type of prescriptions being used, the materials being removed to convert structure within these stands produces a miniscule increase in outputs over the totals projected by the Forest Plan as amended by Screens in this entry, however, it will not be available for future entries as SSLT. In comparison to the totals, the increase is imperceptible.

This portion of the amendment does not change the allocation of any of the lands within the Bald Angel project area; it merely allows the change of the LOS structure from one type to another with no net loss in LOS to meet the HRV's for this area. The scale of the change of management on these acres is imperceptible when compared to the total goods and services estimated for the Forest Plan.

D. Required and Additional Disclosures

This section discloses the effects of the alternatives on the human environment as specified by law, regulation, policy, or Executive Order.

Cultural Resources

No impacts to any known cultural resource site would result from implementation of any of the action alternatives. This responds to the non-key issue of protection of cultural resources.

Tribal Treaty Rights

Treaties provide that Native Americans will continue to have the right to erect suitable buildings for fish curing, privileges of hunting, gathering roots and berries, and pasturing stock on unclaimed lands. Indian treaty rights and privileges were considered throughout this analysis and maintained through appropriate design and layout features, especially related to resources such as fish, wildlife, and riparian areas. All alternatives are relatively equal in their treatment of treaty rights and are expected to maintain treaty rights and opportunities into the future. This responds to the non-key issue of Indian treaty rights and trust responsibilities.

Biological Diversity

All existing native and desirable introduced species and communities are maintained with all alternatives. Aspen restoration efforts would increase diversity. Erosion control measures (seeding) would use native species when possible (EA, section two). Biological diversity is not expected to be affected.

Public Safety

No long-term public safety problems are anticipated with any of the alternatives. Short-term safety hazards such as log truck traffic and falling trees near roads would be mitigated through contract safety provisions and are not anticipated to impact public safety.

Research Natural Areas, Experimental Forests, and Wilderness

There is one research natural area within the project area, however, no activities have been proposed within it and all activities proposed adjacent to it will ensure its protection. There are no adjacent research natural areas or experimental forest associated with the Bald Angel project area, however, the Eagle Cap Wilderness is located immediately to the east, but outside, of the project area. There are no activities proposed adjacent to it and project design will ensure its protection. There are no known significant cumulative effects from the project and other projects implemented or planned on areas separated from the affected area of the project beyond those evaluated in Chapter IV of the FEIS of the Forest Plan. The physical and biological effects are limited to this analysis area. No actions are proposed which are considered precedent setting.

There are no known effects on the human environment that are highly uncertain or involve unique or unknown risks. None of the actions threaten a violation of Federal, State, or local law. Action alternatives would comply with air and water quality regulations (laws). Although the effects on the quality of the human environment are not likely to be highly controversial, based on public participation, the project proposals themselves are highly controversial.

There is no expectation that there would be a change to public health and safety. Mitigation and precautions apply to all the action alternatives. Should there be a wildfire under any alternative, there could be an adverse impact to public health in terms of a change in the water quality. Other safety measures are discussed or are a standard part of sale contracts.

There are no known plant communities containing yew species within the analysis area.

Probable Adverse Environmental Effects that Cannot Be Avoided

Some impacts caused by implementation of management activities proposed in this analysis that cannot be avoided may be considered adverse according to individual interpretations. Stumps and disturbed areas are not a pleasing sight to some people, visually or environmentally. Truck traffic would compete with public traffic on roads used in common. Traffic and removal activities would also create dust and noise. Smoke from prescribed burning, fuels reduction, and slash disposal is an irritant and an unpleasant sight to some people. Recreation users may find changes to the areas they have visited in the past, either through reduced or increased access, changed landscape, or changes in vegetation.

Irreversible and Irretrievable Commitment of Resources

Irreversible resource commitments are actions that either deplete a non-renewable resource or disturb another resource to the point that it cannot be renewed within 100 years. There are no known significant irreversible resource commitments or irretrievable loss of timber production, wildlife habitats, soil production, or water quality from actions initiated under any of the alternatives. No heritage sites are known to be affected.

Impacts to soil and water are controlled by management practices and mitigation measures and would not represent an irreversible resource commitment, except for the minor acreage involved in log landing sites used for decking logs and in road construction. For all practical purposes, rock is a non-renewable resource. Use of rock as surfacing represents an irretrievable commitment of a resource, although due to quantities of supply, it is not a significant commitment. Existing roads and newly constructed roads constitute a more-or-less permanent commitment of a portion of land to a purpose other than timber production.

Some non-designated old growth may be affected under the action alternatives, however, the affect is generally considered a positive one and there will be no net loss of old growth. In addition, some loss of snag habitat would occur under all action alternatives. It is not known whether this is an irretrievable or irreversible action at this time. It is also not known what impact this type of change may have on unidentified nest sites of management indicator species.

Energy Requirements of Alternatives

Management alternatives that require less energy efficient methods such as helicopter logging are less energy-efficient. The need for less energy-efficient and more expensive techniques, such as helicopter logging is often due to the need to mitigate soil damage or adverse effects on watershed and other resources that would occur if more energy-efficient means, such as tractor yarding systems were employed. In this analysis, a combination of yarding systems and road development scenarios were developed in order to evaluate the tradeoffs of implementing various options.

Prime Farmlands, Range Land, Forest Land

Actions taken under any of the alternatives would have no impact on farmland, rangeland, or forestland inside of outside the National Forest. There are no prime farmlands affected by the proposal. Wetlands and floodplains associated with streams and springs would be protected using mitigation guidelines previously identified. No designated Wild and Scenic rivers would be affected by this project proposal.

Civil Rights, Women, Minorities, Environmental Justice

There are no known direct or adverse effects on women, minority groups, or civil rights of individuals or groups. Action alternatives are governed by sale or service contracts, which contain nondiscrimination requirements to prevent adverse impacts to these groups. The no action alternative may have some short-term adverse impacts on the local community by not providing timber sale receipts. To the greatest extent possible all populations have been provided the opportunity to comment before decisions are rendered on proposals and activities affecting human health or the environment. The proposals within this EA would not have a direct or indirect negative effect on minority or low-income populations (Presidential Exec. Order No. 12898 on Environmental Justice).

Wetlands and Floodplains

Executive Orders 11988 and 11190 require protection of wetlands and floodplains. Wetlands in the Bald Angel project area are generally stream channel-associated seeps and springs. All are protected by the INFISH RHCAs in the action alternatives. Isolated seeps and springs would be protected with appropriate buffers. The floodplains within the area are generally very narrow, due to the steep topography. Nearly all floodplains are avoided or protected by RHCAs in this project.

IV. CONSULTATION WITH OTHERS

Public scoping for the Bald Angel Restoration project was initiated in the July, 1996 under the names of the Tucker Creek and Sawdust projects. These projects were identified as a part of the 5-year District Vegetation Management program in the La Grande District Schedule of Proposed Actions (SOPA). In January 2000, these two projects were combined to become the Tucker Dust project in the SOPA. In the Fall of 2002, the project boundaries were adjusted and the project was renamed Bald Angel and has appeared in each quarterly SOPA since then. This mailing is distributed to a mailing list of 100 - 600 (Forest-wide SOPA) individuals, organizations, and agencies. Between 1997 and 2002 three Environmental organizations and one individual expressed interest in this project.

A detailed description of the proposed action was mailed on April 22, 2005 to approximately 100 forest users and concerned publics soliciting comments and concerns related to this project. One letter of response and three phone calls were received from interested parties, which are part of the Comments Appendix of the EA.

On May 12, 2005, the Bald Angel Interdisciplinary Team and Ranger met with several interested local landowners within the project area to discuss and clarify the proposed action. In general they were in favor of the activities proposed.

A brief overview of the project was presented to the Union County Community Forestry Board as a part of District program of work for 2004-2006. Members also received a copy of the Proposed Action.

Scoping and consultation for the project was initiated and is on-going with the Confederated Tribes of the Umatilla Indian Reservation.

The Oregon Department of Fish and Wildlife (ODF&W) office was contacted as part of the Proposed Action scoping process.

Permittees who graze cattle within the Bald Angel analysis area were notified of project planning activities.

The proposed action was mailed to the Eastern Oregon ATV Association and a follow-up phone call was made to offer clarification if needed on the Area closure proposal in this project. No comments were received.

This project has been submitted to The State Historical Preservation Officer (SHPO) for review.

An analysis file for this project is available for public review at the La Grande Ranger District. The analysis file includes specialist's reports, data specific to the project, public notifications and their responses, meeting notes, and miscellaneous documentation.

Several local/adjacent landowners expressed interest in this project over the phone. Their calls and responses are located in the Comments Appendix for this project.

A 30-day Comment Period for this Environmental Assessment was published in The Observer and Baker City Herald newspapers. Comment letters received and responses are located in the appendix for this EA..

Bald Angel Appendix D Cumulative Effects Analysis Process and Project Area Activities

The following process and assumptions were used by the Bald Angel ID Team in their analysis of the effects of actions proposed in this document on their resources.

A. Analysis Area - In general, the analysis area will be the project area. If the resource being analyzed necessitates extending the analysis area outside the project area for an appropriate analysis then the extent of the analysis area is documented under each resource area.

B. Effects - The specific effects of each action alternative on the environment, including the No Action alternative are to be analyzed by each resource area.

Actions to be analyzed by ALL resources are:

1. Commercial timber harvest include logging systems (tractor, skyline, helicopter)
2. Non-commercial timber harvest (SCN) include logging systems
3. Prescription Modifications for Corridors
4. Road Reconstruction
5. Prescribed Fire – including mechanical pre-treat
6. Control lines for fire
7. RHCA Treatments
8. Area Closure
9. LOS Conversion – MS to SS and Forest Plan Amendment to treat LOS<HRV
10. Temporary Road Construction
11. Specified Road Construction
12. Precommercial thinning
13. Road Obliterations
14. Mitigation Measures

Show the cause and effect for Direct, Indirect, and Cumulative effects, defined as follows:

Direct Effects: Explain the direct effects the implementation of the alternatives would have on the environment. These include effects which are caused by the action and occur at the same time and place as the action.

Indirect Effects: Describe indirect effects of alternatives on the environment. Indirect effects include those which are caused by the action but are later in time or farther removed in distance what are still reasonable foreseeable.

Cumulative Effects: The cumulative effects analysis will include:

Past Actions + Present Actions + Proposed Actions + Reasonably Foreseeable

Present actions will incorporate all know activities. Reasonably foreseeable future is approximately 5 years within which we are reasonably certain our proposed actions would occur.

Note: should you change any of these parameters, the change is documented in the effects writeup for that resource.

C. Analyze the effects in terms of:

1. **Differences from the present condition:** How do each of the alternatives (include all actions under each) change the environment based on what is there now? What are the specific differences between alternatives? What is the direction of the effect (increase or decrease)?

2. **Duration:** How long will the impacts last?
3. **Significance:** Analyze in terms of context and intensity.
 - **Context:** Analyze whether effects are local, regional, national, or affect society as a whole.
 - **Intensity:** Analyze in terms of severity of impacts.

Effects writeups need to disclose what these actions WILL DO to the environment.

Avoid relative measurements such as "minimal, substantial, etc". Talk about the specific differences between alternatives in units of measure that are relevant, quantifiable, and descriptive. Use the Key Indicators to describe the effects on the key issues.

Use tables graphs, drawings, etc. when appropriate and available.

Use references to relevant scientific studies to back up statements when appropriate and available. In addition, identify where there are information gaps, incomplete or unavailable information.

D. Past Present and Reasonably Foreseeable Future Actions

The following is a list of the past, present and reasonably foreseeable future activities within the project area, and on immediately adjacent public and private lands. This list will serve as a guide for resource specialists as they define their Analysis areas for their resource and identify the direct, indirect, and cumulative effects of implementing the Bald Angel alternatives. Reasonably foreseeable future is defined as within the next 5 years for this exercise.

The ID Team considered historic data from the Powder River Timber Survey Project (Griffin and Conover, 1917 at <http://www.fs.fed.us/r6/uma/publications/history/>) in addition to the information listed below as a part of the analysis of past activities within the project area.

Regen = clearcut, seedtree, shelterwood
 Intermediate = commercial thinning, partial removals, prep cuts, salvage, selection
 Other = final removals, overstory removals

Project Name	SWS	Timber	
		Year	Activity
Bald Angel CE	13E	2004	209 Ac – Intermediate harvest (HTH)
Basin Timber Sale	29D	1997	316 ac – Intermediate 30 ac - Regen
Basin-Goose TS	29D	1999	56 ac - Regen
Beagle Salvage	13C	1983	86 ac – Intermediate 31 ac - Regen
Burn Creek	13E	1987	153 ac – Other 475 ac - Intermediate
Corner	13C	1990	18 ac - Intermediate
Cougar Ridge	29C	1978	104 ac - Other
Cup Salvage	29C	1989	425 ac - Intermediate
Dark Red	29C	1991- 1993	124 ac – Other 227 ac – Intermediate 32 ac - Regen
Dempsey	29C	1992- 1993	379 ac – Intermediate 116 ac - Regen
DS Eastside	29F/H	1997	342 ac - Intermediate

Timber - Continued			
Project Name	SWS	Year	Activity
Eagle Holcomb	29C	1998	42 ac - Intermediate
Easy Oats Salvage	13F	1988	133 ac - Regen
Forshey Creek	29B/C	1982- 1989	1979 ac – Intermediate
Forshey Puzzle	29C	1995	113 ac - Intermediate
Frazier Mtn Trespass	13C	1989	4 ac - Regen
Fuelbreak	29C	1991	13 ac - Intermediate
Gravel Flat	13D/F	1995	417 ac – Intermediate 48 ac – Regen
Huckleberry DS	13C/F	1988- 1989	143 ac – Intermediate 25 ac - Regen
Huckleberry LGRD	13C/F	1986- 1988	43 ac – Other 589 ac – Intermediate 143 ac - Regen
Langrell	13E	1981	299 ac - Intermediate
Lily	29C	1995	14 ac - Intermediate
Lost Goose	29D/E	1991- 1993	35 ac – Other 156 ac – Intermediate 237 ac - Regen
Sawtooth Salvage	29H	1990	14 ac - Intermediate
Sawtooth Springs	29D, E, F, H	1995- 1998	73 ac – Other 676 ac – Intermediate 765 ac - Regen
Sparta Salvage	29C	1984	37 ac - Intermediate
Sufferin Smith Salv	13E	1996- 1998	71 ac – Intermediate 144 ac - Regen
Summit Salvage	13C	1986	25 ac - Regen
Surprise	29C	1986- 1988	416 ac – Other 71 ac – Intermediate 16 ac - Regen
Tamarack Flats	13E	1983	162 ac - Regen
Thorn Spring	13C	1970- 1972 1976- 1978	325 ac - Intermediate
Torch	29C/D	1990- 1992	194 ac – Intermediate 538 ac - Regen
Tucker Creek	29H	1981	138 ac - Intermediate
UNK	13F	1980	73 ac - Intermediate
Upper Goslin	13F/29E	1979	441 ac – Intermediate 48 ac - Regen
Velvet Creek	13F	1989- 1994	145 ac – Other 1378 ac – Intermediate 672 ac - Regen
Waterpipe	29F	1981	66 ac - Intermediate

Overview of Timber Harvest:

Activity	Time Period	Project Name and Location (5 th Field HUC)	Description and Extent of Activity
<p>Timber Harvest</p>	<p>1978 – 1985 > 20yrs Old</p>	<p>Langrell (13E) Tamarack Flats (13E) Tucker Creek (29H) UNK (13F) Upper Goslin (13F/29E) Waterpipe (29F)</p>	<p>These timber harvests projects are greater than 20 years old, treated 1,368 acres with a combination of thinning and regeneration prescriptions. These acres should be fully hydrologically and vegetatively recovered. Associated activities were road building and increased access as a result of these harvests.</p>
	<p>1986 – 1995 Pre INFISH & < 20yrs Old</p>	<p>Burn Creek (13E) Easy Oats Salvage (13F) Huckleberry DS (13C/F) Huckleberry LGRD (13C/F) Lost Goose (29D/E) Sawtooth Salvage (29H) Torch (29C/D) Velvet Creek (13F)</p>	<p>These timber harvests projects are less than 20 years old, but were implemented prior to INFISH standards for RHCA buffers. They treated 5,073 acres with a combination of thinning and regeneration prescriptions. These acres were all treated greater than 10 years ago and would be partially hydrologically and vegetatively recovered. Associated activities were road building and increased access as a result of these harvests.</p>
	<p>1996 – 2005 Post INFISH</p>	<p>Bald Angel CE (13E) Basin TS ((29D) Basin-Goose (29D) DS Eastside (29F/H) Gravel Flat (13D/F) Sawtooth Springs (29D/E/F/H) Sufferin Smith Salvage (13E)</p>	<p>These timber harvest projects were conducted based on all INFISH fisheries and watershed protection and mitigation measures being implemented in full reducing the effects and speeding up the recovery rate. They treated 3,147 acres with a combination of thinning and regeneration prescriptions. Associated activities were road building and increased access but a reduction in road densities through decommissioning after project completion.</p>

RX Burns			
Project Name	SWS	Year	Activity
Angel Point	13F	1997	1500 ac prescribed burning
DSE	29F/H	1995	25 ac prescribed burning
Velvet Creek	13F	1995	95 ac prescribed burning
Sufferin Smith	13E	1996	170 ac prescribed burning
Lost Goose	29D/E	1990	57 ac prescribed burning
Sawtooth Springs	29D/E/F/H	1994	226 ac prescribed burning
Huckleberry DS	13C/F	1988	127 ac prescribed burning
Huckleberry LGRD	13C/F	1986	530 ac prescribed burning
Burn Creek	13C	1987	597 ac prescribed burning
Gravel Flat	13D/F	1995	18 ac prescribed burning
TOTAL			3,345 acres
Irrigation Ditches			
Project Name	SWS	Year	Activity
Big Creek Ditch		On-going	Irrigation ditches are regulated by special use permits and maintenance and restoration are the responsibility of the water right holder(s). Associated activities include ditch maintenance and repair and diversion maintenance and upgrades.
Trout Creek Ditch		On-going	
S. Catherine Ditch		On-going	
Jacobs Ditch		On-going	
Recreation			
Project Name	SWS	Year	Activity
Taylor Green Snowshelter		2005	Emergency snow shelter for winter.
Balm Creek Reservoir (PVT)		On-going	Developed campground on PVT land
West Eagle CG		On-going	Developed CG and trailhead
Firewood Cutting		On-going	District-wide personal use firewood
Snowmobiles Rtes		On-going	
OHV Use - Current		On-going	X miles trails, on roads, and cross-country. Recreational use is low to moderate in the analysis area. OHV use has increase in the last 5 to 10 years. Associated activities include decommissioning roads.
Designated OHV Trails (Future)		2007	
Eagle Creek Cabins (PVT)		On-going	Permanent/recreation residences along Eagle Creek on PVT ground.
Roads			
Project Name	SWS	Year	Activity
Timber Harvest Projects	All SWS	1978-Present	The roads are and increases and decreases in miles and density are directly correlated to the timber harvest activities. Associated activities and structures include decommissioning (earthen berms, obliteration, recontouring), maintenance and culvert replacements and drainage improvement.
6700 Road		2005	Road Maintenance – blading, ditch and culvert cleaning, etc

Range Allotments			
Project Name	SWS	Year	Activity
Big Creek		Active	
Gilkison		Active	
Balm Creek		Active	
Fruit Spring		Active	
Hooton Rock		Active	
Upper Clover		Active	
Balm Creek Rip Exc		2005	Fencing out 1 mile of Balm Creek RHCA

Overview of Range Allotments within project area:

Activity	Time Period	Project Name and Location (5 th Field HUC)	Description and Extent of Activity
Livestock Grazing	1880s - Present	Balm Creek (29B/E) Big Creek (13E/D/F, 29D/E/F/H) Goose Creek (29C/D/E) Hootin Rock (29E/F) Fruit Springs (13D/E, 29H) Gilkison (29F/H) Upper Clover Creek (29F)	Unregulated grazing occurred prior to the early 1900s. After 1995 the listed allotments began regulating the grazing within the analysis area through INFISH. Associated activities and structures include fencing (boundary and riparian), cattle guards, water systems, drift fences, corrals, loading chutes and designated stock driveways.

Wildlife			
Project Name	SWS	Year	Activity
Aspen Restoration			
Forshey Aspen Rehab	29C	1994	4 acres removal of overstory to enhance aspen.
Little Aspen	29C	1996	2 ac removal of overstory to enhance aspen.
Quakey			5 ac removal of overstory to enhance aspen.
Fisheries			
Project Name	SWS	Year	Activity
Conundrum Bio Mat			Instream enhancement to restore sinuosity

Mining			
Project Name	SWS	Year	Activity
40 Claims (Pawnee Gulch, etc)	29 D/E		Of the 40 claims 22 are active mines sites. None have filed a Notice of Intent (NOI), or Plan of Operation (POO) for that area. The claims are regulated under the 1873 Mining Laws. Associated activities include monitoring status of activity and maintaining the database.

Private Land Activities			
Project Name	SWS	Year	Activity
Logging	29F,29H, 13C,D,E		In general, the private lands adjacent to the National forest consist of forest and grasslands that are used for ranching and forest management. Forest management has generally been of an uneven-aged management providing a variety of seral structures and stages. It is anticipated that these management procedures would continue into the foreseeable future. Additionally it is anticipated that hazardous fuels reduction work will be occurring in the WUI area surrounding Medical Springs. Specific management plans were not available although a concerted effort was made to obtain them; however, there are no maps or readily available records.
Grazing			
Roads			
Recreation/Irrigation – Balm Creek Reservoir	29D		Balm Creek Reservoir is primarily used as an irrigation source for the Keating Valley, however, recreational use is permitted on the reservoir – primarily camping and fishing during the summer months. The reservoir gets very low in the late summer and receives very limited recreation use at that time.
Recreation Residences	29D		Several cabins are located within the project area which are primarily used during the summer and fall months for recreational purposes. In general they do not receive heavy use and the only management performed on the property responds primarily to firewise protection measures around the cabin itself.

Cumulative Effects Determination Tables

Silviculture/Vegetation Management

Project	Potential Effects	Overlap in:		Measurable Cumulative Effect?	Extent Detectable?
		Time	Space		
Past Harvest	Continued stand succession and movement toward HRV	Yes	Yes	Yes	Forested stands will continue through successional stage development. Previous harvest reduced the amount of LOS within the area. Proposed treatments will accelerate stands toward LOS and convert warm/dry MSLT stands to SSLT which will move the area toward HRV across the landscape reflecting past and present management activities.
Rx Burn	Stand health, moving toward HRV, and reduction of fir encroachment	Yes	Yes	Yes	Previous prescribed fire treatments began the reintroduction of fire into areas outside historic fire return intervals, but, were primarily focused in grassy timbered stringers. Prescribed fire in this project will continue the treatments started in earlier burns, reduce fuel loadings, improve forage, and reduce encroachment into meadows and reduce the amount of grand fir in timbered stands which would have historically been Douglas-fir and, ponderosa pine. This, in combination with previous burns, would accelerate movement towards desired stand conditions to create healthier stands more resilient to effects from wildfire.
Irrigation Ditches	None	No	No	No	
Camping/Cabins	None	No	No	No	
OHVs	None	No	No	No	
Existing Roads	None	Yes	Yes	No	
Closed Roads	None	Yes	Yes	No	
Grazing	Effect the amount and quality of available forage.	Yes	Yes	No	Grazing forage should be enhanced over the long term from prescribed burning and stand treatments (opening of crown densities).
Wildlife Enhancement	Enhancement of Aspen stands and increased biodiversity.	Yes	Yes	Yes	Project will increase acres of aspen stands which have been enhanced and will be protected in order to keep them from browsing and deciduous tree encroachment. Enhancement and protection of these areas will increase the vegetative diversity within the area.
Mining	None	Yes	Yes	No	

Old Growth

Project	Potential Effects	Overlap in:		Measurable Cumulative Effect?	Extent Detectable?
		Time	Space		
Past Harvest	Reduce canopy closure and structural complexity.	Yes	Yes	Yes	Previous harvest reduced the amount of LOS within the area. Past harvest has positive and negative effects on species into the foreseeable future. Acres of MSLT converted to SSLT reduces structural complexity, but provides for a structure that is significantly underrepresented.
Rx Burn	Reduce canopy closure and structural complexity.	Yes	Yes	Yes	Previous prescribed fire treatments began the reintroduction of fire into areas outside historic fire return intervals, but, were primarily focused in grassy timbered stringers. Prescribed fire in this project will continue the treatments started in earlier burns, reduce fuel loadings, improve forage, and reduce fir encroachment into meadows and timbered stands which would have historically been Douglas-fir, ponderosa pine, larch. Prescribed fire will reduce the amount of overstocked understory creating an ecosystem more resilient during attacks from insects and disease.
Irrigation Ditches	None	No	No	No	
Camping/Cabins	None	No	No	No	
OHVs	Disturbance of old-growth related species.	Yes	Yes	No	Regulated closure area will help reduce the potential for disturbance of species that utilize old-growth.
Existing Roads	Firewood cutting and species disturbance	Yes	Yes	No	Motorized access will be reduced under this project, reducing any potential effects to old growth areas such as fire wood cutting, camping, and harassment.
Closed Roads	Disturbance of old growth related species.	Yes	Yes	No	Regulated closure will reduce the unauthorized use of closed roads and the potential harassment of old growth dependant species.
Grazing	Grazing in old-growth stands.	Yes	Yes	No	There is the potential for stands converted to SSLT, or old growth stands that have been burned to increase livestock grazing due to increased forage.
Wildlife Enhancement	None	Yes	Yes	No	The previously accomplished wildlife enhancement work does not affect old growth. Therefore, there are no cumulative effects on old growth.
Mining	None	Yes	Yes	No	No effect to mines from this project.

Big Game

Project	Potential Effects	Overlap in:		Measurable Cumulative Effect?	Extent Detectable?
		Time	Space		
Past Harvest	Reduction of Cover	Yes	Yes	Yes	In those areas where past harvest activities have reduced satisfactory cover to marginal cover or forage and not yet returned to cover, the Bald Angel project will add incrementally to these reduced cover acres within the area – reducing security habitat, however, the area closure would help to offset this effect by securing blocks of habitat with limited or no motorized access.
Rx Burn	Reduction of cover and forage enhancement	Yes	Yes	Yes	Past, planned, and future prescribed burning reduces some habitat over the short term but in many areas will enhance long term habitat and forage as grasses, shrubs, etc regenerate/sprout. There is a potential to affect hiding cover and some overstory cover while burning as well, however, this affect will be minor over all and will leave cover patches as burning occurs in a mosaic which closer represents historical conditions. Prescribed fire is scheduled over many years to avoid over-depleting forage within the area and to rejuvenate grassy areas when they begin to get overgrown and unpalatable.
Irrigation Ditches	None	No	No	No	
Camping/Cabins	More security habitat	Yes	Yes	Yes	The area closure associated with this project will reduce the number of dispersed recreation sites available for use and concentrate camping in other areas, decreasing the potential for animal disturbance throughout the entire area by providing for security areas.
OHVs	More security habitat	Yes	Yes	Yes	Unregulated OHV use in the past has lead to the creation of unauthorized trails which contribute to the isolation and interruption of connectivity between habitat features in the project area. The area closure would reduce the potential for this isolation, impacts on vegetation, and the disturbance to species using these habitat features.

Big Game Continued

Existing Roads	Improved big game habitat, increased security habitat	Yes	Yes	Yes	The proposed road obliterations and promulgated area closure will result in improvements to big game habitat. The road obliterations and promulgations, if successful in discouraging off highway vehicle access, could improve habitat effectiveness for deer and elk through a reduction in disturbance and an increase in bull and buck escapement. Alternative 4 provides for more security habitat than alternatives 2 and 3 by retaining more cover stands and building no new roads.
Closed Roads	Improved big game habitat, increased security habitat	Yes	Yes	Yes	
Grazing	Forage competition	Yes	Yes	No	Grazing by cattle will continue in six allotments that occur at least partially in this analysis area. Grazing by cattle throughout August, September, and part of October reduces available forage for elk and deer prior to going into the rut. This can lead to elk and deer going into breeding and winter seasons with less body fat than necessary to survive or successfully reproduce. These effects will persist and will not change as a result of any of the action alternatives.
Wildlife Enhancement	Reduction of cover, increased habitat diversity	Yes	Yes	No	The potential minor short term loss of hiding and thermal cover from stand treatments is mitigated through the area closure, and the long term gains of aspen stand development.
Mining	None	Yes	Yes	No	

Fire and Fuels Management

Project	Potential Effects	Overlap in:		Measurable Cumulative Effect?	Extent Detectable?
		Time	Space		
Past Harvest	Return to historic fire intervals; Decrease in fire risk	Yes	Yes	Yes	<p>The effects of the Bald Angel alternatives contribute to the trend toward a decrease in fire risk begun by previous treatments in the area. Following mechanical treatments, the analysis area would contain high-risk stands in 65-68% of the area, as compared to the current 82% total need. Moderate risk stands would be reduced from the current 18% to 16%. Treatment is expected to reduce fire risk for approximately 20 years. Beyond 20 years the trend would begin to increase. It is estimated that 20-30% of the stands in the moderate category would move into the high-risk category. It is estimated that 10-20% of stands in the low risk category would move into the moderate category.</p> <p>The other past/present projects within the project area have very similar treatments to those in Bald Angel (commercial and non-commercial thinning, improvement cuts, and fuels reduction). Prescribe fire would occur in natural openings and in forested areas following mechanical treatment. The cumulative effects of all four projects, combined with Bald Angel, provide for several thousand acres (approximately 15,000-20,000) of fire adapted plant communities (fire regimes 1 and some of 3) to return to historic fire return intervals of 1 to 35 years. These treated acres are approximately 82% of the 24,367 acres of fire regimes 1 and 3 within the Keating / Pongosa watershed.</p> <p>Prescribed burning would produce smoke that may impact nearby sensitive areas. However, smoke emissions could be managed to stay under the 15,000 tons PM10 per year agreed to under the Memorandum of Understanding (October 27, 1994) and meet the Clean Air Act.</p>
Rx Burn	Return to historic fire intervals; Decrease in fire risk, air quality from smoke	Yes	Yes	Yes	

Fire and Fuels Management

Project	Potential Effects	Overlap in:		Measurable Cumulative Effect?	Extent Detectable?
		Time	Space		
Irrigation Ditches	None	Yes	Yes	No	
Camping/Cabins	Increased human cause fire risk	Yes	Yes	Yes	The area closure will maintain access options for fire suppression activities and may reduce the access for people in OHV's and vehicles for dispersed camping, thus reducing the potential for fire starts from vehicles, campfires, and smoking.
OHVs	Increased human cause fire risk	Yes	Yes	Yes	All action Alternatives would increase fire-fighter and public safety by reducing potential for high intensity fast moving crown fires on treated acres on high risk acres and maintaining low to moderate crown fire risk on other acres. While the analysis area is overall a low risk for loss or damage due to high intensity fire. The area closure will maintain access options for fire suppression activities and reduce the access for people in OHV's and vehicles, thus reducing the potential for fire starts from vehicles and smoking.
Existing Roads	Increased human cause fire risk; initial attack access	Yes	Yes	Yes	
Closed Roads	Increased human cause fire risk; initial attack access	Yes	Yes	Yes	
Grazing	Reduce fine fuels	Yes	Yes	Yes	Grazing livestock from seven allotments would reduce the grass component in predominantly natural openings. Overstocked forested areas are generally not heavily grazed by livestock. Due to the grazing standards on stubble height livestock grazing is not expected to reduce fire carrying capacity or increase tree reproduction. As a result, livestock grazing is not expected to impede progression toward historic fire return intervals.
Wildlife Enhancement	None	Yes	Yes	No	
Mining	None	No	No	No	

Socio-Economics

Project	Potential Effects	Overlap in:		Measurable Cumulative Effect?	Extent Detectable?
		Time	Space		
Past Harvest	Payments to County; Jobs generated and/or supported	Yes	Yes	Yes	<p>Socio-economic effects were analyzed in terms of payments to counties and jobs and income. Payments are 25 percent of the stumpage paid to the U.S. Treasury. Employment and income generated as a result of timber harvest is based upon the amount of timber harvested by product, either saw timber or non-saw timber.</p> <p>The cumulative effects of this project are very similar between alternatives, they all will provide the county with receipts which otherwise would be dollars out of the taxpayers pocket. They all will provide a similar number of jobs related to harvesting, transporting, processing, marketing and distributing a valuable product. The income generated by this project contributes to family wage earners and local industries which in turn support other local businesses, hospitals, and services contributing to the overall economic vitality of the County. The products produced from this project would not support the local mills alone, however, when added to the wood products being removed from other private and corporate lands, it contributes to the overall viability and sustainability of local mills and businesses.</p>
Rx Burn	Contracts - Jobs generated and/or supported	Yes	Yes	Yes	
Irrigation Ditches	None	Yes	Yes	No	
Camping/Cabins	Jobs generated and/or supported	Yes	Yes	Yes	
OHVs	Jobs generated and/or supported	Yes	Yes	Yes	
Existing Roads	Payments to County; Jobs generated and/or supported	Yes	Yes	Yes	
Closed Roads	Payments to County; Jobs generated and/or supported	Yes	Yes	Yes	
Grazing	Jobs generated and/or supported	Yes	Yes	Yes	
Wildlife Enhancement	Jobs generated and/or supported	Yes	Yes	Yes	
Mining	None	Yes	Yes	No	

Water Quality, Fisheries Habitat, and Populations

Project	Potential Effects	Overlap in:		Measurable Cumulative Effect?	Extent Detectable?
		Time	Space		
Past Harvest	Modified Peak Flows (ECA)	Yes	Yes	Yes	The highest potential for cumulative effects on the watershed and fisheries resources in the subwatersheds included in the Bald Angel Project is from the modifications of the ECA value from timber harvest - all of the subwatershed's ECA values would be at or below 15%, except 29H for all action alternatives.
Rx Burn	Reduced potential loss to wildfire	Yes	Yes	Yes	Present and future prescribed burning (over the next 5 years) within the analysis area would reduce impacts to water and fisheries resources by preventing large catastrophic wildfires that could result in overstory mortality and severe soil damage resulting in sedimentation of stream channels.
Irrigation Ditches	None	Yes	Yes	No	Irrigation ditches located on NFS lands capture runoff from the headwaters and diverts it to ditches that carry the runoff for use on agriculture lands in the valley bottoms. The water is spread over the valley bottom land where it is captured by infiltration, a small amount is taken up by the plants and the remainder is beneficially filtered and cooled by the soil and returned to the ditches and ultimately the streams. There is not measurable cumulative effect related to this project in conjunction with the ditches.
Camping/Cabins	Sediment Delivery	Yes	Yes	Yes	Recreation activity has remained consistent in the project area primarily centering on big and small game hunting and camping around Balm Creek Reservoir. Restrictions on location of all types of user trails and OHV use would be increased under the area closure, and impacts to riparian areas and stream channels would continue to be reduced. Continued implementation of these forest management activities are not expected to cause adverse effects on water, riparian and fish resources.
OHVs	Road surface erosion	Yes	Yes	Yes	

Water Quality, Fisheries Habitat, and Populations Continued

Project	Potential Effects	Overlap in:		Measurable Cumulative Effect?	Extent Detectable?
		Time	Space		
Existing Roads	Road surface erosion	Yes	Yes	Yes	Road densities on both private and public ground in the analysis area have decreased in the last 10 years and the Bald Angel Project would further reduce road densities through and area closure. Road densities within the analysis area have decreased, due to road closures and decommissioning in recent years. Closing roads reduces sediment yields by allowing adequate road drainage to be installed, decreasing maintenance needs and traffic, and allowing natural regeneration of many of the roadbeds to begin.
Closed Roads	Road surface erosion	Yes	Yes	Yes	
Grazing	Riparian area and stream channel impacts	Yes	Yes	Yes	Improved management (primarily fencing and grazing strategies) on domestic livestock grazing have reduced impacts to riparian areas and stream channels due to the implementation of INFISH standards and guidelines.
Wildlife Enhancement	None	Yes	Yes	No	Enhancement of 25 acres of aspen would also reduce impacts to water and fisheries by improving the functionality of the drainage through improved riparian habitat.
Mining	Sediment Delivery	Yes	Yes	No	Only minor amounts of lode mining has historically occurred within the area – well away from water and very minor in nature.

Soils

Project	Potential Effects	Overlap in:		Measurable Cumulative Effect?	Extent Detectable?
		Time	Space		
Past Harvest	Increase detrimental soil conditions (DSC), reduce organic material	Yes	Yes	Yes	<p>Analysis of the cumulative effects of detrimental soil conditions indicates that soil quality is being maintained on about 96% of the project area, in comparison to the Forest Plan guideline of maintaining at least a minimum of 80% of the project area in a non-detrimental soil condition.</p> <p>On that 4% of the project area considered in a detrimental condition, ground cover, fine organic matter, and coarse woody material is below potential. The remaining 96% has adequate levels and since the project area has been protected from wildfire and rangelands appear to be properly grazed, there are satisfactory accumulations of ground cover, fine organic matter, and coarse woody materials on forestland and rangelands.</p> <p>Implementation of harvest treatments for Alternative 2, 3 and 4 would increase DSCs in the project area about 1.90%, 1.74% and 1.58% respectively. The effect of harvest combined with past and foreseeable future activities and the currently proposed prescribed fire treatments and new and temporary roads would result in a maximum increase in DSCs of approximately 4% for a total of 8%, which is well below the Forest Plan guidelines of 20%. There is less than one mile (2.24 acres) of road proposed for obliteration for all alternatives, which would not result in a measurable decrease in DSCs.</p>
Rx Burn	Increase detrimental soil conditions (DSC), reduce organic material	Yes	Yes	Yes	
Irrigation Ditches	None	Yes	Yes	No	
Camping/Cabins	Increase detrimental soil conditions (DSC)	Yes	Yes	Yes	
OHVs	Increase detrimental soil conditions (DSC)	Yes	Yes	Yes	
Existing Roads	Increase detrimental soil conditions (DSC)	Yes	Yes	Yes	
Closed Roads	Increase detrimental soil conditions (DSC)	Yes	Yes	Yes	
Grazing	Increase detrimental soil conditions (DSC)	Yes	Yes	No	
Wildlife Enhancement	None	Yes	Yes	No	
Mining	Increase detrimental soil conditions (DSC)	Yes	Yes	Yes	

PETS – Wildlife

Project	Potential Effects	Overlap in:		Measurable Cumulative Effect?	Extent Detectable?
		Time	Space		
Past Harvest	None	Lynx - No Eagle – Yes Sens Sp - Yes	Lynx – No Eagle – Yes Sens Sp - Yes	No No No	This project is not within a lynx analysis unit and will therefore have no effect on lynx or lynx habitat. This project will have no effect on bald eagles or their habitat. Impacts to sensitive species will be non-existent or minor in scale and duration, and will not lead to federal listing of these species.
Rx Burn	None	Lynx - No Eagle – Yes Sens Sp - Yes	Lynx – No Eagle – Yes Sens Sp - Yes	No No No	
Irrigation Ditches	None	Lynx - No Eagle – Yes Sens Sp - Yes	Lynx – No Eagle – Yes Sens Sp - Yes	No No No	
Camping/Cabins	None	Lynx - No Eagle – Yes Sens Sp - Yes	Lynx – No Eagle – Yes Sens Sp - Yes	No No No	
OHVs	None	Lynx - No Eagle – Yes Sens Sp - Yes	Lynx – No Eagle – Yes Sens Sp - Yes	No No No	
Existing Roads	None	Lynx - No Eagle – Yes Sens Sp - Yes	Lynx – No Eagle – Yes Sens Sp - Yes	No No No	
Closed Roads	None	Lynx - No Eagle – Yes Sens Sp - Yes	Lynx – No Eagle – Yes Sens Sp - Yes	No No No	
Grazing	None	Lynx - No Eagle – Yes Sens Sp - Yes	Lynx – No Eagle – Yes Sens Sp - Yes	No No No	
Wildlife Enhancement	None	Lynx - No Eagle – Yes Sens Sp - Yes	Lynx – No Eagle – Yes Sens Sp - Yes	No No No	
Mining	None	Lynx - No Eagle – Yes Sens Sp - Yes	Lynx – No Eagle – Yes Sens Sp - Yes	No No No	

PETS – Plants

Project	Potential Effects	Overlap in:		Measurable Cumulative Effect?	Extent Detectable?
		Time	Space		
Past Harvest	Reduction in habitat and plant occurrence	Yes	Yes	Yes	<p>Past management activities such as harvest, burning, ditches, road construction, mining and other recreation uses have led to a decrease in plant occurrence and created physical changes in plant characteristics that persist for decades. In areas which have not recovered the residual effect is degradation in habitat and loss of occupied habitat. These activities in combination with the actions proposed in Bald Angel would increase the potential for this loss of habitat and impacts to individual plants. The degree of the impacts due to project modifications will be minimal in most cases and will not likely contribute to a trend toward federal listing or cause a loss of viability to the populations or species.</p> <p>These activities also contribute to the potential introduction and spread of noxious weeds. Current populations are possibly affecting Carex sites and also leading to degradation of potentially suitable habitat. This condition is likely to occur with or without implementation of the Bald Angel project.</p> <p>While current grazing management regimes are less impacting than historic actions, disturbance to habitat and impacts to sensitive plants ranges from low to high. When impacts occur at the same location as fire and harvest activities, individual plants and their habitat are affected.</p> <p>Minor short term immeasurable impacts to habitat from wildlife enhancement work – will not cumulatively add to measurable impacts.</p> <p>See past harvest above.</p>
Rx Burn	Reduction in habitat and plant occurrence	Yes	Yes	Yes	
Irrigation Ditches	Reduction in habitat and plant occurrence	Yes	Yes	Yes	
Camping/Cabins	Spread of Noxious weeds	Yes	Yes	Yes	
OHVs	Spread of Noxious weeds	Yes	Yes	Yes	
Existing Roads	Reduction in habitat and plant occurrence, Spread of Noxious weeds	Yes	Yes	Yes	
Closed Roads	Reduction in habitat and plant occurrence	Yes	Yes	Yes	
Grazing	Reduction in habitat and plant occurrence	Yes	Yes	Yes	
Wildlife Enhancement	Reduction in habitat and plant occurrence	Yes	Yes	No	
Mining	Reduction in habitat and plant occurrence	Yes	Yes	Yes	

Access and Travel Management

Project	Potential Effects	Overlap in:		Measurable Cumulative Effect?	Extent Detectable?
		Time	Space		
Past Harvest	None	Yes	Yes	No	
Rx Burn	None	Yes	Yes	No	
Irrigation Ditches	None	No	No	No	
Camping/Cabins	Reduction of available dispersed camp sites; closure violations	Yes	Yes	Yes	The area closure associated with this project will reduce the number of dispersed recreation sites available for use and concentrate camping in other areas, diminishing the opportunity for solitude and increase the potential for resource impacts. It will also increase the potential for violations of the closure to access traditional camping areas and create potential enforcement difficulties due to the size of the project area.
OHVs	Closure violations; enforcement issues	Yes	Yes	Yes	There will be an increased potential for violations of the area closure by OHVs to access areas of traditional use, explore less traveled areas, game retrieval, and will contribute to enforcement difficulties due to the size of the project area.
Existing Roads	Closure violations; enforcement issues	Yes	Yes	Yes	There will be an increased potential for violations of the area closure by vehicles to access areas of traditional use, explore less traveled areas, game retrieval, and will contribute to enforcement difficulties due to the size of the project area.
Closed Roads	Closure violations; enforcement issues	Yes	Yes	Yes	There will be an increased potential for violations of the closed roads within the area closure by vehicles to access areas of traditional use, explore less traveled areas, game retrieval, and will contribute to enforcement difficulties due to the size of the project area.
Grazing	None	Yes	Yes	No	
Wildlife Enhancement	None	Yes	Yes	No	
Mining	Closure of mining access routes	Yes	Yes	No	Historic mining operations have created short access routes into mining operations. The area closure in this project may restrict some of these access routes and minimize access to future claims, however; mitigating that would be accomplished as plans of operation are analyzed on a site specific individual basis.

Management Indicator Species – Terrestrial
Goshawk (see also LOS)

Project	Potential Effects	Overlap in:		Measurable Cumulative Effect?	Extent Detectable?
		Time	Space		
Past Harvest	Reduce quality of nest habitat; Disturb known nest sites; increase foraging habitat.	Yes	Yes	No	Some goshawk habitat will be incrementally reduced in quality by this project in addition to that which was historically treated and has not recovered to suitable habitat yet, but there would be no effect to known nest sites from this project due to project design and deferred treatment areas around nest sites. Past intermediate and regeneration treatments in combination with the treatments in this project create an interspersed of structural states that could enhance foraging habitat.
Rx Burn	Foraging habitat enhancement	Yes	Yes	Yes	Previous prescribed burns have improved foraging habitat and the burning proposed in this project will also contribute to foraging habitat, however, there will be short term (1-3 years) reductions until the grasses and shrubs respond. Known nest sites are being protected in all phases of project design/implementation.
Irrigation Ditches	None	No	No	No	
Camping/Cabins	None	No	No	No	
OHVs	Potential for nest site disturbance	Yes	Yes	Yes	Unregulated OHV use in the past has led to the creation of unapproved trails which contribute to the potential for nest site disturbance. The area closure in this area would reduce the potential for this disturbance. Known nest sites are being protected in project design and the area closure will add increased protection and minimize the potential for disturbance during the nesting period.
Existing Roads	Disturb nest sites	Yes	Yes	No	Existing known nest sites are being protected in all alternatives.
Closed Roads	Disturb nest sites	Yes	Yes	No	Existing known nest sites are being protected in all alternatives.
Grazing	None	Yes	Yes	No	
Wildlife Enhancement	None	Yes	Yes	No	
Mining	None	No	No	No	

Management Indicator Species – Terrestrial
Primary Cavity Excavators

Project	Potential Effects	Overlap in:		Measurable Cumulative Effect?	Extent Detectable?
		Time	Space		
Past Harvest	Loss of snag habitat	Yes	Yes	Yes	Past harvest activities have led to a deficiency in large diameter snags and logs over much of the analysis area, however, total snag numbers ≥ 12 " dbh (which will be retained in this project) appear to exist at adequate levels to support snag dependant species between the 30-50% tolerance levels, with higher levels in MA15, riparian areas, and LOS stands. Harvest treatments in this project will indirectly perpetuate this condition by spacing trees so that natural snag recruitment through density related mortality factors will be reduced. However, larger trees will develop so that the trees recruited for snags over the long term will be larger.
Rx Burn	Snags consumed by fire	Yes	Yes	Yes	Some snags and logs are expected to be consumed during burning but it is not possible to predict how many or where. New snags and logs created during burn operations will partially offset those consumed by fire. Snag losses by fire are assumed to be very low since burning prescriptions are aimed at retention of large diameter woody materials.
Irrigation Ditches	None	No	No	No	
Camping/Cabins	None	No	No	No	
OHVs	None	No	No	No	
Existing Roads	Loss of snags to firewood cutting	Yes	Yes	Yes	Open roads provide access to firewood cutters into the areas. Loss of snags to firewood gatherers would contribute in localized areas of snag loss in combination with the loss from harvest operations. However, this would be at very low levels across the project area and because snags ≥ 12 " are being retained in all treatment areas, total snag loss is expected to be minimal.

Primary Cavity Excavators Continued

Project	Potential Effects	Overlap in:		Measurable Cumulative Effect?	Extent Detectable?
		Time	Space		
Closed Roads	Loss of snags to firewood cutting	Yes	Yes	Yes	Successful road closures provide some measure of protection from firewood cutting. Roads being re-opened for use in this project will again provide access to firewood cutters into areas which were previously inaccessible. Loss of snags to firewood gatherers would contribute in localized areas to the cumulative loss of snags from harvest operations. However, this would be at very low levels across the project area because snags $\geq 12''$ are being retained in all treatment areas, total snag loss is expected to be minimal.
Grazing	None	Yes	Yes	No	
Wildlife Enhancement	None	Yes	Yes	No	
Mining	None	No	No	No	

Neotropical Migratory Birds (NTMB)

Project	Potential Effects	Overlap in:		Measurable Cumulative Effect?	Extent Detectable?
		Time	Space		
Past Harvest	Habitat conversion or modification: <ul style="list-style-type: none"> Open stands Setback of shrubs 	Yes	Yes	Yes	This project in combination with the past harvest activities will further change the arrangement and patch sizes that determine habitat selection by NTMB. However, a mosaic of forest and rangeland conditions will exist after this project that will support nesting populations of NTMB and will not result in habitat changes that would be meaningful at local and regional population scales.
Rx Burn	Habitat conversion or modification: <ul style="list-style-type: none"> Loss of snags Open stands Setback of shrubs 	Yes	Yes	Yes	Past, planned, and future prescribed burning reduces habitat over the short term for NTMB but in many areas will enhance long term habitat as shrubs, etc regenerate/sprout. There is a potential to affect snags while burning as well, however, this affect will be minor in contrast to past harvest and firewood cutting.
Irrigation Ditches		Yes	Yes	Yes	In combination with the past and proposed vegetation management and road building in the area, irrigation ditches have diverted water from small streams and converted the previously diverse habitat to that of the surrounding area. However, a mosaic of forest and rangeland conditions will exist after this project that will support nesting populations of NTMB and will not result in habitat changes that would be meaningful at local and regional population scales.
Camping/Cabins		No	No	No	
OHVs		No	No	No	
Existing Roads	Habitat conversion or modification	Yes	Yes	Yes	Existing roads have replaced habitat with non-habitat and influence adjacent habitat by changing the microenvironment and by introducing disturbances from people. This project in combination with existing roads will further change the patch size and arrangement that determine habitat selection by NTMB. A mosaic of forest and rangeland conditions will exist after this project that will support nesting populations of NTMB and will not result in habitat changes that would be meaningful at local and regional population scales.

Neotropical Migratory Birds (NTMB) Continued

Project	Potential Effects	Overlap in:		Measurable Cumulative Effect?	Extent Detectable?
		Time	Space		
Closed Roads	Habitat conversion or modification	Yes	Yes	Yes	Closed roads have modified habitat for NTMB but, in many cases successful road closures are allowing roadbeds to return to resource/habitat production. Roads being re-opened for use in this project will contribute cumulatively in a very minor way to the continued retarding of shrub growth and create a minor reduction of available habitat (because these areas are not yet currently fully recovered).
Grazing	None	Yes	Yes	No	
Wildlife Enhancement	Increased vegetative diversity				The enhancement work planned for in this project, in combination with the aspen work done in the past will add to the habitat protected from browse and enhance the development of aspen and shrub species.
Mining	None	No	No	No	

Unique and Sensitive Habitats

Project	Potential Effects	Overlap in:		Measurable Cumulative Effect?	Extent Detectable?
		Time	Space		
Past Harvest	Isolate and interrupt connectivity	Yes	Yes	Yes	Past harvest and firewood cutting has isolated some unique features and contributed to the severing of connectivity between major rock features and other unique habitat features. Harvest in this project would protect the immediate context of these features; however, the harvest in the Bald Angel project would create a minor incremental negative effect contributing to the further isolation of these areas at the landscape scale.
Rx Burn	None	Yes	Yes	No	
Irrigation Ditches	None	No	No	No	
Camping/Cabins	None	No	No	No	
OHVs	Interrupt connectivity, vegetation impacts, and disturbance	Yes	Yes	Yes	Unregulated OHV use in the past has lead to the creation of unapproved trails which contribute to the isolation and interruption of connectivity between unit habitat features in the project area. The area closure in this area would reduce the potential for this isolation, impacts on vegetation, and the disturbance of species using these habitat features.
Existing Roads	Isolate and interrupt connectivity, and disturbance	Yes	Yes	Yes	Past road building to facilitate timber harvest, recreation and administrative access has isolated some unique features and contributed to the severing of connectivity between major rock features and other unique habitat features. The area closure in this area would reduce the potential for this isolation and the disturbance of species using these habitat features.
Closed Roads	Isolate and interrupt connectivity, and disturbance	Yes	Yes	Yes	Re-opening closed roads has the short term potential to create a minor incremental negative effect contributing to the isolation between major rock features and other unique habitat features. These roads will all be closed following the completion of harvest activities and the area closure would reduce the potential for this isolation and the disturbance of species using these habitat features.

Unique and Sensitive Habitats Continued

Project	Potential Effects	Overlap in:		Measurable Cumulative Effect?	Extent Detectable?
		Time	Space		
Grazing	None	No	No	No	
Wildlife Enhancement	None	No	No	No	
Mining	None	No	No	No	

Rangeland Resources/Grazing

Project	Potential Effects	Overlap in:		Measurable Cumulative Effect?	Extent Detectable?
		Time	Space		
Past Harvest	Increase in forage quality/quantity, increased livestock access/trespass	Yes	Yes	No	Forage quality and quantity would be increased short and long term by opening stands and through prescribed burning. Opening areas not previously accessible to livestock may provide opportunities for livestock to access previously treated stands and trespass into restricted/recreation areas. However, it would be immediately mitigated by permittee.
Rx Burn	Increase in forage quality/quantity, increased livestock access	Yes	Yes	No	Forage quality and quantity would be increased short and long term by opening stands and through prescribed burning areas previously treated by RX burning. Opening areas not previously accessible to livestock may provide opportunities for livestock to trespass into restricted/recreation areas. However, it would be immediately mitigated.
Irrigation Ditches	None	No	No	No	
Camping/Cabins	None	No	No	No	
OHVs	Livestock Harassment	Yes	yes	Yes	The area closure will limit OHV access within the project area and minimize conflicts between grazing/allotment management and OHV use in terms of safety and harassment of livestock.
Existing Roads	Increased livestock access/trespass	Yes	Yes	No	Opening closed roads and treatment areas not previously accessible to livestock may provide opportunities for livestock to trespass into restricted/recreation areas. However, it would be immediately mitigated.
Closed Roads	Increased livestock access/trespass	Yes	Yes	No	Opening closed roads and treatment areas not previously accessible to livestock may provide opportunities for livestock to trespass into restricted/recreation areas. However, it would be immediately mitigated.

Rangeland/Grazing Continued

Project	Potential Effects	Overlap in:		Measurable Cumulative Effect?	Extent Detectable?
		Time	Space		
Grazing	More forage available	Yes	Yes	Yes	Forage quality and quantity would be increased short and long term by opening stands and through prescribed burning. Opening areas not previously accessible to livestock may provide opportunities for livestock to access previously treated stands and better utilize forage throughout the allotment.
Wildlife Enhancement	None	Yes	Yes	No	Wildlife enhancement areas are fenced to restrict access. Activities proposed in this project in combination with the wildlife enhancement areas will have no measurable effect on Rangeland resources and grazing other than to remove small areas from the grazing land base.
Mining	None	No	No	No	This project will not affect the mines or mining activities within the area and will have no effect on Range.

Noxious Weeds

Project	Potential Effects	Overlap in:		Measurable Cumulative Effect?	Extent Detectable?
		Time	Space		
Past Harvest	Noxious Weed Introduction/ existing populations	Yes	Yes	No	There is a potential for the transportation and spread of active noxious weed populations, however, implementation of the action alternatives is not expected to contribute to weed spread over and beyond what would be expected with typical traffic because weed control efforts are on-going, effects are limited to the treatment sites, and management requirements for prevention would be incorporated in project design.
Rx Burn	Seed bed preparation	Yes	Yes	No	Burning in areas where there are active noxious weed populations has the potential to prepare seedbeds for spread of the existing populations. Treatment of the existing populations should keep this to a minimum and avoid known sites.
Irrigation Ditches	Vector for spread of existing populations	No	No	No	Harvest and burning will occur within ¼+ mile of some ditches but will avoid activities close to or through them.
Camping/Cabins	Noxious Weed Introduction/ existing population spread	Yes	Only dispersed camping	No	There is a remote potential for noxious weed introduction into these areas by equipment which could then be spread by campers. However, this is not highly likely because only a very few dispersed sites would be affected and project mgmt requirements would minimize this potential (washed equipment, etc).
OHVs	Noxious Weed Introduction/ existing populations	Yes	Yes	Yes	Regulated closure area will help reduce the potential for spread of noxious weeds by unregulated OHV use.
Existing Roads	Vector for spread of existing populations	Yes	Yes	Yes	There is a potential for the transportation and spread of active noxious weed populations, however, implementation of the action alternatives is not expected to contribute to weed spread over and beyond what would be expected with typical traffic because weed control efforts are on-going, effects are limited to the treatment sites, and management

					requirements for prevention would be incorporated in project design.
Closed Roads	None	Yes	Yes	No	Opening previously closed roads for use as temporary roads has the potential for the transportation and spread of noxious weeds, however, implementation of the action alternatives is not expected to contribute to weed spread over and beyond what would be expected with typical traffic because weed control efforts are on-going, effects are limited to the treatment sites, and management requirements for prevention would be incorporated in project design.
Grazing	Vector for spread of existing populations	Yes	Yes	No	Project will create more openings and disturbed soil which could create seedbeds for the remote possibility that noxious weeds could be carried into these areas by livestock and germinate until ground cover and undergrowth comes back.
Wildlife Enhancement	Noxious Weed Introduction	Yes	Yes	No	
Mining	Noxious Weed Introduction/ existing populations	No	No	No	This project will not affect the mines or mining activities within the area.

Recreation

Project	Potential Effects	Overlap in:		Measurable Cumulative Effect?	Extent Detectable?
		Time	Space		
Past Harvest	None	Yes	Yes	No	
Rx Burn	Impact to availability of some areas for hunting during burning operations. Increased available forage.	Yes	Yes	No	Minor potential to impact hunting opportunities during fall burning but would be very short (<1week) during which activities would occur within an area. Would improve long term available forage, huckleberries, and mushroom gathering.
Irrigation Ditches	None	No	No	No	Harvest and burning will occur within ¼ mile of some ditches but will avoid activities close to them or through them. Will have no effect on ditches and because there is no recreation associated with these ditches – there will be no cumulative effect on recreation.
Camping/Cabins	Smoke	Yes	Yes	Yes	Short term minor potential to affect recreational users using the area to camp in campgrounds or cabins. Could be very short (<1week) period of time when smoke is present in the area from prescribed burning.
OHVs	Available Access/Use Change	Yes	Yes	Yes	OHV use trends have been rising significantly over the last 10-15 years. The area closure within this project will sharply curtail that access and push OHV use into other areas increasing the potential for environmental damage and disturbing non-motorized users. When harvest/burn areas are adjacent to permitted use routes there will be more opportunities to violate the closure order and create enforcement issues.
Existing Roads	Access to Dispersed Rec sites, Safety	Yes	Yes	Yes	4 wheeling driving opportunities will be reduced under this project, access and safety however, on the road will be improved on those roads maintained as open due to maintenance provided by this project and into the future due by being able to focus available funds on priority roads.

Recreation Continued

Project	Potential Effects	Overlap in:		Measurable Cumulative Effect?	Extent Detectable?
		Time	Space		
Closed Roads	Access to Dispersed Rec sites, Non-motorized recreation	Yes	Yes	Yes	The area closure associated with this project will reduce the number of dispersed recreation sites available for use and concentrate camping in other areas, diminishing the opportunity for solitude and increase the potential for resource impacts. The area closure will also increase the opportunities for non-motorized recreation within the area and immediately adjacent to the Wilderness.
Grazing	Cow pies in campgrounds	Yes	Yes	No	Some people do not appreciate cattle and cow pies in campgrounds or on National Forest System lands. This project will have little to no effect on the cattle use of the area, however, a fence built on Glendenning Creek (8/2006) will stop cattle access into the Main Eagle Creek Recreation area.
Wildlife Enhancement	None	No	No	No	
Mining	None	Yes	Yes	No	This project will not affect the mines or mining activities within the area.

Visuals

Project	Potential Effects	Overlap in:		Measurable Cumulative Effect?	Extent Detectable?
		Time	Space		
Past Harvest	R and PR Foreground disturbances	Yes	Yes	No	Minor short term impacts in terms of stumps, but treatments are intermediate harvest and will not create openings.
Rx Burn	Burned ground and trees	Yes	Yes	Yes	Short-term (<1 year) visual impacts before spring greenup the following year. Nearly all visual impacts gone within 3 years.
Irrigation Ditches	None	Yes	No	No	
Camping/Cabins	Smoke	Yes	Yes	No	Short-term (1 week) one time impact from smoke in area.
OHVs	Burned ground and trees	Yes	Yes	No	Short-term (<1 year) visual impacts before spring greenup the following year. Nearly all visual impacts gone within 3 years.
Existing Roads	None	No	No	No	
Closed Roads	None	No	No	No	
Grazing	Cow pies in campgrounds and cows	Yes	Yes	No	Some people do not appreciate cattle and cow pies in campgrounds or on National Forest System lands. This project will have little to no effect on the cattle use of the area, and a fence built on Glendenning Creek (8/2006) will stop cattle access into the Main Eagle Creek Recreation area.
Wildlife Enhancement	See more wildlife	Yes	Yes	No	These are very small projects but their intent (and in combination with the activities in this project) could increase wildlife viewing opportunities.
Mining	None	No	No	No	No change with this project



Fire, fuels and restoration of ponderosa pine–Douglas fir forests in the Rocky Mountains, USA

William L. Baker^{1*}, Thomas T. Veblen² and Rosemary L. Sherriff^{2†}

¹Department of Geography, University of Wyoming, Laramie, WY 82071, USA and

²Department of Geography, University of Colorado, Boulder, CO 80309-0260, USA

ABSTRACT

Aim Forest restoration in ponderosa pine and mixed ponderosa pine–Douglas fir forests in the US Rocky Mountains has been highly influenced by a historical model of frequent, low-severity surface fires developed for the ponderosa pine forests of the Southwestern USA. A restoration model, based on this low-severity fire model, focuses on thinning and prescribed burning to restore historical forest structure. However, in the US Rocky Mountains, research on fire history and forest structure, and early historical reports, suggest the low-severity model may only apply in limited geographical areas. The aim of this article is to elaborate a new variable-severity fire model and evaluate the applicability of this model, along with the low-severity model, for the ponderosa pine–Douglas fir forests of the Rocky Mountains.

Location Rocky Mountains, USA.

Methods The geographical applicability of the two fire models is evaluated using historical records, fire histories and forest age-structure analyses.

Results Historical sources and tree-ring reconstructions document that, near or before AD 1900, the low-severity model may apply in dry, low-elevation settings, but that fires naturally varied in severity in most of these forests. Low-severity fires were common, but high-severity fires also burned thousands of hectares. Tree regeneration increased after these high-severity fires, and often attained densities much greater than those reconstructed for Southwestern ponderosa pine forests.

Main conclusions Exclusion of fire has not clearly and uniformly increased fuels or shifted the fire type from low- to high-severity fires. However, logging and livestock grazing have increased tree densities and risk of high-severity fires in some areas. Restoration is likely to be most effective which seeks to (1) restore variability of fire, (2) reverse changes brought about by livestock grazing and logging, and (3) modify these land uses so that degradation is not repeated.

Keywords

Douglas fir, ecosystem restoration, fire ecology, historical accounts, *Pinus ponderosa*, ponderosa pine, *Pseudotsuga menziesii*, Rocky Mountains.

*Correspondence: William Baker, Department of Geography, Department 3371, 1000 East University Avenue, University of Wyoming, Laramie, WY 82071, USA.

E-mail: bakerwl@uwyo.edu

†Present address: Department of Geography and Environmental Studies, 200 W. Kawili St., University of Hawaii at Hilo, Hilo, HI 96720, USA.

INTRODUCTION

In the Southwestern United States of America, the structure and composition of ponderosa pine (*Pinus ponderosa* P. and C. Lawson) forests are thought to have been altered by fire exclusion, leading to increases in tree density and a host of associated ecological changes (Covington & Moore, 1994). A formalized restoration model (Friederici, 2003) suggests that

restoration of pre-fire exclusion forest conditions and a low-severity fire regime is also consistent with a reduction in the risk of crown fires in ponderosa pine ecosystems. Thus, this low-severity model has contributed to the widespread assumption that ecological restoration and fire hazard mitigation can be simultaneously achieved in most low-elevation, dry forest ecosystems of the western United States (e.g. Covington, 2000), which is a major driving force behind

US national fire policy (United States Department of Agriculture, 2002; White House, 2002). Ecologists have devised detailed proposals for restoring Southwestern ponderosa pine forests and reintroducing fire (Allen *et al.*, 2002; Friederici, 2003). Do these proposals, however, apply to related forests of the Rocky Mountains? Ecologists have cautioned that evidence about the applicability of the low-severity model should be examined before restoration (Gutsell *et al.*, 2001; Veblen, 2003; Brown *et al.*, 2004; Odion *et al.*, 2004; Schoennagel *et al.*, 2004).

In this article, we draw upon some previously unused historical sources and other evidence to assess the applicability of the low-severity model, and an alternative variable-severity model, throughout the ponderosa pine–Douglas fir (*Pseudotsuga menziesii* (Mirbel) Franco) forests of the US Rocky Mountains. The primary focus of this paper is on forests dominated by ponderosa pine, either solely or in mixtures with Douglas fir within the Rocky Mountains (Fig. 1). However, because succession can result in the replacement of ponderosa pine by Douglas fir, we also include some information from forests where ponderosa pine occurs, but Douglas fir is dominant. In this gradient from ponderosa pine-dominated to Douglas fir-dominated forests, other conifers (e.g. *Larix* and *Abies*) or aspen (*Populus tremuloides* (Michx.)) may also be found but are not dominants. The questions addressed about Rocky Mountain ponderosa pine–Douglas fir forests, in

assessing these models, include: (1) was the pre-20th century fire regime (i.e. prior to fire exclusion) dominated by low-severity surface fire or by variable-severity fire (i.e. with a significant role played by severe fires); (2) was tree density generally low and comparable to density expected under the low-severity model, or variable as under the variable-severity model; (3) under the variable-severity model, how did fires of different severity affect spatial and temporal variation in tree density; (4) under the variable-severity model, how did variable fire affect fuels; and (5) under the variable-severity model, what have been the effects of fire exclusion, logging and livestock grazing on tree density and fuels?

The low-severity and variable-severity restoration models

Many forest restoration proposals are based on models (or restoration frameworks) derived from an assessment of historical variability. The idea in using historical variability as a model is not to exactly re-create the past, but to restore enough forest structure, and the processes that maintain it, to put the forest back on a track congruent with its history (Landres *et al.*, 1999). These models are derived using historical ecology – analysis of accounts and photographs by early explorers and settlers, as well as tree-ring based reconstructions of tree density and fire history before EuroAmerican settlement (White & Walker, 1997; Egan & Howell, 2001).

The central image in the low-severity model (Table 1) is a pre-20th century forest with widely spaced, mature trees (often old growth) over a grassy or herbaceous forest floor (Fig. 2a). Low-severity fires are thought to have burned frequently through these fine surface fuels, leaving most larger trees alive, but killing small trees and maintaining low tree density, while preventing fuel buildup. Excluding fires, under this model, leads to increased survival of small trees and a buildup of fuels, which may then cause uncharacteristic high-severity fires. This summary of the low-severity model is necessarily simplified, emphasizing the central features. Variation from this central concept has been elaborated and detailed in a recent collection (Friederici, 2003).

Recent research has concluded that the low-severity model is inappropriate for most ponderosa pine forests in the Colorado Front Range (Veblen *et al.*, 2000; Huckaby *et al.*, 2001; Ehle & Baker, 2003; Sherriff, 2004). Based on the ideas and evidence in this research, we make an initial formulation of a variable-severity model as a coherent alternative to the low-severity model. The new model (Table 1) is based around a variable-severity fire model, often also called mixed severity (Agee, 1993). In this model, natural fires vary in severity and frequency, sometimes burning at low severity in surface fuels and sometimes burning as high-severity fires in the crowns of trees, or with a mixture of surface and crown fire. In the variable-severity model, most of the landscape historically experienced or is capable of supporting high-severity fire and most stands (i.e. 1–100 ha areas of forest) have evidence of mixed- or high-severity fire over the last few centuries. Patches



Figure 1 Location of forest reserves and the reports used in this study. The boundary of the Rocky Mountains is shaded as a backdrop.

Table 1 Comparison of two models of fire and forest structure in ponderosa pine and ponderosa pine–Douglas fir forests

Low-severity model	Variable-severity model
Old-growth trees dominant	Old-growth patches common, but patches of other ages occur
Low-severity surface fires only	Variable fire severity: low-severity surface fires, mixed severity, and high severity
Trees widely spaced, tree density low	Trees varying from dense to widely spaced
Low-severity fires kill few canopy trees	Moderate and high-severity fires kill canopy trees in groups or over large areas
Tree regeneration commonly linked to climate	Tree regeneration enhanced after fires and sometimes linked to climate
Frequent surface fires	Surface fires
1. kill most small trees	1. kill some small trees, leaving some patches
2. prevent fuel buildup	2. have varied effects on fuels
	3. enhance tree regeneration
Fire exclusion leads to	Fire exclusion leads to
1. high tree regeneration	1. low tree regeneration
2. fuel buildup	2. varied fuel effects
3. uncharacteristic high-severity fires	3. decrease in natural high-severity fires

of high-severity fire probably exceeded 100 ha but continuous mapping of past fire severity has not been conducted at broader spatial scales. The central landscape image from this model is of patches of forest varying in tree age and density, including some young, dense patches (Fig. 2b) and some older, lower-density patches (Fig. 2a). Variability in tree age and density comes in part from variation in environment (dry, south-facing slopes vs. moister, north-facing slopes) but also from variation in fire severity within each environment. As fires vary in severity, the number of surviving trees and density of post-fire regeneration also vary, as do snags and dead wood. Not all regenerating young trees are killed by fires. Tree regeneration is also favoured after fires, especially high-severity fires. Thus, the exclusion of fire may have different effects than under the low-severity model, leading in some cases to decreased tree regeneration and other processes that produce fuels thought to lead to subsequent high-severity fire. These two models can and should be revised or replaced with other models as new knowledge of local conditions accumulates, but at the present time these two models are the only models with a substantive body of evidence.

SOURCES OF EVIDENCE

Evidence about the relevance of these two models in the Rocky Mountains is in part from early reports on forest reserves, which later became National Forests, but also from the available scientific literature. The forest reserve reports were conducted by government scientists in the late 1800s. If these scientists had an agenda that affected their observations,

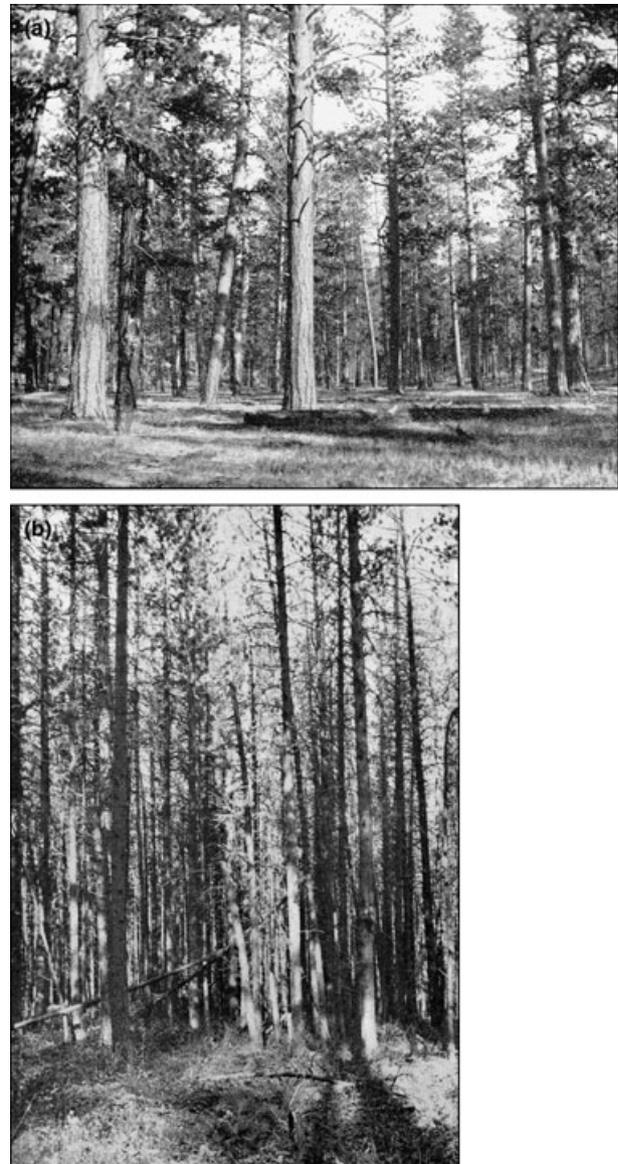


Figure 2 (a) Old-growth ponderosa pine forest is the restoration target under the Southwestern model. This is an example of an open, park-like, old-growth stand in the Bitterroot forest reserve in the late 1800s (reproduced from Leiberg, 1899a, plate LXX). Patches of these old, low-density trees and (b) young, high-density trees in the late 1800s (reproduced from Graves, 1899, plate XXXIV) are included in the restoration target under the Rocky Mountain model.

it was that they were instructed to document the extent of human-set fires and unregulated logging and grazing thought to be affecting resources in the reserves (Pinchot, 1898). However, these were not early explorers in the usual sense, as they were trained scientists who made systematic observations and estimates of area burned and the severity of fires, tree density, tree regeneration, and effects of logging and livestock grazing. We focused on evidence from unlogged portions of the reserves. We extracted all quotes and data relevant to the questions posed in the introduction and

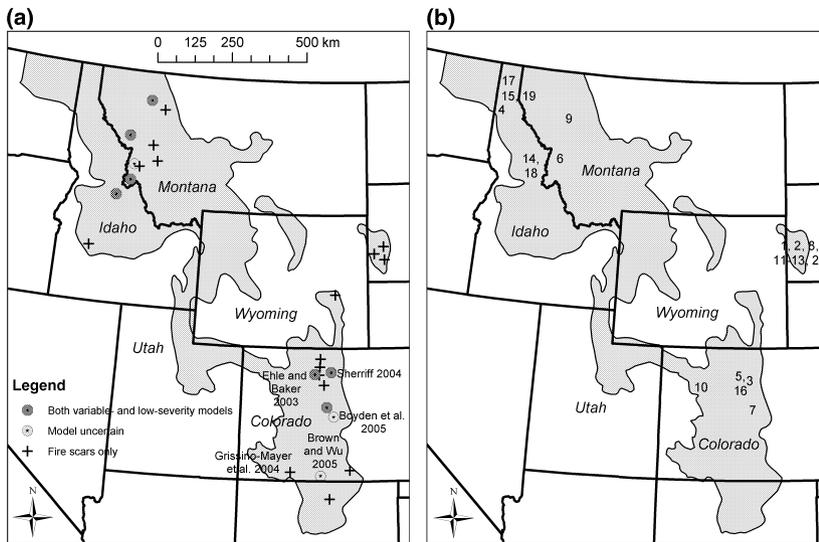


Figure 3 Data sources include (a) tree-ring studies of fire history and (b) direct measurements and tree-ring reconstructions of tree density near AD 1900. In (a) fire-history studies that lack age structure and include only fire scar data are not used, as they do not provide evidence about fire severity; citations for those studies not identified on the map are in Baker & Ehle (2003). Eight of the 10 studies that do include both age structure and fire scars document stands in each sample area in which both the variable- and the low-severity models apply, but two other studies are here considered uncertain (see text); in (b) see Table 2 for the data corresponding to each number.

placed this evidence in tables (see Tables S1–S4 in Supplementary Material) or have reviewed it in the text.

Researchers have generally considered AD 1900 to be sufficiently early in the Rocky Mountain region to provide suitable reference conditions from which to gauge natural fire regimes and forest structure (Arno *et al.*, 1995a,b, 1997; Kaufmann *et al.*, 2001), although climatic conditions and fire regimes may have changed during the 20th century. Forest reserve reports have been used for this purpose in the past (e.g. Shinneman & Baker, 1997). These reports provide direct estimates of the density of small trees near or before AD 1900 in some areas. Precise determination of the proportion of the landscape with a particular tree density usually is not feasible. Nevertheless, the tree density estimates in the 16 forest reserve reports and related documents from the Rocky Mountains used here (Fig. 1) are adequate for evaluating some of the questions posed in the Introduction.

Another source of reliable information on historical fire regimes and forest structure in Rocky Mountain forests consists of tree-ring reconstructions of past fire regimes and forest conditions (Arno *et al.*, 1995b, 1997; Kaufmann *et al.*, 2000; Veblen *et al.*, 2000; Ehle & Baker, 2003; Sherriff, 2004). Relevant aspects of fire history methods are discussed in further detail later, but the critical parameter for the current discussion is the severity of past fires. This requires dating the year of a fire using fire scars, combined with age data from nearby trees (Bekker & Taylor, 2001; Ehle & Baker, 2003; Sherriff, 2004). High-severity fire is identified by evidence that a contiguous area of trees died about the time of a fire and/or regenerated in a pulse after a fire. A precise date for the fire usually comes from a surviving tree inside the high-severity fire or on its margin. Low-severity fires, in contrast, are identified by fire scars from more than one location along with intervening trees that mostly pre-date and thus survived the fire. A single fire event is identified as mixed severity if it has substantial fractions of burn area with evidence of both high- and low-severity fire. We use all available tree-ring studies with

both fire scars and age structure (Fig. 3a). Note that we specifically omit fire-history studies that rely only upon dating fire scars (Fig. 3a), as these studies lack data on age structure and thus do not provide evidence about fire severity. Tree-ring reconstructions of tree density near or before AD 1900 also are used (some of the points in Fig. 3b), although these estimates often are only approximations, due to mortality of some of the trees present at that time.

THE APPLICABILITY OF THE TWO MODELS

Was the historical fire regime dominated by low-severity surface fires?

In Rocky Mountain ponderosa pine–Douglas fir forests, data from the few places with the necessary tree age and fire-history evidence suggest that the pre-20th century fire regime varied in severity, and displayed more mixed- and high-severity fires than expected under the low-severity model. In Colorado, ponderosa pine–Douglas fir forests at Cheesman Lake, southwest of Denver (Brown *et al.*, 1999; Huckaby *et al.*, 2001), pure ponderosa pine forests in Rocky Mountain National Park (Ehle & Baker, 2003), and ponderosa pine–Douglas fir forests in many other locations in northern Colorado’s Front Range (Sherriff, 2004) had variable-severity fire, based on tree-ring evidence, as summarized in a recent review (Romme *et al.*, 2003). In Montana, tree-ring studies show that some ponderosa pine–Douglas fir forests had infrequent high-severity fires as well as more frequent low-severity fires (Barrett, 1988; Arno *et al.*, 1995b, 1997). The area of these forests from eastern Montana to northeastern Wyoming, including the Black Hills, appears to have had variable fire severity, based on historical and tree-ring evidence (Shinneman & Baker, 1997; Arno & Allison-Bunnell, 2002). Forest-reserve reports also indicate that mixed- and high-severity fire (Fig. 4) occurred in pure ponderosa pine forests from Idaho to Colorado (see Table S1, Items 1, 6, 8, 14, 17, 18, 28, 32–38, 40, 42) and in mixed



Figure 4 High-severity fire in a ponderosa-pine forest in the Black Hills in the late 1800s (reproduced from Graves, 1899, plate XXXV).

ponderosa pine–Douglas fir forests (see Table S1, Items 1, 12, 15, 26, 43). Where Douglas fir was more common or dominated, the reports suggest that high-severity fire was also more common (see Table S1, Items 2, 10, 11, 13, 15, 24, 25). Indeed, in Douglas fir forests in ponderosa pine landscapes, surface fires are seldom mentioned – the predominant fire type was reported to be high severity. High-severity fires were reported during early forest examinations in Douglas fir and ponderosa pine–Douglas fir forests on several national forests in Idaho in AD 1900–1915 (Ogle & DuMond, 1997). Reported high-severity fires in ponderosa pine–Douglas fir forests often covered thousands of hectares (see Table S1, Items 15, 37), and exceptional fires of 24,000 to 52,000 ha (60,000 to 128,000 acres) are also reported (see Table S1, Items 38, 42, 43). Only the smallest of these large fires was in a logged area (see Table S1, Item 42).

Low-severity surface fires are mentioned in forest reserve reports for Idaho (see Table S1, Items 3, 7, 9, 42), Montana (see Table S1, Items 16, 19, 20, 21, 42), Wyoming and South Dakota (see Table S1, Items 28–30, 42), and Colorado (see Table S1, Items 30, 41, 42). The reports recognize that low-severity surface fires are promoted by low-density forest with a grassy understorey and by the ability of mature ponderosa pine to resist damage by fire (see Table S1, Items 3, 6, 10, 19, 23, 42). However, low-severity surface fires alone do not imply that mixed- or high-severity fire was lacking, because low-severity fire was also part of the variable-severity model.

Although variable fire-severity appears to have characterized most of the range of ponderosa pine–Douglas fir forests in the Rocky Mountains, in limited areas high-severity fire was absent over the last few centuries. Some stands in Montana (Barrett, 1988; Arno *et al.*, 1995b, 1997), south-western Colorado (Wu, 1999) and the Colorado Front Range (Huckaby *et al.*, 2001; Ehle & Baker, 2003; Sherriff, 2004) were uneven-aged, based on tree-ring reconstructions, suggesting an absence of high-severity fire and dominance by low-severity fire. These stands were more common on lower-elevation or drier sites (Barrett,

1988; Wu, 1999; Veblen *et al.*, 2000; Arno & Allison-Bunnell, 2002; Ehle & Baker, 2003; Sherriff & Veblen, in press). In the only studies to date spanning the elevational range of ponderosa pine, about 20% of the ponderosa pine zone on public and private land in northern Colorado was found to have been dominated by low-severity fires (Platt, 2004; Sherriff, 2004; Platt *et al.*, 2006), suggesting a more low-severity than variable-severity model.

We stress that fire-history data and forest age structures document substantial variation in the fire regime along elevation and moisture gradients within the broad vegetation zone characterized by ponderosa pine–Douglas fir forests, reflecting local variations in moisture availability and other factors that determine fuels productivity and other vegetation attributes (Peet, 1981). For example, in the northern Colorado Front Range, in a c. 61,000 ha area of ponderosa pine–Douglas fir forests extending from 1800 m to 3000 m elevation, the area of more abundant low-severity fire was successfully predicted from elevation and topographic variables (Sherriff, 2004). Although the zone of more low-severity fire is broadly associated with lower elevations, at a finer scale abiotic factors also account for smaller areas of predominantly low-severity fire at mid- to upper elevations in the ponderosa pine zone (Sherriff, 2004).

Why is the natural fire regime in most Rocky Mountain ponderosa pine–Douglas fir forests variable in severity? Extended droughts and high winds can lead to exceptional fire spread across a broad spectrum of fuel loads and forest structures. For example, almost 25,000 ha of ponderosa pine–Douglas fir forest burned on a single day (9 June 2002), driven by strong winds (Finney *et al.*, 2003). Yet, brief episodes when the winds declined and fuel moisture rose, led to low-severity fire in the same landscape (Finney *et al.*, 2003), suggesting that extreme weather, not fuels, was the chief cause of high-severity fire under those conditions. Even during summer, ponderosa pine–Douglas fir landscapes in the Rocky Mountains are subject to rapid increases in wind

speed and changes in direction from jet streams or cold fronts (Baker, 2003). During spring and fall, more frequent cold fronts, along with strong down-sloping winds (foehn or chinook winds), can lead to rapidly spreading, high-severity fires if ignitions occur. Furthermore, variation in topography and time since fire lead to considerable variation in tree density and fuel loads over short distances, as reviewed later. A major fire, burning for days or weeks, may incur substantial variation in wind speed and direction, fuel loads and fuel moisture. During the Hayman fire in Colorado in 2002, strong southwesterly prefrontal winds drove a major fire run through both young and old forests. After the front, winds blew the fire back south, followed by southeasterly winds, before another major fire run, driven again by southwesterly winds (Finney *et al.*, 2003). A map shows a patchy mosaic of varying severity, reflecting this variation in fuels, wind and topography (Fig. 5).

Was tree density generally low and comparable to tree density under the low-severity model?

Both tree-ring reconstructions and forest reserve reports document that tree density was highly variable in Rocky

Mountain ponderosa pine–Douglas fir forests near or before AD 1900, suggesting that the low-severity model is inappropriate in most cases. Pre-fire-exclusion tree densities in ponderosa pine forests under the low-severity model were estimated to fall between about 7 and 60 trees ha⁻¹ (Covington & Moore, 1994), ranging up to 140 trees ha⁻¹ in some areas (Fulé *et al.*, 2002). In contrast, two studies in the northern Colorado Front Range report that current densities of trees that were alive in AD 1900 (an underestimate of AD 1900 tree density) vary from 68 to 3052 trees ha⁻¹ (Ehle & Baker, 2003) and 39 to 3,410 trees ha⁻¹ (Sherriff, 2004). This compares with modern tree density in the unlogged and ungrazed (for a century) Cheesman Lake area, south-west of Denver, of 96–1459 trees ha⁻¹ (Kaufmann *et al.*, 2000). In Montana, reconstructions found tree densities in mature ponderosa pine were between 116–249 trees ha⁻¹ near AD 1900, but data are lacking for forests of other ages (Arno *et al.*, 1995a,b). In Black Hills ponderosa pine forests, tree densities reconstructed for AD 1874 varied from 25 to 1600 trees ha⁻¹ (McAdams, 1995). Forest reserve reports support this large variability, documenting tree densities from 17 to 19,760 trees ha⁻¹ in ponderosa pine and 39 to 7410 trees ha⁻¹ in Douglas fir forests in the Rocky Mountains near or before AD 1900

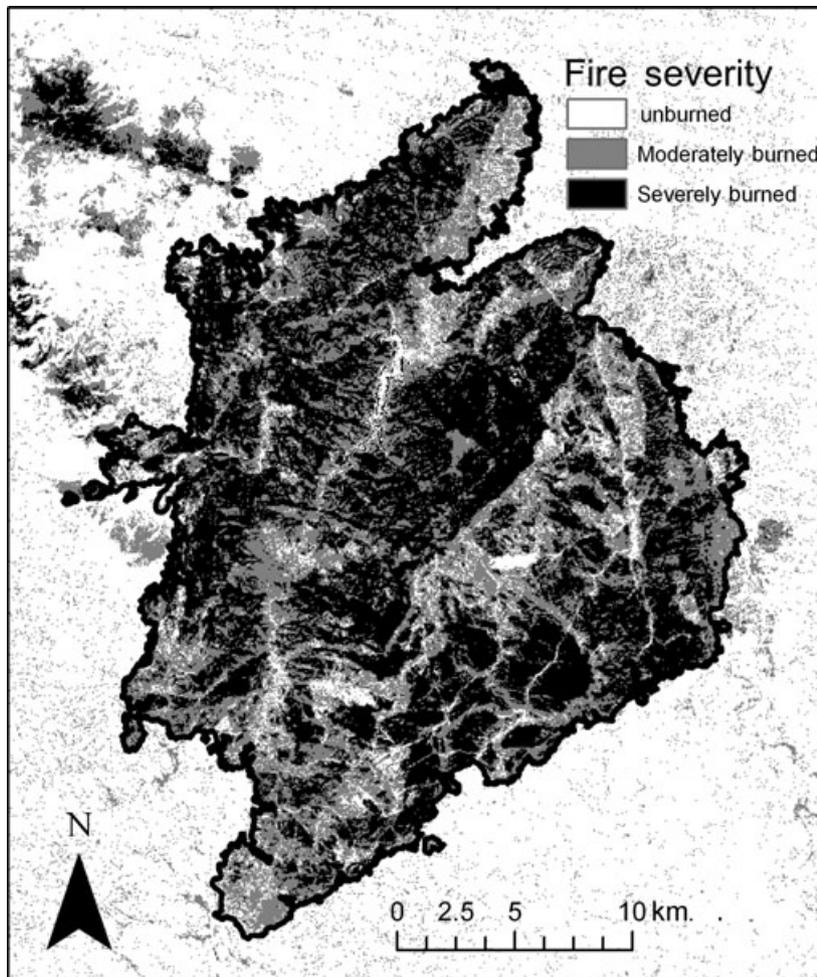


Figure 5 Variation in fire severity, Hayman Fire, Colorado, 2002. Derived from US Geological Survey composite image of differenced normalized burn ratio from Landsat TM (<http://edc2.usgs.gov/fsp/severity>).

Table 2 Estimates of tree density in Rocky Mountain ponderosa pine (PIPO)–Douglas fir (PSME) forests near or before AD 1900. These estimates are either (1) direct reports from near AD 1900 by scientists or (2) reconstructions, based on current trees that were alive near AD 1900

Fig. 3b number	Range (trees acre ⁻¹)	Range (trees ha ⁻¹)	Notes	Forest type	Age of forest	Reference/source
1	7–288	17–710	Large trees only (e.g. > 30 cm)	PIPO	Variable	Brown & Cook (2005)*
2	10–294	25–725	Mean = 344 trees ha ⁻¹	PIPO	Unknown	McAdams (1995) (< 2000 bf/acre forests)†
3	16–1380	39–3410	Trees > 4 cm	PIPO & PSME	100–250 years	Sherriff (2004)‡
4	20–30	49–74	Trees > 70 cm	PIPO & PSME	Unknown	Table S4 Item 6 (in Supplementary Material)
5	28–116	68–286	Trees > 5 cm	PIPO	100–200 years	Ehle & Baker (2003)§
6	47–101	116–249	Pre-1900 trees only	PIPO & PSME	205–445 years	Arno <i>et al.</i> (1995b)¶
7	81	200	Trees > 1.37 m tall	PIPO	c. 90 years	Boyden <i>et al.</i> (2005)
8	88	217	Trees > 12.7 cm	PIPO	Likely > 200 years	Pinchot (1908), Table 1
9	93	230	Trees > 12.7 cm	PIPO & PSME	Likely > 300 years	Pinchot (1908), Table 3
10	100–120	247–296		PSME	Unknown	Table S4 Item 12 (in Supplementary Material)
11	107–143	264–353	From ratios in description	PIPO	'Orig. forest' (old growth)	Table S4 Item 10 (in Supplementary Material)
12	111–648	275–1600	Mean = 633 trees ha ⁻¹	PIPO	Unknown	McAdams (1995) (2–5000 bf/acre forests)†
13	150–200	370–494		PIPO	100 years	Table S4 Item 10 (in Supplementary Material)
14	200–300	494–741	Trees > 10 cm in 'second growth'	PIPO	Likely < 100 years	Table S4 Item 7 (in Supplementary Material)
15	200–300	494–741		PSME	100–150 years	Table S4 Item 4 (in Supplementary Material)
16	402–1236	992–3052	Trees > 5 cm	PIPO	20–40 years	Ehle & Baker (2003)§
17	800–1500	1976–3705	'In some localities'	PIPO & PSME	Unknown	Table S4 Item 1 (in Supplementary Material)
18	800–1500	1976–3705	Trees > 10 cm in 'second growth'	PSME	Likely < 100 years	Table S4 Item 7 (in Supplementary Material)
19	1000–3000	2470–7410		PSME	Young	Table S4 Item 4 (in Supplementary Material)
20	7000–8000	17,290–19,760		PIPO	Young	Table S4 Item 11 (in Supplementary Material)

*This estimate excludes goshawk plots because some of them were not forested in AD 1900. Tree density in 1900 is likely to be an underestimated due to loss of small trees present in 1900 (Brown & Cook, 2005).

†This estimate is tree density in AD 1874, not 1900. Tree density in 1874 is likely to be an underestimated due to loss of small trees present in 1874. bf/acre, board-feet per acre.

‡This estimate is tree density in AD 2003, not AD 1900, but stand age was estimated for AD 1900. These trees were all alive in AD 1900, but others are likely to have died and disappeared, so this is an underestimate of AD 1900 density.

§This estimate is tree density in AD 1999, not AD 1900, but stand age was estimated for AD 1900. These trees were all alive in AD 1900, but others are likely to have died and disappeared, so this is an underestimate of AD 1900 density.

¶The estimate was derived by adding 'number of overstorey trees per acre in 1991–93' and 'estimated number of overstorey trees per acre that died after 1900' from their Table 2, excluding Flathead stands, which have a mixture of tree species.

(Table 2). Qualitative remarks mirror this large quantitative range (see Table S4, Items 2, 3, 6). Leiberg (1897) says 'The number of trees to the acre varies so greatly that it is almost impossible to give, even approximately, an estimate' (see Table S4, Item 6).

Three factors, that explain this great variation in tree density, are identified in the forest reserve reports: tree species composition, environment and stand development. Where forests included more Douglas fir or other trees, density was

higher than in pure ponderosa pine forests (see Table S4, Items 2, 6, 7, 12, 14, 17). Tree density was low in lower-elevation stands and on drier sites and was higher in more mesic stands, found on more northerly facing slopes or at higher elevations (see Table S4, Items 2, 4, 5, 6, 17). Mesic stands often also contained Douglas fir and other trees, so composition and environment were correlated, but density varied with environment even within forests consistent in composition (see Table S4, Item 5). Pure Douglas fir forests usually had

> 250 trees ha⁻¹, while pure ponderosa pine forests could be, but were not always, lower in density (Table 2).

Stand development appears to have strongly affected tree density (see Table S4, Items 1, 3, 6, 8, 10, 11). Young stands (< 100 years old) were naturally dense, having about 1000–20,000 trees ha⁻¹ (Figs 2b & 6a), while older stands typically had < 750 trees ha⁻¹ (Table 2). High initial tree density, followed by thinning, is a natural mode of regeneration and stand development in Rocky Mountain ponderosa pine–Douglas fir forests (Peet, 1981; Lundquist & Negron, 2000; Ehle & Baker, 2003; Sherriff, 2004; see Table S4, Items 8, 11; Fig. 6a), unlike under the low-severity model. However, some young stands were not dense (Fig. 7). Nonetheless, even park-like Rocky Mountain stands were denser than under the low-severity model (see Table S4, Items 3, 6, 14–16, 18; Table 2), and nearly all Rocky Mountain ponderosa pine–Douglas fir forests, for which there are data, were much denser, often by a factor of 5–10 times (Table 2).



Figure 6 (a) Dense, young ponderosa pine trees regenerating naturally after high-severity fire in the late 1800s (reproduced from Graves, 1899, plate XXI A), and (b) a surface fire and a small, dense group of regenerating ponderosa pine trees in the Black Hills in the late 1800s (reproduced from Graves, 1899, plate XXI B).



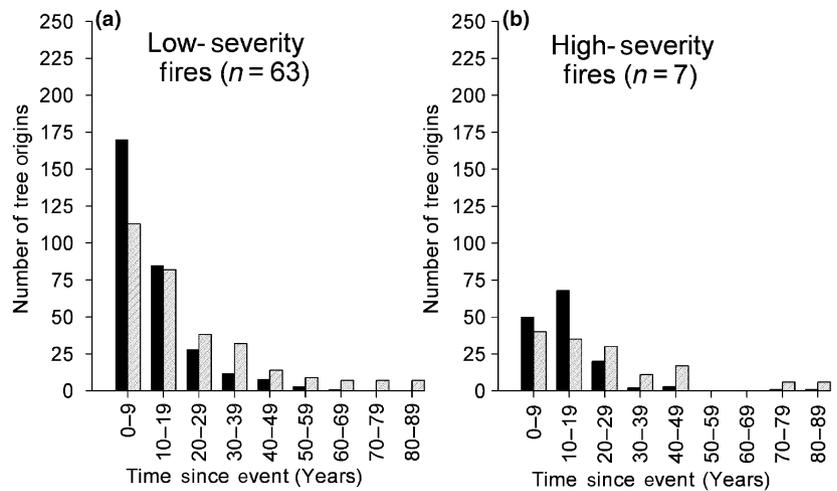
Figure 7 Young, open, low-density ponderosa-pine forest in the Lewis and Clarke forest reserve in the late-1800s (reproduced from Ayres, 1900a, plate IX, part B).

How do fires of different severity affect spatial and temporal variation in tree density?

Given that stand development strongly influences tree density, how is the fire regime linked to stand development processes? Contemporary observations document that low-severity surface fires kill small ponderosa pine and Douglas fir trees (Baker & Ehle, 2001). Similar fires killed small trees in the pre-fire exclusion era, based on forest reserve reports from Idaho to Colorado (see Table S2). One report, on the western Bitterroot reserve, says ‘a certain percentage of saplings usually pass through a fire unharmed, the amount depending on their age and the quantity of litter on the ground’ (Leiberg, 1900a, p. 350), which is also evident in an early photograph (Fig. 6b) and is consistent with observations of contemporary fires (Baker & Ehle, 2001).

Although low-severity surface fires kill small trees in ponderosa pine–Douglas fir forests, tree establishment increases after these fires (Sackett, 1984; Boyce, 1985) because of reduced competition with bunchgrasses for moisture and nutrients, shown experimentally in the Southwest (Pearson, 1942). Seed germination and seedling survival are also favoured by bare mineral soils (Sackett, 1984; Boyce, 1985) or scorched needles on top of mineral soil (Bonnet *et al.*, 2005). In Rocky Mountain National Park, regeneration of ponderosa pine in the pre-EuroAmerican era was elevated within the first 10 years after low-severity fires and did not continue during longer intervals after fire (Fig. 8). In southwestern Colorado, regeneration of ponderosa pine occurred almost entirely within 20 years after fires (Wu, 1999). Forest reserve reports also indicate that low-severity surface fires favour tree regeneration (see Table S3). Reports from Idaho, Montana and Wyoming–South Dakota suggest that, after surface fires, small trees are often found, sometimes in dense thickets (see Table S3). Small trees of Douglas fir, white fir (*Abies concolor* (Gord. & Glend.) Lindl. E Hildbr.), or other

Figure 8 Observed (solid bars) and expected (shaded bars) density of tree regeneration vs. interval since fire for (a) low-severity surface fires and (b) high-severity fires in ponderosa pine forests in Rocky Mountain National Park, Colorado. Expected density is the same total density assigned proportion to the actual frequency of fire intervals. Reproduced from Ehle & Baker (2003) with permission of the Ecological Society of America.



shade-tolerant species were present as thickets in the understorey of some mature ponderosa pine–Douglas fir forests and often appear to increase after fire (see Table S3). Short fire-free intervals or episodes of fire were found in other studies to lead to periodic cohorts of shade-tolerant trees in western ponderosa pine–Douglas fir forests prior to EuroAmerican settlement (Wu, 1999; Agee, 2003). Regeneration may be concentrated within 1–2 decades after fire, because lower competition, bare mineral soil and other conditions disappear as the understorey recovers. Small trees regenerating after fire can be killed by the next surface fire; long-term survival of ponderosa pine after surface fire requires a fire-free period of several decades or more (Baker & Ehle, 2001).

Ponderosa pine and Douglas fir also regenerate after high-severity fires, often at high density, although density may vary with site conditions (Peet, 1981). In the Colorado Front Range, regeneration after high-severity fires was abundant and naturally dense (Veblen & Lorenz, 1986; Hadley & Veblen, 1993; Kaufmann *et al.*, 2000; Ehle & Baker, 2003; Sherriff & Veblen, in press). Tree-ring dating suggests that tree regeneration also followed high-severity fires in the pre-fire exclusion era in Montana ponderosa pine–Douglas fir forests (Arno *et al.*, 1995b, 1997) and in south-western Colorado (Wu, 1999). Early forest examinations (AD 1900–1915) documented dense reproduction of both Douglas fir and ponderosa pine in places after high-severity fire on several national forests in Idaho (Ogle & DuMond, 1997). Trees generally regenerate even after very large high-severity fires. The Hayman fire in Colorado in 2002, for example, burned in part in dense, young forests that regenerated after large high-severity fires in the late 1800s (Jack, 1900). However, regeneration can sometimes be delayed (Graves, 1899; Leiberg, 1904b), creating openings that may slowly fill in over a century or more (Kaufmann *et al.*, 2000). More typically, forest reserve reports indicate that dense thickets of small trees naturally followed high-severity fires in both ponderosa pine (e.g. see Table S4, Items 8, 11) and Douglas fir (Leiberg, 1899a) forests, and this high density often persisted for decades (Table 2), suggesting that the low-severity model is inappropriate.

At the landscape scale (i.e., a few hundred ha or more) in Rocky Mountain ponderosa pine–Douglas fir forests, variable fire severity and variation in environment led to a mosaic of patches naturally varying in age and tree density. Some patches were large. Extensive areas of old forest (e.g. > 200 year-old) covered the Black Hills (Graves, 1899; Shinneman & Baker, 1997), the west side of the Bitterroot (Leiberg, 1900a) and parts of other reserves. Some reserves also had large stands of mature (e.g. > 100-year-old), but not old forest, as in Montana's Little Belt Mountains (Leiberg, 1904b). Expanses of recently burned or young ponderosa pine–Douglas fir forest also occurred, as in the Black Hills (Graves, 1899) and southern Colorado (Jack, 1900). Some of these were in logged forests, but most were not. Other landscapes had finer-scale mosaics of burned and unburned forest of various ages (Graves, 1899). Some early photos show this finer scale spatial variability in tree density and patch age (Fig. 9). Landscape-scale fire histories with age-structure analysis (Huckaby *et al.*, 2001; Ehle & Baker, 2003) have found similar patchy patterns. Landscape-scale evidence is scanty, but suggests that the uniform, low density, old-growth landscape, expected under the low-severity model, was not the predominant pattern in most areas of Rocky Mountain ponderosa pine–Douglas fir forest.

Dense patches of tree establishment can often be clearly linked to documented severe fires, but climatic variability may also influence tree establishment and survival. For example, short intervals (i.e. 1–3 years) of abundant ponderosa pine establishment have been linked to short intervals of favourable climate in northern Arizona (Savage *et al.*, 1996). Similarly, in the northern Colorado Front Range, recent (i.e. post-1970) annual episodes of ponderosa pine establishment in grassland ecotones have been linked to 1–2 year periods of wet climate (League, 2004; League & Veblen, 2006). Some retrospective studies of pre-20th century forest conditions have suggested that multi-decadal wet periods are responsible for 30–40 year pulses of tree regeneration evident in age structures in the Rockies (Boyden *et al.*, 2005; Brown & Cook, 2005; Brown & Wu, 2005). However, some of the pulses during wet periods were immediately preceded by fires (e.g. AD 1684 and 1818 in



Figure 9 A ponderosa pine landscape in AD 1903 along Hermosa Creek about 25 km north of Durango, Colorado. Photo by E. Howe (No. 204) courtesy of the US Geological Survey Photographic Library, Denver, Colorado.

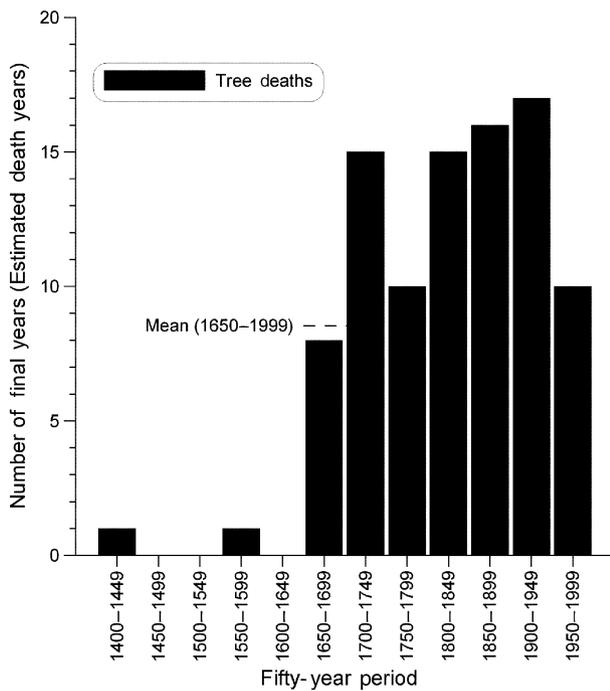


Figure 10 Estimated 50-year period when dead wood died in nine plots in ponderosa pine forests in Rocky Mountain National Park, Colorado. The null hypothesis, that tree deaths are independent of 50-year period since 1650, cannot be rejected ($\chi^2 = 3.102$, $P = 0.796$).

Brown & Wu, 2005), and the effects of fire and climate are thus confounded. Furthermore, some wet periods are not associated with above average numbers of tree establishment dates in these studies. Other age-structure studies in the Front Range have not shown a clear association between episodes of establishment of ponderosa pine and climatic variability, independent of fire (Mast *et al.*, 1998; Kaufmann *et al.*, 2001; Ehle & Baker, 2003). However, these retrospective age-structure studies all have limited ability to resolve potential confounding of fire and climate effects over the long-term or

of grazing and, in some cases, logging effects during the past c. 150 years. Future studies need to overcome the confounding and potential complexity of interactions that have limited the ability to retrospectively identify and quantify a climatic effect on tree regeneration.

In summary, under the variable-severity model, which appears to better fit the available evidence for ponderosa pine–Douglas fir forests in the Rocky Mountains, the landscape mosaic naturally varies over time and space as a result of variable-severity fire and other processes that kill trees and facilitate regeneration. After high-severity fire or other disturbance, a pulse of dense tree regeneration may occur and, as these trees mature, tree density increases relative to the pre-disturbance forest (Veblen & Lorenz, 1986; Ehle & Baker, 2003; Sherriff, 2004). Ongoing low-severity fires, as well as insects, disease and other small disturbances, may kill a tree or small groups, lowering density, but also encouraging new regeneration, resulting in a fine age mosaic (Lundquist & Negron, 2000). However, the next moderate or high-severity event may kill larger groups of these trees, reducing tree density again, although trees remain denser than expected under the low-severity model. Because fires and other events are spatially variable, at any one time adjacent or nearby stands may differ significantly in tree density, age and fuel loads (Hadley & Veblen, 1993; Ehle & Baker, 2003; Sherriff, 2004).

How did historical fire regimes affect fuels?

Ideas about how fuel loads fluctuated during the pre-fire exclusion era must be inferred from contemporary observations of trends in fuel with time since fire and inferences about changes in the processes that produce and consume fuels, because there are no direct data on fuel loads in the pre-fire exclusion era. Under the low-severity model, large, dead wood should be maintained at relatively low levels by low-severity surface fires. Because fire is a principal fuel-load regulator, fuel accumulation would be relatively more homogeneous than

where fire severity is highly variable. Under a variable fire-severity model, fuel beds would tend to be strongly spatially heterogeneous, and not accumulate consistently after fires. Moreover, other processes (e.g. disease and windstorms) may so affect fuel production rates and patterns that a consistent response to fire or fire exclusion is clouded or not at all evident.

In the Rocky Mountains, large data sets from the northern Rockies ($n = 6706$ plots; Brown & See, 1981) and Colorado ($n = 328$ plots; Robertson & Bowser, 1999) indicate that the particulars of a stand's history (e.g. timing of fires or windstorms) determine fuel loads, and these loads are spatially heterogeneous. Specifically, the multiple processes that produce dead fuels, such as disease and disturbances (e.g. root disease, beetles, lightning, wind, fire and frosts), damage and kill trees of all ages. Spatio-temporal variability in these processes prevents consistent trends in fuel buildup (Knight, 1987; Robertson & Bowser, 1999; Lundquist & Negron, 2000; Harmon, 2002). The available evidence appears more consistent with the variable-severity model, which emphasizes variability in the landscape fuel mosaic and the multiple fuel-producing processes.

THE EFFECTS OF LAND USES ON FOREST CONDITIONS

The effects of land uses on forest structure are comparatively well known for the low-severity model (e.g. Friederici, 2003), and are likely similar in the Rocky Mountains where this model is appropriate. However, in most of the region, where the variable-severity model is more appropriate, tree density, age and fuels were highly variable, making responses to land use difficult to detect or attribute to a land use. Re-photography shows that tree cover has increased in some Rocky Mountain ponderosa pine–Douglas fir forests over the last century (e.g. Veblen & Lorenz, 1991), and there is also evidence of density increase from tree-ring reconstructions (e.g. McAdams, 1995). There are many plausible explanations of these changes, including natural processes (e.g. recovery after disturbance), reviewed earlier, as well as land-use effects (fire exclusion, logging, and livestock grazing), which are now discussed in turn.

Effects of fire exclusion on tree density and fuels

Researchers have commonly assumed that long intervals between fires will lead to increased survival of tree regeneration, so excluding fires is thought to increase tree density (e.g. Arno *et al.*, 1997). This may be true under the low-severity model, but, in the variable-severity model, the effects of fire exclusion are more complex. After severe fires, both ponderosa pine and Douglas fir typically establish abundantly. Less fire in the 20th century (Brown *et al.*, 1999; Veblen *et al.*, 2000) has resulted in comparatively fewer opportunities for tree establishment. This is reflected in tree population age structures indicating abundant establishment for several decades following severe fires in the 19th century and relatively little

establishment during the 20th century (Veblen & Lorenz, 1986; Ehle & Baker, 2003; Sherriff, 2004). Some ponderosa pine–Douglas fir fires in the late 1800s and early 1900s burned severely during regional drought years (e.g. 1851, 1872, 1879, 1880, 1889, 1910 and 1919) that affected large parts of the Rocky Mountain region (Barrett *et al.*, 1997; Brown *et al.*, 1999; Veblen *et al.*, 2000; Sherriff, 2004). Thus, the high stand densities, that are interpreted as effects of fire exclusion in the low-severity model, in the variable-severity model may reflect recovery after these widespread, severe fires and also logging (see below) in the late-19th century.

Exclusion of low-severity fire, under the variable-severity model, can reduce, not increase ponderosa pine regeneration (Ehle & Baker, 2003), but can also enhance seedling survival under certain circumstances. Elsewhere in the western USA, relict mesas that were never grazed by livestock, but that had long intervals without fire, show that tree regeneration may be low where surface fires are rare or are excluded and disturbances from human activities do not occur (Rummell, 1951; Madany & West, 1983). Fire exclusion in undisturbed forests may reduce ponderosa pine regeneration (Ehle & Baker, 2003), but in the post-settlement era, where soil disturbance associated with mining or road construction promotes ponderosa pine establishment (Sherriff, 2004), the survival of these juveniles would be enhanced by subsequent fire exclusion. At low elevation sites in the Front Range, where the low-severity model more likely applies, climatic variation in ecotonal areas also promoted seedling establishment (League, 2004) and ponderosa pine generally survived abundantly in the 20th century following the exclusion of low-severity fires which otherwise could have killed the seedlings (Mast *et al.*, 1998; Sherriff, 2004). However, the relative importance of livestock grazing and other disturbances in triggering this tree establishment is not known. Overall, available evidence suggests that, where the variable-severity model applies, observed post-settlement tree density increases are most typically recovery from past mixed- or high-severity fires or logging. Exclusion of low-severity fires may only have facilitated tree regeneration on otherwise disturbed sites, or where the low-severity model applies on low elevation xeric sites (Sherriff, 2004).

Has fire exclusion resulted in unnatural fuel buildups that have shifted the fire regime towards significantly more severe fires? The complexity of this question is illustrated here for the example of large, dead wood, which is only one of several types of fuel. Fire exclusion affects not only the rate of consumption of fuels, but the rate of processes that produce fuels (e.g. tree mortality). Excluding fires lowers consumption of wood on the forest floor, but also shuts down the damage and mortality process, potentially decreasing the production of dead fuels from live trees (Harmon, 2002). Excluding fires reduces the input of snags and dead wood that are the largest dead fuels in these forests (Brown & See, 1981), leaving this wood in live trees that are less flammable. Large, dead wood and associated smaller branchwood and twigs can increase fire intensity and severity (Agee, 1993; Brown *et al.*, 2003), so the contribution

of dead wood to fire severity could be reduced, not increased by fire exclusion. Is there empirical evidence that dead wood has or has not built up? In Rocky Mountain National Park, the deaths of 110 down or standing dead trees dated in nine plots in ponderosa pine forests did not support the hypothesis that dead wood had built up since fire exclusion in 1915 (Fig. 10; Ehle & Baker, 2003). Furthermore, substantial amounts of large, dead wood on the floor in Colorado ponderosa pine–Douglas fir forests are not recent inputs, but have been there for hundreds of years (Fig. 10; Brown *et al.*, 1999).

Present loadings of large, dead wood [generally > 3'' (7.5 cm) diameter] in Rocky Mountain ponderosa pine–Douglas fir forests range widely. The mass of large, dead wood in mature Colorado ponderosa pine–Douglas fir forests is low (mean = 3.4 Mg ha⁻¹ for 328 plots; Robertson & Bowser, 1999) relative to similar forests in the northern Rockies (9–23 Mg ha⁻¹; Brown & See, 1981), Black Hills (mean = 12.7 Mg ha⁻¹ for 151 plots in a variety of forests; Reich *et al.*, 2004), and Southwest (18 Mg ha⁻¹; Sackett, 1979). At one site in south-western Colorado, large wood averaged 17.7 Mg ha⁻¹ (Romme *et al.*, 1992).

Because there are no direct data on fuel loads in the pre-fire exclusion era, present fuel loads can only be evaluated in a relative sense. For example, in the northern Rockies, Brown & See (1981) estimated the wood needed for wildlife habitat and mycorrhizal activity, indicators of ecosystem health, and said '...ponderosa pine and Douglas fir cover types are deficient in downed woody material or contain only slight excesses...' (p. 9), as 22–34 Mg ha⁻¹ was considered by these authors to be necessary, fuel levels that are above most existing levels in these forests. Brown *et al.* (2003) recommended 11–45 Mg ha⁻¹ in warm, dry ponderosa pine and Douglas fir, and up to 67 Mg ha⁻¹ in cool Douglas fir forests, as an optimum to maintain soil health, while keeping fire hazard low. They also suggest that high fire hazard occurs if large dead fuels exceed about 55 Mg ha⁻¹, well above present fuel loads in most Rocky Mountain ponderosa pine–Douglas fir forests.

The notion, under the low-severity model, that fire exclusion leads to fuel buildup to hazardous levels is not supported in the case of large, dead wood in most Rocky Mountain ponderosa pine–Douglas fir forests. Nor does tree density, often considered a fuel, necessarily increase with only fire exclusion in these forests, as reviewed earlier. Available evidence suggests that, in most Rocky Mountain ponderosa pine–Douglas fir forests where the variable-severity model applies, there is no need to decrease large, dead wood [> 3'' (7.5 cm) in diameter], if the goal is to offset effects of fire exclusion in ecological restoration. Retaining or increasing large, dead wood may be a more common restoration need in forests affected by fire exclusion or by logging, reviewed next.

Effects of logging and livestock grazing on tree density and fuels

It has long been known that logging of large overstorey trees in ponderosa pine forests can lead to a pulse of tree regeneration,

often concentrated within one to a few decades after logging, and this pulse, if it occurs, can later become a dense, young understorey in the forest (Curtis & Wilson, 1958; Smith & Arno, 1999). For example, the Lick Creek study in Montana documented that an original stand of about 125 trees ha⁻¹ before logging in 1907–1911 had over 1500 trees ha⁻¹ by 1948 (Smith & Arno, 1999). Logging is favourable to the establishment of the relatively shade-intolerant ponderosa pine by opening up the stand and exposing bare mineral soil suitable for tree seedling establishment, but the density of establishment after logging is highly variable (Schubert, 1974; Veblen & Lorenz, 1986; Heidmann, 1988). Kaufmann *et al.* (2000), for example, found total tree densities were significantly higher on only about half of a logged landscape relative to the comparable, unlogged Cheesman Lake landscape of Colorado. Many ponderosa pine–Douglas fir forests had been high-grade logged by about AD 1900 (e.g. Graves, 1899; Romme *et al.*, 2000), leading to potential tree-density increases during recovery, a process that continues today. In the northern Colorado Front Range, most sites of ponderosa pine–Douglas fir forests logged in the late 19th or early 20th centuries now support dense populations of young trees, although many of these sites were also burned and grazed (Veblen & Lorenz, 1986, 1991).

Logging may increase or decrease fuels, depending on whether stumps and residual material (slash) are burned or removed, but large, dead wood is clearly reduced because tree boles are removed. In the early days, slash was routinely left, greatly increasing the loadings of small and fine fuels that most directly affect fire severity (Dodge, 1972; Harmon, 2002). As wood became more valuable, less was left, and sanitation–salvage operations also removed snags and dead wood, so that wood fell below historical levels, leading eventually to minimum standards for retention after harvest (Harmon, 2002). Where logging removes larger, more fire-resistant trees, the smaller fuels (including small, live trees) that contribute to fire severity may still be increased (Weatherspoon & Skinner, 1995). Logged forests today may often be deficient in large, dead wood, because tree boles were removed, and this wood may often need to be increased when restoring logged stands.

Livestock grazing may have complex effects, but generally increases tree density in formerly open stands and thereby increases the fine fuels that contribute most to fire intensity and severity. Removal of grass reduces competition, allowing more trees to successfully regenerate, shown experimentally in the Southwest (Pearson, 1942), and also by paired comparisons in other parts of the West, in which mesas subject to livestock grazing have much higher tree density than do comparable nearby ungrazed mesas (Rummell, 1951; Madany & West, 1983). Grazing can also initially reduce the quantity of fine grass fuels needed for surface fires, and the onset of heavy grazing in south-western ponderosa pine landscapes is temporally associated with a marked reduction in surface fires (e.g. Savage & Swetnam, 1990). However, fine fuels are likely not to have remained low for long. Higher tree density increases fine fuels that lead to faster fire spread and increases

ladder fuels that lead fire into the canopy (Zimmerman & Neuenschwander, 1984), together increasing the potential for more fires and more severe fires. However, this potential effect is most important in mature and old-growth forests, which are rare today, and in younger forests evidence of tree density increase is difficult to detect or is minor, as explained later.

In Rocky Mountain ponderosa pine–Douglas fir forests, most of the apparent increase in tree density over the last century is not in undisturbed mature forests, but in the younger forests that predominate today that may not be overly dense for their age, as explained below. These young forests regenerated after burning and/or logging, accompanied in some places by overgrazing, since EuroAmerican settlement, and are now recovering from these disturbances, as is well documented in the Black Hills and southern Rockies (Gary & Currie, 1977; Veblen & Lorenz, 1986; Shinneman & Baker, 1997; Romme *et al.*, 2000). Extreme droughts in these areas during the second half of the 19th century promoted widespread fires, ignited either by humans or by lightning, which today are reflected in extensive areas of dense, post-fire stands (Veblen *et al.*, 2000; Schoennagel *et al.*, 2004). However, every forest-reserve report (Fig. 1) documents wasteful logging as well as large fires, that were thought to have been set by early settlers, so this pattern occurs throughout the Rockies.

Ponderosa pine–Douglas fir landscapes in the Rocky Mountains today have increased tree density and tree size due in part to normal recovery from these past natural (fire) and human disturbances. Tree regeneration may continue for 30–50 years after these major disturbances (Veblen & Lorenz, 1986), and density may appear to increase for some time after that, as trees grow taller and crowns expand, filling in the canopy. Early historical photographs reveal many burned and/or logged ponderosa pine–Douglas fir forests that were already dense at the time of their disturbance in the 19th century (e.g. Veblen & Lorenz, 1991). Tree density increase, due to recovery from past disturbance, does not necessarily require restoration, as explained further in the next section.

RESTORATION

Identifying the restoration model for a particular landscape

The goal of ecological restoration is to enhance the resilience and sustainability of ecosystems through management decisions that return them to a state considered to be within the historical range of conditions prior to significant impacts from EuroAmerican land uses (Landres *et al.*, 1999). To achieve ecological restoration, as well as ecosystem-based management in general, managers need to understand how past disturbances shaped landscapes prior to permanent EuroAmerican settlement (Veblen, 2003).

It is impossible to determine the correct restoration model for a particular place without some collection of information on the site to be restored (White & Walker, 1997; Veblen, 2003). In ponderosa pine–Douglas fir ecosystems of the Rocky

Mountains, over short distances, such as on slopes of opposite aspect, either the low-severity or the variable-severity model may apply (Ehle & Baker, 2003; Sherriff, 2004). How is the model to be determined? The key criterion to distinguish these two models is the presence or absence of high-severity or variable-severity fires prior to logging and fire exclusion. Abundant fire scars of different dates are required to document the low-severity model, but it is necessary to sample sufficient age structure, along with fire scars, to determine whether trees regenerated in a pulse, suggesting high-severity fire occurred (Kaufmann *et al.*, 2000; Ehle & Baker, 2003; Sherriff, 2004). Dating down wood to identify episodes of synchronous tree death (Ehle & Baker, 2003) and dating growth releases on surviving trees (Goldblum & Veblen, 1992) can help date past high-severity fires. It is also essential to cross-date fires, so individual fires can be traced, as well as to have multiple, unbiased sampling locations across a landscape (e.g. Bekker & Taylor, 2001). Once a set of sites has been classified by fire regime, it is possible to produce a predictive map of fire regimes (Sherriff, 2004). Of course, site-specific and local fire-history data may lead to new models, or allow more definition of these two models. For example, more data are needed to be able to specify the relative importance of high-severity or mixed-severity fire where the variable-severity model is appropriate.

Identifying land-use effects, followed by reversal and modification

Under the variable-severity model, to determine if tree density in a particular stand is outside the range of historical variability requires comparison with historical data from stands at the same stage of development (Table 2), not with more mature or old-growth forests. Forests logged around AD 1900, that are roughly a century old today, are compared to 100-year-old stands around AD 1900, which had up to about 750 trees ha⁻¹ (Table 2), a density not likely to be exceeded today in many cases. For example, an 80-year-old ponderosa pine stand in Montana had 593 trees ha⁻¹ in the 1990s (Arno *et al.*, 1995a,b), a density not exceptional in forests of this age in the northern Rockies near to AD 1900 (Table 2). Similarly, present densities of trees in relatively undisturbed mature forests in Colorado average 241 trees ha⁻¹, ranging from 40 to 810 trees ha⁻¹ ($n = 328$ plots; Robertson & Bowser, 1999), comparable to the range of variability in tree densities for similar mature stands near to or before AD 1900 (Table 2). Local tree-density estimates must be used, but thinning today's forests, whether young or old, to dramatically lower tree densities is not likely to be warranted at the stand level in most Rocky Mountain ponderosa pine–Douglas fir forests where the variable-severity model applies.

Although livestock grazing and logging or physical disturbances (e.g. roads and mining) are expected to have increased tree density, the pattern and magnitude of this increase is difficult to quantify at the stand level, given high natural variability in density. To determine this requires detailed

analysis of age-structure for comparison of nearby logged and unlogged forests (e.g. Kaufmann *et al.*, 2000), and analysis of livestock grazing records or records of other disturbance. Relatively undisturbed mature forests are likely to be not far outside historical variability for tree density and fuels, as suggested above. Thus, this type of research may not be cost effective for these forests, particularly because as these stands age, natural thinning processes and passive restoration of low-severity fire may accomplish some reduction in density. The most effective restoration strategy for undisturbed mature and old-growth forests is likely a passive approach, in which fire is restored, but natural processes (from fire and other sources of mortality) accomplish gradual restoration of tree density and fuels.

A complex restoration problem that does require research is the matter of shade-tolerant trees (e.g. white fir and Douglas fir), which are often thought to have increased in ponderosa pine forests because of fire exclusion or logging (e.g. Arno *et al.*, 1995b; Wu, 1999; Kaufmann *et al.*, 2001; Keane *et al.*, 2002a). Livestock grazing has also been shown, in an enclosure study, to favour Douglas fir regeneration in mixed forests (Zimmerman & Neuenschwander, 1984). The hypothesis for increased Douglas fir, based on the low-severity model, is that cessation of frequent surface fires is allowing Douglas fir to invade ponderosa pine stands. However, fire scar and tree age data do not support that hypothesis, at least for the northern Colorado Front Range (Sherriff, 2004). Evidence was also presented earlier that these trees were present in other Rocky Mountain forests near to or before AD 1900 as a component of the canopy of some mature forests, as thickets in the understorey of some forests, and often appear to increase after fire (see Table S3). Moreover, past episodes of high-severity fires associated with droughts also would have resulted in patchy stand ages across landscapes (Veblen *et al.*, 2000), and therefore varying relative abundances of ponderosa pine and Douglas fir (Agee, 2003). Because multiple explanations exist for the presence and abundance of young, shade-tolerant trees, these trees need to be dated and linked definitively to a particular land use (e.g. livestock grazing, logging, fire exclusion) before their removal is ecologically appropriate in restoration, and so that the correct land use, as discussed later, can be modified.

Where the low-severity model applies, restoration at the stand level is appropriate. At low elevations in the northern Colorado Front Range, near the ecotone with the Plains grassland, thinning to restore more open conditions is consistent with evidence of past fire and landscape structure (Sherriff, 2004). We caution, however, that the extent of the landscape in this area that fits this more low-severity model for ponderosa pine is only about 20% of the ponderosa pine zone. Relatively little of the area suitable for restoration through thinning is on Forest Service land, which is the main source of funding for both restoration and fire hazard reduction (Platt, 2004).

Under the variable-severity model, the proportions of the historical landscape that contained patches of different age and

tree density would have varied substantially over time due to relatively long periods with minimal fire occurrence followed by episodes of widespread and severe burning at landscape scales (Brown *et al.*, 1999; Veblen *et al.*, 2000). This is an important contrast with the low-severity model in which low-severity fires are believed to have occurred often enough to maintain a relatively uniform uneven-aged, old-growth landscape (Covington & Moore, 1994). For the variable-severity fire regime, more research is needed to characterize historical spatial variability in the proportions and configurations of particular categories of forest age, fuel loads and tree density across landscapes. However, any fixed restoration target (e.g. crown closure in AD 1900; Kaufmann *et al.*, 2001) under the variable-severity model is inappropriate, as it may just be an instant when crown closure happened to be low due to preceding fires that were particularly high in severity. Instead a multi-century, landscape-scale restoration framework is needed. Although the variable-severity restoration model is incomplete at the landscape scale, it can still guide management response to severe fires. For example, the modern occurrence of extensive and severe fires in the Rocky Mountains should not be perceived as outside the historical range of variability for ponderosa pine–Douglas fir forest forests, and should not trigger efforts to create forest structures that would exclusively support low-severity fires.

Current knowledge is sufficient for guiding efforts to restore old-growth structures today which are scarce due to widespread logging and anthropogenic burning in the late 19th to early 20th centuries (Veblen & Lorenz, 1986; Schoennagel *et al.*, 2004). Slight thinning and prescribed fire could be used to encourage development of structures (e.g. large trees and down wood) typical of later stages of stand development in some of these young stands as a step in the direction of restoration at the landscape scale (Kaufmann *et al.*, 2001). The resulting increase in sizes of ponderosa pine will result in larger seed crops favourable to wildlife and also in nesting sites for cavity-nesting birds (Krannitz & Duralia, 2004). However, in management aimed at accelerating the recovery of old-growth structures, protection of all pre-EuroAmerican trees is needed to ensure that this restoration truly leads to old forests, and the wood from thinning is generally needed to replenish wood lost to logging or burning.

If even the modest landscape restoration warranted now is begun without identification of land-use effects at the stand level and modification of those land uses, restoration may be futile. Identification of which land uses affected a stand proposed for restoration is essential. Fire exclusion, logging and livestock grazing do not have the same effects on these forests, their effects vary with environment, and they require different restoration actions. Before restoration begins, it makes sense to modify or minimize the particular land uses that led to the need for restoration, to avoid repeating degradation and ongoing, periodic subsidies that merely maintain land uses at non-sustainable levels (Hobbs & Norton, 1996). For example, thinning an overgrazed forest, without restoring native bunchgrasses lost to grazing, may simply lead

to a new pulse of tree regeneration that will have to be thinned again. Moreover, if bunchgrasses are restored, new grazing methods that will sustain restored native bunchgrasses are needed. These bunchgrasses have been shown in Southwestern forests to be a key ecosystem component that discourages or prevents tree regeneration (Pearson, 1942).

CONCLUSIONS

The data available to address the applicability of the variable-severity and low-severity models include about 80 observations from 16 forest reserve reports (Fig. 1), supplementary historical analyses (e.g. Shinneman & Baker, 1997), 10 fire scar/age structure studies (Fig. 3a), and 20 direct measurements or reconstructions of tree density near AD 1900 (Fig. 3b, Table 2). Based on these data together, the variable-severity model, which emphasizes an important role for severe fires in the historical fire regime, appears to apply to a larger portion of the ponderosa pine–Douglas fir zone in the Rocky Mountains than does the low-severity model. In most Rocky Mountain ponderosa pine–Douglas fir forests, the variable-severity model, in which forest structures were shaped mainly by infrequent severe fires, is consistent with the evidence of fire history and tree age structures in these forests. Only limited areas of ponderosa pine–Douglas fir forests in the Rocky Mountains, primarily at low elevations and on xeric sites, appear to have been shaped primarily by low-severity fires. To assess which model may best fit a potential management area, site-specific information on fire history and forest conditions is required.

For the purpose of ecological restoration in Rocky Mountain ponderosa pine–Douglas fir landscapes, the most appropriate action at the present time is a mixture of modest passive and active approaches. Undisturbed mature forests require little or no restoration – a passive approach is best. Active approaches may include a little thinning of young stands to enhance structures typical of later stages of development, combined with protection of old trees, reversal of adverse effects of logging and livestock grazing, and changes in land uses so they do not continue to cause degradation. Reintroduction of both low-severity surface fires and high-severity fires may be feasible under some circumstances of land use. However, reintroduction of fire should not be based on converting dense mature stands into sparse open woodlands based on the false premise that surface fires previously maintained tree populations at low densities. Thinning these forests is likely to lead to renewed tree regeneration, hence a need for renewed thinning, in a potentially endless, costly and futile cycle that does not restore the forest. Large, dead wood in most of these forests does not need reduction; certainly, raking, piling and burning large, dead wood is misdirected as these fuels may be ancient and are more likely to be in deficit than in surplus. A modest suite of reversal–reform approaches will provide benefits for both people and the ecosystem, and can begin today, even without needed research at the landscape scale. Ponderosa pine–Douglas fir forests in the Rocky

Mountains, where the variable-severity model applies, are not in seriously degraded condition, compared to forests in which the low-severity model applies, and do not require much costly thinning and other active restoration actions. The variable-severity model, which applies to most of these forests, suggests that Rocky Mountain ponderosa pine–Douglas fir landscapes historically were dense, have long been naturally fire-prone, are dangerous places to live, and will remain so after restoration.

ACKNOWLEDGEMENTS

We thank Paul Hessburg, Craig Allen, Deborah Paulson, Tania Schoennagel, Robert Keane and two anonymous referees for comments on earlier drafts. This work was supported in part by the US Geological Survey, Biological Resources Division, Cooperative Agreements 1434-HQ-97-RU-01542 to W.L.B. and 99CRAG0016 to T.T.V., by the Colorado State Forest Service (T.T.V.), National Science Foundation Dissertation Improvement Award No. BCS-0221493 to R.L.S., and by NSF Award DEB-0314305 to T.T.V.

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SUPPLEMENTARY MATERIAL

The following supplementary material is available for this article online from <http://www.Blackwell-Synergy.com>:

Table S1 Observations in forest reserve reports on fire severity in ponderosa pine–Douglas fir forests

Table S2 Observations in forest reserve reports on killing of small trees by surface fires

Table S3 Observations in forest reserve reports on tree regeneration after surface fires

Table S4 Observations in forest reserve reports on the density of trees in ponderosa pine–Douglas fir forests

BIOSKETCHES

William L. Baker is Professor of Geography and member of the Ecology Program at the University of Wyoming. His research interests are in fire ecology, landscape ecology and conservation.

Thomas T. Veblen is Professor of Geography at University of Colorado at Boulder, where he has taught since 1981. He has conducted research on biogeography and ecology in the forests of Guatemala, southern South America, New Zealand and the US Rocky Mountains.

Rosemary L. Sherriff is an Assistant Professor of Geography at University of Hawaii at Hilo. Her research interests include biogeography, vegetation and disturbance dynamics, and landscape change.

Editor: Glen MacDonald

HCPC Bald Angel Comments

Kurt Wiedenmann
3502 Highway 30
La Grande, Or 97850

January 9, 2006

Sent via e-mail and snail mail

Dear Kurt,

Please accept these comments from Hells Canyon Preservation Council and the Sierra Club Juniper Group the the Bald Angel proposal..

Please incorporate in these comments all prior comments and appeals for this Bald Angel proposal or other named proposals in this area made by HCPC.

Thank you for enhancing the cumulative effects analysis in the new EA. The EA did not address any harvest before 1978 which likely highly impacted the species mix and age of existing trees in the area. It is very likely that the area was completely logged from the 1800's up until 1978 at least once. The impacts of this earlier logging have left their mark on the present stand of trees and need to be analyzed.

The new EA underscores the degraded baseline conditions of the Bald Angel project area. This area would be referred to by Aldo Leopold and others as a sick forest, mainly due to human disturbance. Poor water quality, loss of wildlife habitat, diversity and old growth are of primary concern to the public. .Fire suppression has also contributed to the high level of stress on this ecosystem.

“The proposed treatments are prescribed to address needs within the project area for the next 10+ years.” P.3. The key issues seem to cover a time frame much longer than 10+ years, p. 10. These conflicting time frames blur the objective of this proposal.

Roads continue to be a high level stresser in the area, p3. High road densities in combination with regulated cross country OHV access create problems for wildlife and water quality. Several miles of drawbottom roads located in or near riparian zones continue to degrade water quality through sediment delivery.

The proposed action p. 3, is unclear and does not detail proposed actions. Stands needing fuels and density reduction will only be effective for the next 10 years but the lasting impacts will last much longer. Alternative 2 is the proposed action. Alternative 3 is the preferred action.

The EA states that fuel reduction is needed to “aid in fire suppression” and to “reintroduce fire as a disturbance factor”. It seems that fire could, on its own, without fire suppression reduce fuel and density levels. The public pays for the FS to fight fires, and pays the FS to light fires and pays for fuel reduction. Nature can provide these services without charging the taxpayers for these services.

Old growth, LOS, MSLT, SSLT, Old Forest Habitat, MA 15 all relate to old growth habitat available on the WWNF. These definitions all get entangled with one another and confuse the issue for the public. In November of 2005 I requested an inventory of old growth on the WWNF and was sent a map of MA 15 areas. This implies that MA15 areas are old growth but a number of people have told me that not all MA 15 areas are old growth and there are other areas outside of MA 15 that are old growth. Others have said LOS (late old structure) is often found outside of MA 15 areas. Most people would agree true old growth has declined significantly from the historical range of variability (HRV).

In the book “Forest Dreams, Forest Nightmares”, about the Blue Mountains it states, “In 1912, 71% of the stands were open and full of old pine, in 1991 only 10 percent fits this description.” I doubt that in 2006 there is 10 percent left but there is no accurate data to confirm this.

The EA clearly states that old growth (i.e. MSLT and SSLT) is lacking in the Bald Angel project area and implied that it is lacking on a forest wide level and is not well connected for source habitat for terrestrial species, p. 9... The need for old growth is critical to provide habitat for the population viability of many species.

The abbreviated analysis of insects and disease in the EA is incomplete as a key issue and suggests the need for an EIS to fully explain the forest dynamics and possible alternative solutions, if truly needed.

The Eastside Screens were implemented to protect large living trees to provide habitat for many species. Whether or not the screens have been effective is unknown because of a lack of population data to provide evidence either way. There is also no evidence to show the effectiveness of old growth as defined by the Forest Plan or LOS or SSLT or MSLT is protecting wildlife viability.

The 36,700 acre Bald Angel project area may or may not be effectively treated to decrease the possibility of a high severity fire. Climate has been and will likely continue to be the primary factor in large scale wildfires of high severity. Typically only a small portion of any fire has high severity impacts to the soil. So the public wants to know, what are the costs in terms of taxpayer dollars and to the environment and what are the benefits of this proposal? This EA fails to give a clear picture of this proposal in these terms. For example, what is the probability of a high severity fire in the next 10 years with no action and what would be the probability after the treatment? How will global climate change effect fire behavior in this project area?

“Restore hydrologic processes to ensure favorable water quality conditions for aquatic, riparian and municipal uses.” P. 9. The only part of the action alternatives that will help restore hydrologic processes in the area are the motorized closures if it is enforced.

“HRV is important to wildlife populations because the distribution, quality and quantity of habitat largely determine the potential for a wildlife species to exist at viable levels. As habitat was converted, fragmented and opened to motorized access, many species were reduced in number and others were precluded from portions of their geographic range altogether” p. 12. The EA supplies no population data to confirm or deny this statement. Managing habitat is important for the

viability of species but without population data the public does not know what the past impacts have been or will be into the future. With the continued loss of habitat it is likely to expect declining wildlife populations for MIS and other species.

“Late/old habitat is not well connected anywhere in analysis area, with many patches isolated by more than a mile from the next closest patch.” P. 12. This fragmentation spells trouble for many species in terms of lack of habitat and cover.

Action alternatives will most likely to negatively affect existing cover and big game security habitat. With nearly 9,000 acres of winter range at lower elevations big game will likely suffer from the proposed actions.

Elk, a MIS, will likely continue to experience population declines if this proposed moves forward. The HEI standard is not being met. The management objectives set by ODFW are not being met. Considering that motorized use is continuing to occur on closed roads and there is no proposal to increase enforcement, what makes you believe closing more roads will keep motorized traffic from using this area? The impacts of OHV use on closed roads is not considered in the HEI analysis so the HEI is inaccurate in estimating effects of motorized use on elk populations. Unregulated motorized use will continue to degrade elk habitat and degrade other resources such as snag retention by firewood cutters unless action is taken to correct the problem.

“Fuel conditions are an important factor in wildland fire behavior.” P. 16. This may be true but recent science shows the most important factor is weather so managing fuels will likely only have a small effect on fire impacts. The consequences of fuel management are not well described in the EA. For example, what are the increased erosion factors from increased driving on roads and disturbing ground when reducing fuels? An EIS could explore more of these impacts in detail.

The impacts to water quality as discussed on pages 18-20 point out the poor health of the watersheds in the analysis area. Proposed action alternatives will likely further degrade water quality. According to the analysis file, “All streams within the project area are well below the objective of 96 pools/mile and are considered in poor condition.”

“Rodents prevent reestablishment of native perennial grasses and shrubs by frequently churning the soil...” What about impacts of livestock grazing on native perennial grasses? The EA fails to discuss how grazing has replaced native perennial grasses with annual non-native grasses and the impacts this has on the ecosystem. An EIS could explore this issue.

Pileated woodpecker, northern goshawk and American marten, all MIS, depend on old growth and mature forests. P. 21. Unfortunately there is not data on population trends of these species in the analysis area or on the forest as a whole. Without population data, habitat for these species is critical for gauging the viability of these species. Unfortunately the action alternatives will decrease habitat for these species, likely adversely impacting the population viability.

Elk appear to be the only MIS that has any population trend data available. The trend is declining and should be a concern of the WWNF. MIS serve as indicators of a broad range of other species p. 22. In addition, neotropical birds have experienced population declines in many areas of North

America (Finch, 1991) and likely declines in the analysis area also but there is no data offered for the Bald Angel area.

NOAA recommends less than 2 miles per square mile and no valley bottom roads for steelhead. It seems rational to use this same recommendation for wild native trout in the analysis area to reband trout, a sensitive species. The table on page 23 shows many areas violating the Forest Plan road density guidelines. Illegal user-created roads add to the actual miles and densities that further put a strain on the ecosystem and are not accounted for in figuring road density numbers.

Magistrate Judge Papak ruled in the recent NF Burnt River case on the WWNF wrote:

“Forest Plan Open-Road Density Standards

Plaintiffs argue that the Forest Service's authorized mining plans fail to comply with the open-road density standards of the WWNF Forest Plan. This open-road density guideline provides that the Forest Service must "[m]eet the specific open-road density guidelines found in the direction for individual management areas unless a specific exception is determined, through the Forest Service NEPA process, to be needed to meet management objectives." AR 00227

The Forest Service points out that prior to the ROD, the open-road density for all the subwatersheds in the project area exceeded the Forest Plan guidelines. AR 08075; FEIS II-57.

The Forest Service argues that it has complied with the open-road density provisions of the Forest Plan in that road closures and decommissionings will decrease open-road density in one of the management areas, and that the agency has complied with its responsibility under NEPA and found an exception to the guideline was necessary to meet the management objectives of providing access for miners and others. In the ROD, the Forest Service notes that mining plans will exceed road densities "due to mining and private property access needs, administrative use and needs of other forest users." AR 07951. However, the ROD and the FEIS do not present an analysis of whether these are the specific management objectives that warranted exceptions from open-road density guidelines. To the extent that the Forest Service relies on the speculative road closures and decommissionings addressed above, this court is not persuaded the Forest Service has made a proper finding regarding open-road density in the project area. Also, the Forest Service has failed to make a determination that the plans at issue necessarily warrant a specific exception from the Forest Plan's open-road density guideline to achieve management objectives. While the Forest Service argues that it is not required to make more "formal findings" on this issue, this court disagrees because without more analysis, a reviewing court will not have a basis for rational review. See *Motor Vehicles Manufacturers Ass'n v. State Farm Mutual Auto Ins. Co.*”

Given this ruling, the WWNF needs to re-assess the road density issue in Bald Angel and clearly give reasons why an exception is warranted. Without more analysis the court is likely to take a hard look at the Bald Angel proposal. Table on page 104 discloses several watersheds are out of the Forest Plan compliance.

According to the analysis file, "...a complete field reconnaissance was not done on this project," in terms of road inventory. Field reconnaissance typically yields an increase of open route miles due to unclassified roads.

Alternative A was eliminated because it did not adequately reduce tree densities in overstocked stands. No data is offered by the EA to confirm that thinning of small diameter would not achieve the objective. Again, an EIS could be necessary to shed light on this issue.

Cutting commercial logs within the riparian areas would violate the INFISH no-cut buffer guidelines and decrease the large woody recruitment in riparian zones. Non-commercial thinning could reduce stand density with less disturbances to streams.

The 9th Circuit panel said forest managers had scant evidence to prove their claim that thinning and salvage logging in old-growth forests would benefit wildlife. Rather, the majority said, it is unclear whether the proposed logging would benefit old-growth dependent species like the northern goshawk and pileated woodpecker.

"Just as it would be arbitrary and capricious for a pharmaceutical company to market a drug to the general population without first conducting a clinical trial to verify that the drug is safe and effective, it is arbitrary and capricious for the Forest Service to irreversibly 'treat' more and more old-growth forest without first determining that such treatment is safe and effective for dependent species," the majority of the 9th Circuit found ([Land Letter](#), Dec. 15, 2005).

The EA does not adequately demonstrate that thinning MSLT will help old growth dependent species in the Bald Angel area. Again the need for an EIS is warranted.

Alternative 2, the proposed alternative, and Alternative 3, the preferred alternative, are supposed to improve long term forest health, protect and increase LOS, protect and increase big game security and return fire intervals to natural levels. P. 35. Unfortunately this can not be expected for several reasons. First, "The proposed treatments are prescribed to address needs within the project area for the next 10+ years." Not for the long term. Second, the EA fails to demonstrate how LOS will be protected by thinning old growth and what are the consequences of thinning on wildlife and other resources such as water quality? Third, big game security will be degraded by logging and the roads closed alone will not effectively stop motorized use of the closed roads. Fourth, fire return intervals will only return to natural levels if the WWNF is committed to prescribed burning every 20 years which is beyond the scope of this project or natural fire is allowed to return to its normal process in the area.

The EA states that stocking levels exceed recommended numbers in approximately 25% of the stands across all biophysical groups in the Bald Angel Planning area. No data is offered as to what the natural levels of overstocked stands were historically. It is impossible for the decision maker and the public to compare the differences.

Past release treatments may have helped to maintain appropriate stocking levels in the short term but may make things worse in the longer term as new seedlings are established when trees and brush are removed.

There have been no large fires in the planning area since 1963 so the fire return interval has been disrupted and has contributed to overstocked stands because of fire suppression.

The “collateral” damage expected from these action alternatives include weed spread, increased sediment in streams, loss of wildlife cover, loss of complexity and diversity, reduced canopy closure, reduced prey base for predators, fragmented wildlife corridors, continued fire suppression will move the area further out of balance, soil compaction and loss and tax payer subsidies. The public should be asked if it is worth over \$1,000,000 to do this project? Could the money be spent on other projects such as real restoration to help wildlife instead?

Throughout the EA there are many references to allowing mature stands to progress toward LOS habitat for wildlife but there is no proposal to designate these stands as replacement old growth and protect them from future logging. Perhaps there should be a forest plan amendment to change or create a new management area designation to protect these places from development and take them out of the timber base.

It is interesting that the EA is concerned about “dollars out of the taxpayer’s pocket” p. 95 in relation to county payments but no mention of dollars out of the taxpayers pocket in regards to the national taxpayers expected by the action alternatives as a whole. Under the current system counties no longer get 25% of stumpage.

The economic analysis of the action alternatives paints a grim picture of this project. The lack of clear and complete economic information begs for the need of an EIS to properly present the true costs and benefits of this proposal.

The EA claims there will be no measurable changes to sediment delivery rates as well as no direct impacts on stream shade and bank stability but gives no data or analysis as to why this might be true. Again, an EIS is needed

Some detrimental soil conditions (DSC) require recovery times of 100 or more years p. 105. After reviewing all the past disturbances in the project area, it seems very likely DSCs happened and have not yet recovered. Adding new soil impacts that the action alternatives would do, will only add to the problem. “Essentially, all life depends upon the soil... There can be no life without soil and no soil without life, they have involved together.” - Charles Kellogg, 1938.

The loss of nutrients by removing trees from the ecosystem will decrease long term soil health. Reducing the N-capital is only a small part of the loss. Other benefits of trees left on site have not been analyzed in terms of soil health or wildlife needs. Again, an EIS is needed.

The top of page 122 refers to INFS with no explanation as to what it is?

The 4 of 6 grazing allotments in the project area are overdue for NEPA analysis as mandated by the Rescissions Act. Without this analysis, cumulative impacts on wildlife are unknown and provide no information on forage, weed spread by livestock or adverse water quality impacts from grazing.

Clearly there is a need to prepare an EIS for this proposal given the size and scope of direct and indirect impacts, cumulative impacts and the lack of complete data and information on a number of issues. If the WWNF decides not to do an EIS then we suggest you choose Alternative 4, amended to exclude commercial logging.

In December 2006 I requested to know if the WWNF Roads Analysis is final?

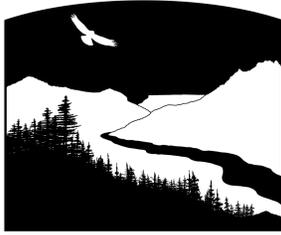
I also requested any new additions to the analysis file for this project. Please confirm that I have the complete analysis file.

Thank you for the opportunity to comment.

Sincerely,

Larry McLaud
Hells Canyon Preservation Council
PO Box 2768
La Grande, OR 97850
541-963-3950

Asante Riverwind
Eastern Oregon Forest Organizer
Oregon Chapter Sierra Club
P.O. Box 963
Sisters, Oregon 97759
(541) 549-1782 office
(541) 306-7737 field



OREGON WILD

Formerly Oregon Natural Resources Council (ONRC)

PO Box 11648 | Eugene OR 97440 | 541-344-0675 | fax 541-343-0996
dh@oregonwild.org | <http://www.oregonwild.org/>

9 Jan 2007

Kurt Wiedenmann
LaGrande District Ranger
kwiedenmann@fs.fed.us

Subject: Bald Angel Vegetation Management Project EA #2

Dear Ranger Weidenmann:

Please accept the following comments from Oregon Wild (formerly Oregon Natural Resources Council) concerning Bald Angel Vegetation Management Project EA #2 dated December 2006. Oregon Wild represents about 5,000 members who support our mission to protect and restore Oregon's wildlands, wildlife, and water as an enduring legacy. Our goal is to protect areas that remain intact while striving to restore areas that have been degraded. This can be accomplished by moving over-represented ecosystem elements (such as logged and roaded areas) toward characteristics that are currently under-represented (such as roadless areas and complex old forest).

The preferred alternative 2 involves:

- 12.5 mmbf
- 4869 acres of timber harvest
- 352 acres of “release” w/ harvest
- 860 acres of “release” w/o harvest
- 3885 acres of tractor logging, plus 618 acres of skyline, and 359 acres of helicopter)
- 13,770 acres of prescribed fire
- 128 acres of treatment in RHCAs
- 1445 acres of LOS (old forest) treatment
- 937 acres of wildlife corridors treated
- 1843 acres of satisfactory cover degraded to marginal cover
- 3118 acres of marginal cover converted to forage
- 16.64 miles of road closure
- ?1-29 miles of road decommissioning
- 2.26 miles of road reconstruction

- 1.7 miles of road construction
- 10.4 miles of temporary road construction
-

This project has not significantly changed since it was previously approved. The concerns raised in our appeal remain valid:

- The EA fails to adequately consider and evaluate a reasonable number and variety of alternatives, in violation of NEPA's requirements of examining all reasonable alternatives that meet project objectives.
- The EA fails to adequately examine cumulative effects from past logging, grazing and adjacent private land management.
- The EA would further degrade already degraded big game habitat by constructing additional roads on an area that already exceeds LRMP standards for road density and removing cover.
- The EA represents a flawed approach to protecting soil health, as directed by the LRMP.
- The EA fails to adequately protect snags and down wood to the degree required by the LRMP and indicated as proper under ICBEMP.
- The EA proposes to convert multi story old growth (MSLT) into single story old growth (SSLT) when the amount of old growth is below the HRV for both old growth types.
- The inadequate economic analysis violates NEPA.
- The data gaps and lack of clear references to scientific information violates NEPA.
- The EA will not ensure the viability of wildlife species and is a violation of NFMA.

General recommendations for fuel reduction thinning

1. When conducting commercial thinning projects take the opportunity to implement other critical aspects of watershed restoration especially reducing the impacts of the road system and livestock grazing and establishing the ecological processes that will allow streams and fire regimes to recover.
2. Use the historic range of variability as a guide, but don't just focus on seral stage. Consider also the historic abundance of large trees, large snags, roadless areas, etc. all of which have been severely reduced from historic norms.

3. New evidence indicates that far more of the “dry” forests, rather than being typified low severity fire regimes, were in fact dominated by mixed severity fire regimes (including significant areas of stand replacing fire), so mixed severity fire is an important part of the historic range of variability that should be restored. The goal should not be a uniform low severity fire regime, but rather a wide mix of tree densities in patches of varying sizes. This objective can often be met by reintroducing fire.
4. Prioritize treatment of the dense young stands that are most "plastic" and amenable to restoration. Another priority is to carefully plan and narrowly target treatments to protect specific groves of fire-resistant, old-growth trees that are threatened by ingrowth of small fuels.
5. Thin from below, retaining the largest trees. Retain all large trees and most medium sized trees so they can recruit into the larger classes of trees and snags. Regardless of size, retain all trees with old-growth characteristics such as thick bark, yellowing bark, flat top, asymmetric crown, broken top, forked top, etc. These trees have important habitat value and human values regardless whether they are 21” dbh.
6. Remember diameter caps are a tool in the tool box, don't reject the tool out of hand. The public likes it a lot because it gives them assurances. It is OK to use different diameter caps for different species, lower limits for fire resistant species, higher limits for fire intolerant species. The exceptional circumstances in which diameter caps allegedly don't work, are more rare than the circumstances in which alternative techniques will lead to unintended consequences, including lack of public trust.
7. Recognize that thinning affects fire hazard in complex ways, possibly even making fire hazard worse because thinning: creates slash; moves fine fuels from the canopy to the ground (increasing their availability for combustion); thinning increases ignition risk; thinning makes the forest hotter, dryer, and windier; and makes resources available that could stimulate the growth of future surface and ladder fuels. Fuel reduction must find the sweet spot, remove enough of the small surface and ladder fuels while retaining enough of the medium and large trees to maintain canopy cover for purposes of microclimate, habitat, hydrology, suppression of ingrowth, etc.
8. There is growing evidence that in order to be effective, mechanical treatments must be followed by prescribed fire. But the effects of such fires must also be carefully considered.
9. Don't thin to uniform spacing. Use variable density thinning techniques to establish a variety of microhabitats, break up fuel continuity, create discontinuities to disrupt the spread of other contagious disturbances such as disease, bugs, weeds, fire, etc.
10. Retain patchy clumps of trees which is the natural pattern for many species.
11. Retain and protect under-represented species of conifer and non-conifer trees and shrubs. Retain patches of dense young stands as wildlife cover and pools for recruitment of future forests.
12. Use your creativity to establish diversity and complexity both within and between stands. Use skips and gaps within units to help achieve diversity. Gaps should be

- small, while skips should be a little larger. Gaps should not be clearcut but rather should retain some residual structure in the form of live or dead trees. Landings do not make good gaps because they are clearcut, highly compacted and disturbed, more likely subject to repeated disturbance, and directly associated with roads.
13. Thin heavy enough to stimulate development of some understory vegetation, but don't thin so heavy that future development of the understory become s more significant problem than the one being solved with the current project.
 14. The scale of patches in variable density thinning regimes is important. Ideally variability should be implemented at numerous scales ranging from small to large, including: the scale of tree fall events; pockets of variably contagious disturbance from insects, disease, and mixed-severity fire; soil-property heterogeneity; topographic discontinuities; the imprint of natural historical events; etc.
 15. Recognize that thinning captures mortality and that plantation stands are already lacking critical values from dead wood due to the unnatural stand history of all clearcut and planted stands.¹
 16. Retain abundant snags and course wood and green trees for future recruitment of snags and wood. Retention should be both distributed and in clumps so that thinning mimics natural disturbance. Retention of dead wood should generally be proportional to the intensity of the thinning, e.g., heavy thinning should leave behind more snags not less. Retain wildlife trees such as hollows, forked tops, broken tops, leaning trees, etc.
 17. If using techniques such as whole tree yarding or yarding with tops attached to control fuels, the agency should top a portion of the trees and leave the greens in the forest in order to retain nutrients on site.
 18. Avoid impacts to raptor nests and enhance habitat for diverse prey species. Train marking crews and cutting crews to look up and avoid cutting trees with nests of any sort and trees with defects.
 19. Take proactive steps to avoid the spread of weeds. Avoid and minimize soil disturbance. Use canopy cover and native ground cover to suppress weeds.
 20. Buffer streams from the effects of heavy equipment and loss of bank trees and trees that shade streams. Mitigate for the loss of LWD input by retaining extra

¹ Tom Spies made some useful observations in the Northwest Forest Plan Monitoring Synthesis Report: "Certainly, the growth of trees into larger diameter classes will increase as stand density declines (Tappeiner and others 1997). At some point, however, the effect of thinning on tree diameter growth levels off and, if thinning is too heavy, the density of large trees later in succession may be eventually be lower than what is observed in current old-growth stands. In some cases, opening the stand up too much can also create a dense layer of regeneration that could become a relatively homogenous and dominating stratum in the stand. Furthermore, if residual densities are too low, the production of dead trees may be reduced (Garman and others 2003). Thinning should allow for future mortality in the canopy trees." <http://www.reo.gov/monitoring/10yr-report/documents/synthesis-reports/index.html>

snags and wood in riparian areas. Recognize that thinning captures mortality that is not necessarily compensated by future growth.²

21. Protect soils by avoiding road construction and machine piling, minimizing ground-based logging, and avoiding numerous, large, burn piles. Where road building is necessary, ensure that the realized restoration benefits far outweigh the adverse impacts of the road, build the roads to the absolute minimum standard necessary to accomplish the job, and remove the road as soon as possible to avoid firewood theft and certainly before the next rainy season to avoid stormwater pollution.

Eastside screens

The NEPA analysis must disclose how the project will comply with all the requirements of the Eastside Screens.

The Eastside Screens say “2) Outside of LOS, many types of timber sale activities are allowed. The intent is still to maintain and/or enhance LOS components in stands subject to timber harvest ... Manipulate vegetative structure that does not meet late and old structural (LOS) conditions, ... in a manner that moves it towards these conditions as appropriate to meet HRV. ... Manipulate vegetation in a manner to encourage the development and maintenance of large diameter, open canopy structure.”

Looking at the old-growth definition from ICBEMP

(<http://www.icbemp.gov/pdfs/sdeis/Volume2/Appendix17a.pdf>) it is clear that LOS “components” such as abundant snags must be retained and recruited, and many small and medium sized trees are needed grow into large trees. Thinning dense understory trees might help move stands toward LOS, but any action that would remove snags or reduce recruitment of medium trees into large tree classes would not be consistent with the Eastside Screens.

The Eastside Screens also state “To reduce fragmentation of LOS stands, or at least not increase it from current levels, stands that do not currently meet LOS that are located within, or surrounded by, blocks of LOS stands should not be considered for even-aged regeneration, or group selection at this time.” Any action that would build roads or establish young even-aged stands would not meet the Eastside Screens. Heavy thinning for fuel reduction should also be evaluated under this connectivity standard.

Recognizing the fact that past logging practices have greatly reduced the abundance of large trees and snags, the Eastside Screens also require that projects use the best available science to meet the intent of 100% potential populations of primary cavity excavators.

² “[T]he data have not supported early expectations of ‘bonus’ volume from thinned stands compared with unthinned. ... [T]hinings that are late or heavy can actually decrease harvest volume considerably.” Talbert and Marshall. 2005. Plantation Productivity in the Douglas-fir Region Under Intensive Silvicultural Practices: Results From Research And Operations. *Journal of Forestry*. March 2005. pp 65-70. *citing* Curtis and Marshall. 1997. LOGS: A Pioneering Example of Silvicultural Research in Coastal Douglas-fir. *Journal of Forestry* 95(7):19-25.

While the potential population methodology has been discredited the Forest Service must still meet the intent by not taking any action that could reduce population of primary cavity excavators.

The NEPA analysis must take a hard look at the habitat needs of primary cavity excavators over the long term. It is not enough to meet the needs of woodpeckers for a few years after harvest. Maintaining viable populations of primary cavity excavators will require retention of virtually all the overstory trees so that there is a long-term supply of snags and dead wood.

Capturing mortality will make a bad situation worse for snag habitat

Page 130 of the EA indirectly admits that the proposed logging will make a bad situation worse for snag habitat, because past logging activity has resulted in a deficit of large snags and the current action will continue that negative trend. The EA then has two misleading statements: that thinning benefits large snags, and that this is a minor incremental effect.

The east side screens require that the Forest Service maintain 100% potential population levels of primary cavity excavators determined using the best available science. Since current Forest Service standards have been scientifically discredited, the FS needs to investigate options and adopt new standards using NEPA and NFMA procedures.

The EA does not consider or disclose the cumulative regional adverse impact of past, present and the foreseeable aggressive fuel reduction efforts on already degraded snag habitat. An EIS is needed to address this issue.

New information on Snags.

An unavoidable impact of all commercial logging is to “capture mortality” which reduces valuable snag habitat in the short-term (via hazard tree felling) and in the long-term (via delayed recruitment and reduced overall recruitment). For example, in a thinning project on the Siuslaw National Forest “modeling stand #502073 over a 100-year cycle [using ORGANON] predicts a total stand mortality of 202 trees (>10 inches dbh) for the unthinned stand, while mortality for the thinned stand was two trees. Therefore, thinning will reduce density-dependent mortality within the stand by 99%.”³ There is no reason to think that thinning in densely stocked forests elsewhere would be any different.

The federal forest agencies now recognize that current methods and assumptions concerning snag habitat standards are outdated, and the old snag standards do not ensure enough snags to meet the intent of the standard, yet the agencies have not adjusted their management plans to account for this new information nor have they developed new standards that are consistent with the latest scientific information. The agencies need to prepare a EIS to consider a replacement methodology for maintaining species and other

³ NOAA April 4, 2006 Magnuson Act consultation on Essential Fish Habitat and Response to Siuslaw NF Lobster Project BA.

values associated with dead wood. This is especially critical because adequate dead wood is recognized as an essential feature of healthy forests and the Forest Service has identified lots of “management indicator species” associated with dead wood habitat.

Back in the early 1990s the Forest Service recognized the their forest plans were not adequate to maintain populations of spotted owls and they tried to develop plans to conserve spotted owl without following NEPA and NFMA procedures. The courts said they had to stop cutting owl habitat until they had complied with environmental laws. This is the same situation we find ourselves in today with dead-wood associated species. The agencies should stop harming dead wood habitat until they have a legal plan to conserve associated species over the long-term.

Bull et al. states that the current direction for providing wildlife habitat on public forest lands does not reflect the new information that is available which suggests that to fully meet the needs of wildlife, additional snags and habitat are required for foraging, denning, nesting, and roosting (1997). Johnson and O’Neil (2001) and Rose et al. (2001) also state that several major lessons have been learned in the period 1979 to 1999 that have tested critical assumptions of earlier management advisory models (2001), including some of the assumptions used to develop the current recommendations in the LRMP Standards and Guidelines, as amended by the Regional Forester’s Amendment #2. Some assumptions include:

- calculation of numbers of snags required by woodpeckers based on assessing their “biological (population) potential” is a flawed technique (Johnson and O’Neil 2001). Empirical studies are suggesting that snag numbers in areas used and selected by some wildlife species are far higher that those calculated by this technique (Johnson and O’Neil 2001).
- numbers and sizes (dbh) of snags used and selected by secondary cavity nesters often exceed those of primary excavators (Johnson and O’Neil 2001).

This suggests the current direction of managing for 100 percent population potential levels of primary excavators may not represent the most meaningful measure of managing for cavity-nesters and that these snag levels, under certain conditions, may not be adequate for some species.

<http://www.fs.fed.us/r6/frewin/projects/analyses/barneslong/ea/appb.pdf>

Lessons Learned During the Last Fifteen Years

...

Several major lessons have been learned in the period 1979-1999 that have tested critical assumptions of these earlier management advisory models:

- . Calculations of numbers of snags required by woodpeckers based on assessing their biological potential. (that is, summing numbers of snags used per pair, accounting for unused snags, and extrapolating snag numbers based on population density) is a flawed technique. Empirical studies are suggesting that snag numbers in areas used and selected by some wildlife species are far higher than those calculated by this technique.²²⁶

- . Setting a goal of 40% of habitat capability for primary excavators, mainly woodpeckers,³⁶⁹ is likely to be insufficient for maintaining viable populations.
- . Numbers and sizes (dbh) of snags used and selected by secondary cavity-nesters often exceed those of primary cavity excavators.
- . Clumping of snags and down wood may be a natural pattern, and clumps may be selected by some species, so that providing only even distributions may be insufficient to meet all species needs.
- . Other forms of decaying wood, including hollow trees, natural tree cavities, peeling bark, and dead parts of live trees, as well as fungi and mistletoe associated with wood decay, all provide resources for wildlife, and should be considered along with snags and down wood in management guidelines.
- . The ecological roles played by wildlife associated with decaying wood extend well beyond those structures per se, and can be significant factors influencing community diversity and ecosystem processes.

Rose, C.L., Marcot, B.G., Mellen, T.K., Ohmann, J.L., Waddell, K.L., Lindely, D.L., and B. Schrieber. 2001. Decaying Wood in Pacific Northwest Forests: Concepts and Tools for Habitat Management, Chapter 24 in *Wildlife-Habitat Relationships in Oregon and Washington* (Johnson, D. H. and T. A. O'Neil. OSU Press. 2001)

<http://www.nwhi.org/nhi/whrow/chapter24cwb.pdf>

The potential population models are based on the number of trees needed for nesting cavity-excavator birds, however, “[t]he high value of large, thick-barked snags in severely burned forests has as much to do with feeding opportunities as it does with nesting opportunities they provide birds.” (Hutto. *ConBio* 20(4). 2006). The number of snags needed to support bird feeding, escape from predators, and other life functions, is different than, and likely higher than, the number of snags needed to support nesting, so the agencies’ existing “potential population” snag standards are arbitrary and capricious.

There is evidence that retaining more than the minimum number of snags has significant benefits for cavity dependent species. Comparing two sites in Northern California, Blacks Mountain Experimental Forest (BMEF) with little past logging and lots of snags, and Goosenest Adaptive Management Area (GAMA) with lots of logging and fewer snags, the author’s found “... three times as many snags (6.38/acre vs. 2.04/acre, respectively) ... The use of snags by cavity-nesting bird species was dramatically different between the sites. Thirty-one cavity-nesting pairs from 10 species were detected at BMEF, while only one pair each of two species were detected at GAMA... This fifteenfold difference is much greater than any measure of snags or cavities reported. ...”

We feel that forest managers may well be asking a misleading question. “Snags per acre” requirements implicitly assume an equilibrium condition and reflect only one ecological requirement for a given cavity-nesting species. ... [C]onsideration of foraging habitat and other ecological requirements must be part of the “snags per acre” management considerations. This is an important, but somewhat daunting proposition, as potential cavity-nesting species are diverse, and each species likely has very different foraging ecologies, as well as other differences in habitat requirements. ... [C]avity nesters at BMEF used larger snags on average ... [T]he loss of large trees due to logging in eastside pine and

other forests, over the past century has major implications for cavity-nesting birds. ... [F]orest managers must have a sense of snag recruitment in relationship to snag fall, and the patterns and processes that underlie them, when addressing wildlife needs. ... We view the understanding of these complexities to be of primary importance in forest management for wildlife.

Steve Zack, T. Luke George, and William F. Laudenslayer, Jr. 2002. Are There Snags in the System? Comparing Cavity Use among Nesting Birds in “Snag-rich” and “Snag-poor” Eastside Pine Forests. USDA Forest Service Gen. Tech. Rep. PSW-GTR-181. http://www.fs.fed.us/psw/publications/documents/gtr-181/017_Zack.pdf

Another recent science publication asked that the agencies salvage policies be brought up to date with current science.

Inadequacy of Current Snag Guidelines

Current snag-retention guidelines for most North American plant community types fall between 1 and 8 snags/ha. These guidelines emerged primarily from a consideration of the nesting requirements of cavity-nesting vertebrate species in the now classic Blue Mountains book (Thomas 1979). The retention of 8 snags/ha was judged to support 100% of the maximum population density of any of the woodpecker species that occur in the Blue Mountains area (Thomas 1979: Appendix 22). Bull et al. (1997) concluded that about 10 snags/ha in ponderosa pine and mixed-conifer forests should support viable populations of cavity-nesting birds. Thus, most current U.S. National Forest guidelines generally converge on the recommendation to retain 6–10 trees/ha, as do guidelines for Washington State, the Ontario Ministry of Natural Resources, the U.S. Army Corps of Engineers, and many other land management agencies.

It has been acknowledged that snag guidelines should be sensitive to forest type and forest age because “the wildlife species that use snags are influenced by the stage of forest succession in which the snag occurs” and by the breakdown stage of the snag (Thomas et al. 1979). Moreover, snag types, sizes, and densities vary significantly with vegetation type (Harris 1999; Harmon 2002; White et al. 2002). Therefore, it follows necessarily that the desired snag types and densities will differ with both plant community type and successional stage and that we need as great a variety of guidelines as there are community types and successional stages (Bull et al. 1997; Everett et al. 1999; Rose et al. 2001; Kotliar et al. 2002; Lehmkuhl et al. 2003). Unfortunately, we have generally failed to adjust snag-retention recommendations to specific forest age, and nowhere is that failure more serious than for those special plant community types that were ignored in the development of the generic guidelines—recently burned conifer forests. Such forests are characterized by uniquely high densities of snags (Angelstam & Mikusinski 1994; Hutto 1995; Agee 2002; Drapeau et al. 2002), and snag use by most woodpeckers in burned forests requires high snag densities because they nest in and feed from burned snags.

These facts have been overlooked in the development and implementation of meaningful snag-management guidelines. Indeed, these guidelines have generally

converged toward an average of 6–7 trees/ha because that number was deemed more than adequate to meet the nesting requirements of cavity-nesting wildlife species (Thomas et al. 1979:69). Snag guidelines were not originally developed with an eye toward non-nesting uses of snags or from an attempt to mirror snag densities that typically occur on unmanaged reference stands. Snag guidelines are still much narrower than numerous authors have suggested they ought to be, and we currently run the risk of managing coarse woody debris with uniform standards across historically variable landscapes, which is entirely inappropriate. Instead, we should be managing for levels of coarse woody debris that more accurately mirror levels characteristic of the natural disturbance regime (Agee 2002). Clearly, we need more data on what might constitute meaningful snag targets for all forest types and successional stages, and those targets should be set on the basis of reference conditions from natural post disturbance forests, not from managed forest stands and certainly not from consideration of only a single aspect of an organism's life history.

Newer guidelines that are appropriate for snag dependent species that occupy standing dead forests at the earliest stage of succession are beginning to trickle in (Saab & Dudley 1998; Haggard & Gaines 2001; Saab et al. 2002; Kotliar et al. 2002), and authors suggest that 200–300 snags/ha may better address the needs of wildlife in burned forests. The issue has yet to receive the serious management attention it deserves, but the comprehensive review of habitat needs of vertebrates in the Columbia River Basin (Wisdom et al. 2000) and the recently developed DecAID modeling effort in Washington and Oregon represent important efforts toward providing that kind of management guidance (Marcot et al. 2002).

Current Postfire Management Decisions Related to Snag Retention

The following points regarding management decisions apply to western forest types that experience crown fire as at least a minor component of their fire regimes (and that is virtually all western forest types).

(1) The USFS uses fire as a motivation to harvest trees. This is evident because in most cases where postfire logging is proposed they had not already sold green-tree harvests in those particular areas prior to the time of fire disturbance. Even though land managers are becoming more aware of the overwhelmingly negative ecological impacts of postfire salvage logging, the management has not shifted correspondingly toward less salvage harvesting. Instead, the most common justification for such harvests seems to have shifted recently from “salvaging” what economic value there might be to preventing another catastrophic fire (McIver & Starr 2000). Recent modifications of legislation and regulations by provincial governments in Canada (cited in Nappi et al. 2003) and by the U.S. government as well (Healthy Forests Restoration Act) expedite or even provide incentives for salvage logging. Such legislation provides no commitment to meaningful snag retention on burned forest lands. This failure to appreciate the value of burned forests to ecosystem sustainability is exacerbated by the fact that industrial lands (and

most state lands) are, and probably always will be, completely salvage logged after fire because the value of those lands to those landowners lies entirely with the potential for short-term economic gain. The onus lies squarely on public land managers to provide the necessary protection of snag resources on burned forest land, and that has yet to happen.

(2) The usual agency response to questions about the amount or kind of burned trees to leave is that it does not really matter because they propose taking only a small proportion of what burned, so there must be plenty left for wildlife. Although that could be true, there is no scientific basis for such a conclusion. The volume of burned timber needed to enable populations to expand enough so that they can weather the next hiatus without fire in a particular area is unknown.

(3) If a partial salvage is proposed, the level of snag retention is generally based on a gross misapplication of current snag guidelines. In short, meaningful snag management guidelines for burned forests are lacking because the general public and the land management agencies that act on behalf of the public do not recognize the biological value of snags in burned conifer forests.

Hutto, R.L., 2006. Toward Meaningful Snag-Management Guidelines for Postfire Salvage Logging in North American Conifer Forests. *Conservation Biology* Volume 20, No. 4, 984–993.

The bottom line is that current management at both the plan and project level does not reflect all this new information about the value of abundant snags and down wood. The agency must avoid any reduction of existing or future large snags and logs (including as part of this project) until the applicable management plans are rewritten to update the snag retention standards. See also PNW Research Station, “Dead and Dying Trees: Essential for Life in the Forest,” *Science Findings*, Nov. 1999 (<http://www.fs.fed.us/pnw/science/scifi20.pdf>) (“Management implications: Current direction for providing wildlife habitat on public forest lands does not reflect findings from research since 1979; more snags and dead wood structures are required for foraging, denning, nesting, and roosting than previously thought.”) and Jennifer M. Weikel and John P. Hayes, HABITAT USE BY SNAG-ASSOCIATED SPECIES: A BIBLIOGRAPHY FOR SPECIES OCCURRING IN OREGON AND WASHINGTON, Research Contribution 33 April 2001, <http://www.fsl.orst.edu/cfer/snags/bibliography.pdf>.

Consider the following before relying on DecAID

The agency often tries to use DecAID as a substitute for the outmoded potential population methodology. DecAID, the Decayed Wood Advisor for Managing Snags, Partially Dead Trees, and Down Wood for Biodiversity in Forests of Washington and Oregon, <http://www.notes.fs.fed.us:81/pnw/DecAID/DecAID.nsf> Although DecAID helps bring together lots of useful information about snag associated species, the agency must recognize and account for the short-comings of DecAID and cannot rely on DecAID to provide the project-level snag standards because: DecAID is a tool designed for plan

level evaluations, because DecAID itself has not been subjected to NEPA analysis and comparison to alternatives, and because DecAID is an inadequate tool for the purpose.

1. Before relying on DecAID, the agency must prepare a comprehensive NEPA analysis to consider alternative ways of ensuring viability of all species dependent upon snags and dead wood. While it is true that the “potential population” or “habitat capability” method is no longer considered scientifically valid, the agency has not yet considered a full range of alternative methods to replace the habitat capability method mandated in the forest plans.
2. Before using DecAID, the agency must establish a rational link between the tolerance levels in DecAID and the relevant management requirements in the applicable resource management plan. For instance, since the Northwest Forest Plan and the Eastside Screens require maintenance of 100% potential population of at least some cavity-dependent species, the agency must explain why that does not translate into maintaining *100% of the potential tolerance level*. If the site is capable of supporting 80% tolerance levels, the agency should not be able to manage for 30-50% tolerance levels and still meet the 100% potential population requirement.
3. DecAID does not replace the discredited forest plan standards because DecAID is informational only. DecAID does not specify management objectives. The agency must specify the management objective based on RMP objectives for the land allocation or based on natural “range of variation.” Since large snags are outside the natural range of variability across the landscape, the agency must retain all large snags to start moving the landscape toward the natural range of variability, or the agency must carefully justify in the NEPA analysis every large snag it proposes to remove. See Jerome J. Korol, Miles A. Hemstrom, Wendel J. Hann, and Rebecca A. Grave nmier. 2002. *Snags and Down Wood in the Interior Columbia Basin Ecosystem Management Project*. PNW-GTR-181. http://www.fs.fed.us/psw/publications/documents/gtr-181/049_Korol.pdf This paper estimates that even if we apply enlightened forest management on federal lands for the next 100 years, we will still reach only 75% of the historic large snag abundance measured across the interior Columbia Basin, and most of the increase in large snags will occur in roadless and wilderness areas.
4. The agency cannot use “average” snag levels (e.g. 50% tolerance level) as a management objective within treatment areas, because treatments are essentially displacing natural disturbance events which would normally create and retain large numbers of snags, so disturbance areas should have abundant snags, not average levels of snags. It would be inconsistent with current science and current management direction to manage only for the mid-points and low points. The agency should manage for the full natural range dead wood levels, including the peaks of snag abundance that follow disturbance.
5. Be sure to use the DecAID tool appropriately. The agency must address the dynamics of snag habitat over time, by ensuring that recommended snag levels are maintained over time given typically high rates of snag fall and low rates of snag recruitment following fire. These dynamics are not accounted for in the DecAID advisor. The agency often misuses the DecAID decision support tool by

looking at only a snap-shot in time. The agency relies on DecAID to analyze impacts on snag dependent species, but the agency fails to recognize that “DecAID is NOT: ... a snag and down wood decay simulator or recruitment model [or] a wildlife population simulator or analysis of wildlife population viability. ... Because DecAID is not a time-dynamic simulator ... it does not account for potential temporal changes in vegetation and other environmental conditions, ... DecAID could be consulted to review potential conditions at specific time intervals and for a specific set of conditions, but dynamic changes in forest and landscape conditions would have to be modeled or evaluated outside the confines of the DecAID Advisor.”

Marcot, B. G., K. Mellen, J. L. Ohmann, K. L. Waddell, E. A. Willhite, B. B. Hostetler, S. A. Livingston, C. Ogden, and T. Dreisbach. In prep. “DecAID -- work in progress on a decayed wood advisor for Washington and Oregon forests.” Research Note PNW-RN-XXX. USDA Forest Service, Pacific Northwest Region, Portland OR. (pre-print)

<http://wwwnotes.fs.fed.us:81/pnw/DecAID/DecAID.nsf/HomePageLinks/44C813BC574BDFCC88256B3E006C63DF>

To clearly and explicitly address the issue of “snag dynamics” the can start by reading and responding to the snag dynamics white paper on the DecAID website which says “To achieve desired amounts and characteristics of snags and down wood, managers require analytical tools for projecting changes in dead wood over time, and for comparing those changes to management objectives such as providing dead wood for wildlife and ecosystem processes” and includes “key findings” and “management implications” including “The high fall rate (almost half) of recent mortality trees needs to be considered when planning for future recruitment of snags and down wood. Trees that fall soon after death provide snag habitat only for very short periods of time or not at all, but do contribute down wood habitat. In fact, these trees are a desirable source of down wood as they will often begin as mostly undecayed wood and, if left on the forest floor, will proceed through the entire wood decay cycle with its associated ecological organisms and processes that are beneficial to soil conditions and site productivity.”

<http://wwwnotes.fs.fed.us:81/pnw/DecAID/DecAID.nsf/HomePageLinks/863EEA66F39752C088256C02007DF2C0?OpenDocument>

6. The tolerance levels from DecAID may be too low to support viable populations of wildlife associated with dead wood, because anthropogenic factors that tend to reduce snags (e.g., firewood cutting, hazard tree felling, fire suppression, and salvage logging) may have biased the baseline data that DecAID relies upon to describe “natural” conditions. See Kim Mellen, Bruce G. Marcot, Janet L. Ohmann, Karen L. Waddell, Elizabeth A. Willhite, Bruce B. Hostetler, Susan A. Livingston, and Cay Ogden. *DecAID: A Decaying Wood Advisory Model for Oregon and Washington* in PNW-GTR-181, citing Harrod, Richy J.; Gaines, William L.; Hartl, William E.; Camp, Ann. 1998. *Estimating historical snag density in dry forests east of the Cascade Range*. PNW-GTR-428.
http://www.fs.fed.us/pnw/pubs/gtr_428.pdf

7. DecAID is still an untested new tool. The agencies must conduct effectiveness monitoring to determine whether the snag and down wood retention recommendations in the DecAID advisor will meet management objectives for wildlife and other resource values.
8. The “unharvested” inventory data used in DecAID may represent but a snapshot in time, and fail to capture the variability of dead wood over time, including the pulses of abundant dead wood that follow disturbances and may prove essential for many wildlife species.
9. DecAID must be used with extreme caution in post-fire landscapes because the data supporting DecAID does not include natural post-fire landscapes. (“The inventory data likely do not represent recent post-fire conditions very well ... young stands originating after recent wildfire are not well represented because they are an extremely small proportion of the current landscape ... The dead wood summaries cannot be assumed to apply to areas that are not represented in the inventory data.” “DecAID caveats” <http://www.notes.fs.fed.us:81/pnw/DecAID/DecAID.nsf>).
10. DecAID relies on a wide range of sources in the literature, some of which recommend much higher levels of snag retention than reflected in the advisor. The agency NEPA analysis should disclose the published literature with higher levels of snag and wood retention and discuss their potential relevance for the project. (“the agency must disclose responsible opposing scientific opinion and indicate its response in the text of the final statement itself. 40 C.F.R. § 1502.9(b).” Center for Biological Diversity v. United States Forest Service, No. 02-16481 (9th Cir., Nov. 18, 2003).)
11. DecAID tolerance levels need careful explanation. These tolerance levels are very difficult to put in terms that are understandable by the general public, but if the Forest Service is going to use this tool they must make it understandable. The NEPA analysis should provide cumulative species curves for each habitat type and each forest structural stage and should explain the studies and publications that support the data points on the curves. What kind of habitat were the studies located in? What was the management history of the site? Was the study investigated nesting/denning, or roosting and foraging too?
12. DecAID does not account for the unique habitat features associated with some types of snags. DecAID primarily just counts snags and assumes that all snags of approximately the same size have equal habitat value, but this fails to account for the fact that certain types of snags and dead wood features are unique, such as: hardwood snags, hollow trees and logs, different decay classes, etc. The NEPA analysis must account for these features and the agency should disproportionately retain dead wood likely to serve these unique habitat functions.
13. DecAID authors caution that “it is imperative, however, to not average snag and down wood densities and sizes across too broad an area, such as across entire watersheds, leaving large areas within watersheds with snags or down wood elements that are too scarce or too small” Kim Mellen, Bruce G. Marcot, Janet L. Ohmann, Karen L. Waddell, Elizabeth A. Willhite, Bruce B. Hostetler, Susan A. Livingston, and Cay Ogden. *DecAID: A Decaying Wood Advisory Model for Oregon and Washington* in PNW-GTR-181.

http://www.fs.fed.us/psw/publications/documents/gtr-181/042_MellenDec.pdf

While we agree that snags and down wood must not be averaged over wide areas, we also must emphasize that snags and down wood are far below historic levels on non-federal lands, so in order to ensure viable populations of wildlife and avoid trends toward ESA listing, federal lands must be managed to compensate for the lack of down wood on non-federal lands.

14. DecAID appears to be based on the idea that the habitat needs of certain key wildlife species represent the best determinant of how much dead wood to retain, and this may in fact be true, but DecAID should also include cumulative curves for other ecological functions provided by dead wood, including: site productivity, nutrient storage and release, erosion control, sediment storage, water storage, water infiltration and percolation, post-fire micro-site maintenance, biological substrate, thermal mass, etc. How much dead wood is needed for these functions?
15. DecAID may be best used for program level planning rather than project level planning. See Dallas Emch and Gary Larson, 2006. Review & Analysis of Remainder of Comments on EA Supplements for Multiple Timber Sales on Mt. Hood & Willamette National Forests on Remand in ONRCA v. Forest Service CV-03-613-KI (D.Or.). 4-10-06.

Snag retention standards overestimate habitat capability

The traditional snag habitat model used by the agency is based on outdated science⁴ which vastly overestimates habitat capability for snag-dependent species because it fails to consider important factors such as:

1. the model does not explicitly consider snag height so some snags may be too short for some species;
2. rates of snag fall rates over time;
3. snag recruitment rates over time;
4. use of space by each species;
5. the need for roosting structures [and foraging trees, and escape cavities] as well as nesting structures;
6. recent data on species needs from the Cascades and Blue Mountains has not been incorporated into the model
7. Numbers and sizes (dbh) of snags used and selected by secondary cavity-nesters often exceed those of primary cavity excavators.
8. the fact that snags should be retained in clumps AND dispersed to meet various species needs and ecological functions.
9. federal managers attempting to maintain viable populations of native cavity-dwellers need to consider generally degraded snag habitat conditions on adjacent and nearby non-federal lands.

⁴ THOMAS, J. W., TECHNICAL EDITOR. 1979. Wildlife habitats in managed forests-the Blue Mountains of Oregon and Washington. U.S. Dep. Agric. Agric. Handb. No. 553. 512pp; CLINE, S. P., A. B. BERG, AND H. M. WIGHT. 1980. Snag characteristics and dynamics in Douglas-fir forests, western Oregon. J. Wildl. Manage. 44:773-786; NEITRO, W. A., V. W. BINKLEY, S. P. CLINE, R. W. MANNAN, B. G. MARCOT, D. TAYLOR, AND F. F. WAGNER. 1985. Snags. Pages 129-169 in E. R. Brown, tech. ed. Management of wildlife and fish habitats in forests of western Oregon and Washington. U.S. Dep. Agric. For. Serv. Publ. R6F& WL-192-1985.

Ohmann, McComb, & Zumrawi; SNAG ABUNDANCE FOR PRIMARY CAVITY-NESTING BIRDS ON NONFEDERAL FOREST LANDS IN OREGON AND WASHINGTON; *Wildl. Soc. Bull.* 22:607-620, 1994

<http://www.fs.fed.us/pnw/pubs/journals/ohmann-snagabundance.pdf>; Rose, C.L., Marcot, B.G., Mellen, T.K., Ohmann, J.L., Waddell, K.L., Lindely, D.L., and B. Schrieber. 2001. Decaying Wood in Pacific Northwest Forests: Concepts and Tools for Habitat Management, Chapter 24 in *Wildlife-Habitat Relationships in Oregon and Washington* (Johnson, D. H. and T. A. O'Neil. OSU Press. 2001) <http://www.nwhi.org/nhi/whrow/chapter24cwb.pdf> Schulz, Joyce, Terri T., Linda A. A spatial application of a marten habitat model. 1992, *Wildl Soc. Bulletin* 20:74-83.

The agency's analysis of snag retention and habitat for cavity dependent species is faulty at both a programmatic level and at a project level. The agency must defer any decision on this project until it reviews all the available new information and amends its management plan standards to provide adequate snags for wildlife and all other ecosystem functions.

New information on Pileated Woodpeckers indicates Standards & Guidelines are Inadequate.

Pileated woodpeckers play a unique role in the forest ecosystem

- a. They excavate cavities in trees that are later used by numerous other species not just for nesting, but also for roosting and foraging. Benefited species include spotted owls and their prey.
- b. Their excavations accelerate wood decomposition, nutrient cycling, and fungi dispersal. Kerry L. Farris, Martin J. Huss And Steve Zack. The Role Of Foraging Woodpeckers In The Decomposition Of Ponderosa Pine Snags. *The Condor* 106:50–59. The Cooper Ornithological Society 2004. <http://www.sabp.net/woodpeckers&spores.pdf>
- c. The pileated woodpecker's ability to excavate large cavities in relatively sound trees that are in the early stages of heart wood decay, means that the resulting cavity trees may provide uniquely long-lasting habitat.
- d. The combined foraging activities of pileated woodpeckers and all the species they assist tend to mediate insect outbreaks.

The NEPA analysis failed to consider significant new information on pileated woodpeckers including:

- a. Pileated woodpeckers need more and larger roosting trees than nesting trees. They may use only one nesting tree in a year, they may use 7 or more roosting trees.
- b. West of the Cascades, pileated woodpeckers tend to prefer nesting in decadent trees rather than snags.
- c. West of the Cascades, standing snags are important foraging sites because down wood may be too wet to harbor carpenter ants (the favored foods of the pileated woodpecker).
- d. West of the Cascades, Pacific silver fir is often used for nesting (but not roosting).

- e. West of the Cascades, western redcedar is often used for roosting (but not nesting).

Determining pileated woodpeckers population potential based on nesting sites alone will not provide adequate habitat for viable populations of this species. This new information is not recognized in current management requirements at the plan or project level. The EIS must address this new scientific information. See *Science Findings* Issue 57 (October 2003) Coming home to roost: the pileated woodpecker as ecosystem engineer, by Keith Aubry, and Catherine Raley <http://www.fs.fed.us/pnw/sciencef/scifi57.pdf>

Temporary Roads

The November 2000 National Forest Roadless Area Conservation FEIS p 3-30 says that temporary roads are not designed and constructed to the same standard as classified roads and therefore result in a “higher risk of environmental impacts.” The NEPA analysis must account for this increased risk of temporary roads compared to permanent roads.

The Roadless FEIS also says:

Temporary roads present most of the same risks posed by permanent roads, although some may be of shorter duration. Many of these roads are designed to lower standards than permanent roads, are typically not maintained to the same standards, and are associated with additional ground disturbance during their removal. Also, use of temporary roads in a watershed to support timber harvest or other activities often involves construction of multiple roads over time, providing a more continuous disturbance to the watershed than a single, well-designed, maintained, and use-regulated road. While temporary roads may be used temporarily, for periods ranging up to 10 years before decommissioning, their short- and long-term effects on aquatic species and habitats can be extensive. [The FEIS has similar disclosures citing extensive impacts to terrestrial species and habitats, and rare plant populations.]

Roadless Area Conservation FEIS — Specialist Report for Terrestrial and Aquatic Habitats and Species prepared by Seona Brown and Ron Archuleta, EIS Team Biologists <http://roadless.fs.fed.us/documents/feis/specprep/index.shtml>

For the semi-permanent roads that will be tilled, BLM’s own soils scientist has little faith in the restorative value of this technique. He says: “What I have seen so far have been nothing more than modified rock rippers and little lateral fracture of the soil occurs and the extent of de-compacting is very limited.” Coos Bay BLM, Big Creek Analysis file, section F, Soils Report. page 4.

The agency assumes that temporary and semi-permanent new roads will have no effect because they are temporary. The agency has shown no scientific evidence for this assumption. In fact, scientific research has shown exactly the opposite. Effectiveness of Road Ripping in Restoring Infiltration Capacity of Forest Roads. Charles H. Luce, USDA Forest Service Intermountain Research Station, 1221 S. Main, Moscow, ID 83843. September 1996. *Restoration Ecology*, Vol. 5, No. 3. page 268.

Research results, published in *Restoration Ecology*, shows there is nothing temporary about temporary roads, and that ripping out a road is NOT equal to never building a road to begin with. The saturated hydraulic conductivity of a ripped road following three rainfall events was significantly greater than that of the road surface before ripping... most saturated hydraulic conductivities after the third rainfall event on a ripped road were in the range of 22 to 35 mm/hr for the belt series and 7 to 25 mm/hr for the granitics. These conductivities are modest compared to the saturated hydraulic conductivity of a lightly disturbed forest soil of 60 to 80 mm/hr.” id. Even this poor showing of restoring pre-road hydrologic effects worsened with repeated rainfall. “Hydraulic conductivity values for the ripped treatment on the granitic soil decreased about 50% with added rainfall ($p(K1=K2)=0.0015$). This corresponded to field observations of soil settlement and large clods of soil created by the fracture of the road surface dissolving under the rainfall... The saturated hydraulic conductivity of the ripped belt series soils also dropped from its initial value. Initially, and for much of the first event, the ripped plots on the belt series soil showed no runoff. During these periods, run-off from higher areas flowed to low areas and into macropores.... Erosion of fine sediment and small gravel eventually clogged these macropores... Anecdotal observations of roads ripped in earlier years revealed that after one winter, the surfaces were nearly as solid and dense as the original road surfaces.” Id. Even though ripped roads increase water infiltration over un-ripped roads, it does not restore the forest to a pre-road condition. “These increases do not represent “hydrologic recovery” for the treated areas, however, and a risk of erosion and concentration of water into unstable areas still exists.” Luce, C.H., 1997. Effectiveness of Road Ripping in Restoring Infiltration Capacity of Forest Roads, *Restoration Ecology*; 5(3):265-270. <http://www.fs.fed.us/rm/boise/teams/soils/People/luce.htm>

Don't focus on reducing canopy fuels.

Before embarking on an aggressive strategy of crown fuel reduction, the agency must address the responsible opposing viewpoints regarding the manifold values of retaining more canopy to retain cooler temperatures and moisture. Responsible opposing experts say that reducing ground fuels and ladder fuels should be the first priority and reducing canopy fuels a lesser priority. (e.g. Jim Agee. Risk Assessment for Decision-making Related to Uncharacteristic Wildfire, Conference Portland, Oregon Nov 17-20, 2003 http://outreach.cof.orst.edu/riskassessment/presentations/ageej_files/v3_document.htm “Reduce Crown Density • Important to address once surface fire and torching are addressed. • DON'T START HERE!!!! ... Treatments that reduced surface fuels, treated ladder fuels, and kept the big trees fared best.”) An EIS is needed to respond to opposing viewpoints and consider the consequences of alternative approaches to fuel reduction.

Sierra Club v. Eubanks, 335 F.Supp.2d 1070 at 1081 (E.D. Cal. 2004) ["Defendants have failed to take the 'hard look' required by NEPA at scientific studies which suggest that the timber removal proposed actually increases, not reduces, fire risk."]

Mark Finney and Warren Cohen also emphasize the three step approach to fuel reduction that places reduced emphasis on canopy fuel reduction.

Thus, Van Wagner's (1977) relationships suggest that fuel management prescriptions can limit crown fire activity by first reducing surface fuels to limit fireline intensity, then thinning the smallest trees or pruning to elevate the base of aerial fuels from the ground surface. A final measure may involve crown thinning (removal of some canopy level trees) to make difficult the transition to active crowning.

Finney and Cohen. 2003. Expectation and Evaluation of Fuel Management Objectives. USDA Forest Service Proceedings RMRS-P-29.
http://www.fs.fed.us/rm/pubs/rmrs_p029/rmrs_p029_351_366.pdf

Modeling shows that canopy fuel reduction is accomplished at the expense of increasing surface fire intensity.

Modifying canopy fuels as prescribed in this method may lead to increased surface fire intensity and spread rate under the same environmental conditions, even if surface fuels are the same before and after canopy treatment. Reducing CBD to preclude crown fire leads to increases in the wind adjustment factor (the proportion of 20-ft windspeed that reaches midflame height). Also, a more open canopy may lead to lower fine dead fuel moisture content. These factors increase surface fire intensity and spread rate. Therefore, canopy fuel treatments reduce the potential for crown fire at the expense of slightly increased surface fire spread rate and intensity.

Scott, Joe. 2003. Canopy Fuel Treatment Standards for the Wildland-Urban Interface. USDA Forest Service Proceedings RMRS-P-29. 2003.
http://www.fs.fed.us/rm/pubs/rmrs_p029/rmrs_p029_029_038.pdf

Calculations of crown bulk density (CBD) are oversimplified. Typical calculations of CBD "carries the implicit assumption that canopy biomass is distributed uniformly within the stand canopy, which is unlikely to be true even in stands with very simple structures; multi-storied stands are probably even more poorly represented by this procedure."⁵ Canopy fuels are not uniform horizontally or vertically, so the risk of spreading crown fire may be over-estimated by these methods.

In the open, solar radiation impinges directly on the earth's surface. Because both the earth and the air above it are poor conductors, heat is concentrated at the surface and in the layer of air next to it. Ground fuels can thus become superheated ... A mature, closed stand has a fire climate strikingly different from that in the open. Here nearly all of the solar radiation is intercepted by the crowns ... Because of the lower temperature and higher humidity, fuels within closed stands are more moist than those in the open under ordinary weather conditions ... [F]irebrands that do not contain enough heat to start a fire in a closed stand may readily start one in the open. Fires starting in the open also burn more intensely and build up to conflagration proportions more quickly since less of the heat produced by the fire is used in evaporating water from the drier fuels.

Countryman, C.M. 1955. Old-growth conversion also converts fire climate. *Fire Control Notes* 17(4): 15-19.

⁵ NEXUS software help files.

The BLM admits that there is “conflicting opinion regarding logging, canopy closure, and fire risk” and scientific disagreement about the appropriate fuel reduction tools and the extent of crown thinning needed to achieve desired conditions. Medford BLM, South Deer LMP Decision Record. Sept. 1, 2005 (p 24).

Fuel reduction thinning must retain enough trees to ensure long-term recruitment of future old-growth.

The Forest Service should consider some of the information from The Klamath Tribes’ Dec 2003 proposed forest management plan for the Winema National Forest (<http://www.klamathtribes.org/forestplan.htm>), in particular the uncertainty regarding how many small and medium trees need to be retained in order to achieve desired numbers and sizes of large trees in the future. Consider ONRC’s January 2004 comments on the Tribal forest plan:

We know that past logging has left us with too few big trees, and we know we want to restore complex forest with big trees. We also know that the historic density of small trees was highly variable (10-39 feet² basal area; p 15). But we do not understand rates and distribution of tree mortality, so we do not know how many small and medium trees to save today so that we end up with the “right” number of big trees later. Goals for medium sized trees may need to be specified, although this is understandably difficult given that fire regimes have been altered, reference sites may not be available, and given our limited understanding of tree mortality rates. In stands that have few large trees and many smaller trees, the plan should explain how diameter limits less than 21 inches should be used to help restore complex forests. We must retain options by managing for variability. Effective adaptive management will be critical.

...

ONRC supports standards & guidelines that encourage natural regeneration and (if necessary) limited, patchy, low-density replanting (p 110). We also support the plan’s intent to avoid homogenous or ubiquitous “park-like” stands across the landscape and the critical need to retain untreated patches of small trees and brush to provide for forest complexity, wildlife cover, long-term recruitment of trees and snags, etc.

Disclose the effect of removing trees over 12 inches.

Please place a diameter limit on trees to be cut. We suggest a 12 inch maximum diameter cap. The best available information indicates fire hazard can actually be increased by the removal of trees that form the canopy (generally over 12 inches in diameter). The best available information indicates that the existence of brush and trees under 12 inches tend to contribute most to fire hazard (by increasing ground and ladder fuels) whereas retention of trees over 12 inches dbh can actually reduce fire hazard. This is because brush and small diameter trees tend to have their canopies (i.e. flashy fuels) close to the ground where it can carry flames into the canopy, while trees larger than about 12 inches

tend to have fire resistant bark, greater “ground to crown” distances, and the canopy of the larger trees provides shade which maintains fuel moisture, reduces wind speed, and suppresses the growth of ladder fuels, which results in reduced fuel hazard and reduced costs of maintaining favorable fuel conditions. See C. Larry Mason, Kevin Ceder, Heather Rogers, Thomas Bloxton, Jeffrey Connick, Bruce Lippke, James McCarter, Kevin Zobrist, Investigation of Alternative Strategies for Design, Layout and Administration of Fuel Removal Projects; Rural Technology Initiative; July 2003; http://www.ruraltech.org/pubs/reports/fuel_removal/ If the agency thinks the tipping point is not at approximately 12 inches dbh, please provide a sound scientific basis for a different diameter limit. Absent a sound justification the agency risks making an arbitrary and capricious decision.

The agencies often cite Omi and Martinson (2002) to support the efficacy of thinning to reduce fuel hazard, but the agencies almost never acknowledge the significant remaining uncertainties cited in that report. “Still unanswered are questions regarding necessary treatment intensities ... more information is clearly needed.” Omi, P.N., and Martinson, E. J. 2002. Effect of fuels treatment on wildfire severity. Final report. Western Forest Fire Research Center. Submitted to the Joint Fire Science Program Governing Board <http://www.cnr.colostate.edu/frws/research/westfire/FinalReport.pdf> The thinning reviewed in Omi and Martinson was pre-commercial, and their four study sites were anything but randomly chosen. The agency must give weight to other findings such as those in Martinson, E., Omi, P.N., and Shepperd W., 2003. Fire behavior, fuel treatments, and fire suppression on the Hayman Fire, Part 3 Effects of fuel treatments on fire severity. Hayman Fire Case Study, pp. 96-126, USFS Rocky Mountain Research Station Gen. Tech. Rep. RMRS-GTR-114. Ogden, UT, http://www.fs.fed.us/rm/pubs/rmrs_gtr114.html, which clearly demonstrates that recently completed fuel reduction projects had NO EFFECT on fire severity in the mixed conifer forests during extreme fire weather. A discussion of the implications of these results for mixed conifer forests can be found in: Schoennagel, T., Veblen, T.T., and Romme, W.H., 2004. The interaction of fire, fuels, and climate across Rocky Mountain forests. *BioScience*, 54: 661-676. http://www.colorado.edu/geography/biogeography/publications/Schoennagel_et_al_2004.pdf

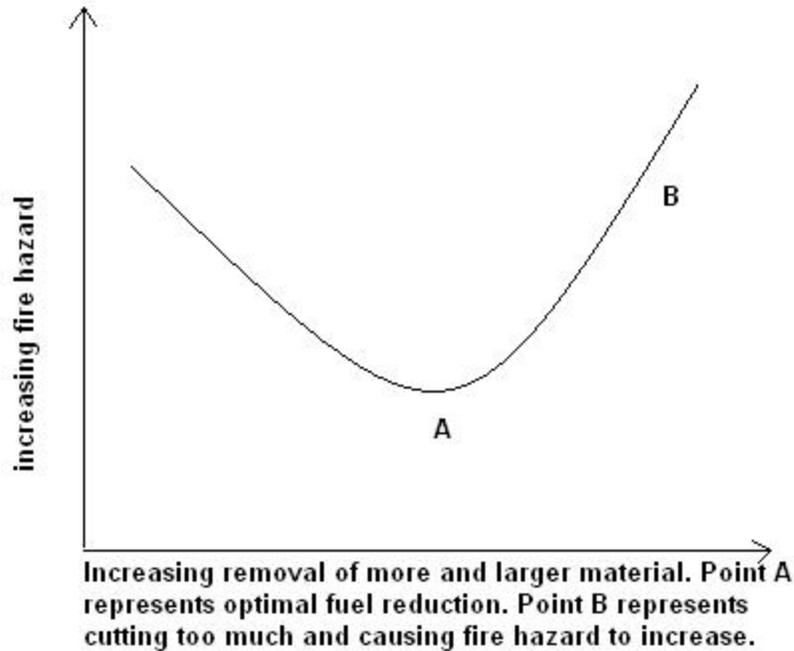
Thinning for fuel reduction results on a U-shaped response curve.

- A little thinning (removing small trees (<8” dbh) and brush from the ladder fuel and surface fuel zones) almost always reduces fire hazard and (as long as activity fuels are treated) rarely increases fire hazard,
- With a little more thinning the fire hazard benefit flattens out. Removing trees <8” dbh up to 12-14” dbh eliminates some small fuels (which has a positive effect on fire hazard) but also reduces the canopy (which has a negative effect on fire hazard because it creates more slash, reduces fuel moisture, increases wind speed,

and stimulates the growth of ladder fuels⁶). Removing the larger fuels begins to erase the gains made by removing small fuels;

- Then at some point any further removal of the canopy (thinning trees over ~12” dbh) actually increases fire hazard in direct conflict with the National Fire Plan, the HFI, the HFRA, and the purpose and need of this project.

Where does this project fall on the U-shaped curve? The NEPA analysis must disclose this.



The State of Oregon recognizes the following concerns associated with fuel reduction treatments. The NEPA analysis must address these concerns.

Table 3: Principles of Fire-Resilient Forests (from Agee 2002.)

Principle	Effect	Advantage	Concerns
<i>Reduce surface fuels</i>	Reduces potential flame length	Control easier, less torching	Surface disturbance, less with fire than with other techniques
<i>Increase height to live crown</i>	Requires longer flame length to begin torching	Less torching	Opens understory, may allow surface wind to increase
<i>Decrease crown density</i>	Makes tree-to-tree crown fires less probable	Reduces crown fire potential	Surface wind may increase and surface fuels may be drier

⁶ And see Kerry L. Metlen, Carl E. Fiedler. 2006. Restoration treatment effects on the understory of ponderosa pine/Douglas-fir forests in western Montana, USA. *Forest Ecology and Management* 222 (2006) 355–369. <http://plantecology.dbs.umt.edu/CV's/Kerry/Metlen%20y%20Fiedler%2006.pdf>

Keep larger trees	Thicker bark and taller crowns	Increases tree survivability	Removing smaller trees is economically less profitable
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Institute for Natural Resources. 2004. REPORT OF THE FOREST FUELS AND HAZARD MITIGATION COMMITTEE TO THE OREGON DEPARTMENT OF FORESTRY OREGON FIRE PROGRAM REVIEW. December 10, 2004. Oregon State University http://inr.oregonstate.edu/download/white_paper_final.pdf

citing Agee, J. 2002. Fire behavior and fire-resilient forests in S.A. Fitzgerald (ed.), Fire in Oregon's Forest: Risks, Effects, and Treatment Options. A synthesis of current issues and scientific literature. Special Report for the Oregon Forest Resources Institute, Portland, OR. Pp. 119-126.

Disclose and consider the effects of thinning on late successional species.

The agency must focus the NEPA analysis on species that are most likely to be adversely affected by logging—in most cases that is wildlife associated with relatively dense, closed-canopy forest conditions and those associated with snags and dead wood, for instance: American marten, Northern goshawk, Pileated woodpecker, and various species of late successional birds.

Logging almost always opens up the forest canopy, reduces vegetation cover, and reduces the current and future abundance of dead standing trees and down wood. Adverse effects are therefore likely to occur for species associated with these habitat conditions.

- Tree canopy cover is the single best correlate of flying squirrel population density, “with an apparent threshold of 55 percent canopy cover separating low- from high-density populations.” PNW Research Station. Rocky to Bullwinkle: Understanding Flying Squirrels Helps us Restore Dry Forest Ecosystems. Science Findings. Issue Eight. February 2006. <http://www.fs.fed.us/pnw/science/scifi80.pdf>
- Bull, E.L. 2002. The value of coarse woody debris to vertebrates in the Pacific Northwest.
- Machmer, M. 2002. Effects of ecosystem restoration treatments on cavity-nesting birds, their habitat, and their insectivorous prey in fire-maintained forests of southeastern British Columbia.
- Maguire, C.C. 2002. Dead wood and the richness of small terrestrial vertebrates in southwestern Oregon.

Latter three in: Laudenslayer, W.F., P.J. Shea, B.E. Valentine, P.C. Weatherspoon and T.E. Lisle, tech. coords. Proceedings of the symposium on the ecology and management of dead wood in western forests. 1999 Nov 2-4, Reno, NV. US Department of Agriculture, Pacific Southwest Research Station, Gen. Tech. Rep. PSW-GTR-181, Albany, CA.

<http://www.fs.fed.us/psw/publications/documents/gtr-181/>

The NEPA analysis must consider and disclose the effects of thinning on birds associated with late successional forests. A study of forest thinning on BLM lands in SW Oregon

has “found fewer bird species in thinned areas” says the Medford Mail Tribune, September 17, 2003. The Southern Oregon University research by SOU’s Stewart Janes revealed that “many birds declined” after the thinning and “the species suffering the most were red-breasted nuthatches, chestnut-backed chickadees, Pacific-slope flycatchers and hermit warblers,” all species associated with late-succession forests.” The ornithologists found the declines “surprising” and said the results are “directly applicable to the kind of forestry practices they’re talking about now,” i.e. increasing thinning to reduce fuels. <http://www.mailtribune.com/archive/2003/0917/local/stories/18local.htm>

Concerns about Fuels Management Effectiveness

Oregon Wild supports use of prescribed fire, and, if necessary, careful thinning and removal of small diameter material and flammable brush in ecologically appropriate locations in order to help restore fire regimes. We urge the agency to avoid road building and prioritize such activities in the wildland-urban interface.

We support efforts to limit the initiation and spread of crown fires through the reduction of fine surface fuels and (partial) treatment of ladder fuels to increase the crown base height, but we oppose efforts to heavily thin the overstory canopy in an effort control crown-to-crown fire spread. The most significant effect of this type of heavy thinning is to increase the warming and drying of ground fuels and to increase the growth of ladder fuels, both of which significantly detract of the risk reduction objectives and are expensive to treat. The NEPA analysis must address the complex effects of thinning including tendencies to reduce and increase fire hazard.

The Report to the President that forms the foundation for the National Fire Plan recommends that we “Invest in Projects to Reduce Fire Risk. **Addressing the brush, small trees, and downed material** that have accumulated in many forests because of past management activities, especially a century of suppressing wildland fires, **will require significant investments** to treat landscapes through thinning and prescribed fire.” Whitehouse. Managing the Impact of Wildfires on Communities and the Environment. A Report to the President In Response to the Wildfires of 2000. September 8, 2000. http://199.134.225.81/Documents/Managing_Impact.pdf The main point here is that the fuels that need to be removed are small fuels, including brush and down wood that will require “investments” as opposed to commercial sized material.

The NEPA document must address the fact that there is very little scientific support for aggressive thinning to reduce fire hazard. In fact, there is building scientific evidence that thinning can make the fuel hazard worse instead of better. Thinning makes forests "Hotter, Drier and Winder." Science still has a long way to go to be able to confidently predict the consequences of various combinations of thinning and other treatments. “Detailed site-specific data on anything beyond basic forest structure and fuel properties are rare, limiting our analytical capability to prescribe management actions to achieve desired conditions for altering fuels and fire hazard.” Graham, Russell T.; McCaffrey, Sarah; Jain, Theresa B.(tech. eds.) 2004. Science basis for changing forest structure to

modify wildfire behavior and severity. Gen. Tech. Rep. RMRS-GTR-120. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 43 p. http://www.fs.fed.us/rm/pubs/rmrs_gtr120.html

In a mixed-conifer, mixed-severity fire regime study area in SW Oregon, Crystal Raymond found that “Fire severity was greater in thinned treatments than untreated. ... The additional fine wood left from the thinning operation (despite whole-tree yarding) most likely caused higher fire intensity and severity in the thinned treatments.”

... [T]he presence of activity fuels increased potential surface fire intensity, so increases in canopy base height did not decrease the potential for crown fire initiation. ... [C]rown fire is not a prerequisite for high fire severity; damage and mortality of overstory trees in the wildfire was extensive despite the absence of crown fire, and the low predicted crown fire potential before and after the fuel treatment. Damage to and mortality of overstory trees were most severe in thinned treatments (80 – 100% mortality), least severe in the thinned and under-burned treatment (5% mortality), and moderate in untreated stands (53-54% mortality) following a wildfire in 2002. Fine fuel loading was the only fuel structure variable significantly correlated with crown scorch of overstory trees. Percentage crown scorch was the best predictor of mortality 2 years post-fire. Efforts to reduce canopy fuels through thinning treatments may be rendered ineffective if not accompanied by adequate reduction in surface fuels.

Crystal L. Raymond. 2004. The Effects of Fuel Treatments on Fire Severity in a Mixed-Evergreen Forest of Southwestern Oregon. MS Thesis.

http://depts.washington.edu/nwfire/publication/Raymond_2004.pdf Raymond also found that “A greater percentage of pre-fire fine wood was consumed in the thinned plots than in the unthinned plots during the Biscuit fire suggesting that fine fuel moisture may have been lower in the thinned plots.” And “the Biscuit Fire was observed to have more moderate fire behavior in stands with a sub-canopy tree layer compared to more open stands, suggesting that the sub-canopy trees did not function as ladder fuels. ... Higher foliar moisture of broad-leaved species could have dampened fire behavior, inhibiting rather than aiding crown fire initiation.”

Similarly, Hanson and Odion (2006)⁷ compared wildfire behavior in seven previously thinned mixed-conifer forests vs. adjacent unthinned forest in the Sierra Nevada and found —

Contrary to our hypothesis, the mechanically thinned areas had significantly higher fire-induced mortality ($p = .016$, $df = 6$) and combined mortality ($p = .008$, $df = 6$) than the adjacent unthinned areas. Thinned areas predominantly burned at high severity, while unthinned areas burned predominantly at low and moderate severity ... Possible explanations for the increased severity in thinned areas

⁷ Hanson and Odion. 2006. FIRE SEVERITY IN MECHANICALLY THINNED VERSUS UNTHINNED FORESTS OF THE SIERRA NEVADA, CALIFORNIA 2006 Fire Congress Proceedings. <http://www.emmps.wsu.edu/2006firecongressproceedings/Extended%20Abstracts%20PDF%20Files/Poster/hanson.pdf>

include persistence of activity fuels, enhanced growth of combustible brush post-logging, desiccation and heating of surface fuels from increased insolation, and increased mid-flame windspeeds. Given that sampling transects in thinned versus unthinned areas were only 100 m apart in each experimental unit, fire weather should have been the same for the thinned and unthinned areas sampled in each site. Thus, mechanical thinning on these sites appears to have effectively lowered the fire weather threshold necessary for high severity fire occurrence.

A study in mixed-conifer forests in California showed that forest reserves were more effective than logging in terms of reducing fire hazard.

[T]he efficacy of seven traditional silvicultural systems and two types of reserves used in the Sierra Nevada mixed conifer forests is evaluated in terms of vegetation structure, fuel bed characteristics, modeled fire behavior, and potential wildfire related mortality. The systems include old-growth reserve, young-growth reserve, thinning from below, individual tree selection, overstory removal, and four types of plantations. These are the most commonly used silvicultural systems and reserves on federal, state, and private lands in the western United States. Each silvicultural system or reserve had three replicates and varied in size from 15 to 25 ha; a systematic design of plots was used to collect tree and fuel information. The majority of the traditional silvicultural systems examined in this work (all plantation treatments, overstory removal, individual tree selection) did not effectively reduce potential fire behavior and effects, especially wildfire induced tree mortality at high and extreme fire weather conditions. Overall, thinning from below, and old-growth and young-growth reserves were more effective at reducing predicted tree mortality.

Scott L. Stephens and Jason J. Moghaddas. 2005. Silvicultural and reserve impacts on potential fire behavior and forest conservation: Twenty-five years of experience from Sierra Nevada mixed conifer forests. *Biological Conservation* 125 (2005) 369–379.

Thinning opens stands to greater solar radiation and wind movement, resulting in warmer temperatures and drier fuels throughout the fire season. [T]his openness can encourage a surface fire to spread, ...
USDA Forest Service; Influence of Forest Structure on Wildfire Behavior and the Severity of Its Effects, November 2003.
<http://www.fs.fed.us/projects/hfi/2003/november/documents/forest-structure-wildfire.pdf>

Opening up closed forests through selective logging can accelerate the spread of fire through them because a physical principle of combustion is that reducing the bulk density of potential fuel increases the velocity of the combustion reaction. Wind can flow more rapidly through the flaming zone. Thinned stands have more sun exposure in the understory, and a warmer microclimate, which facilitates fire (Countryman 1955).

...

[F]uel reduction activities – particularly mechanized treatments – inevitably function to disturb soils and promote the invasion and establishment of non-native species. Pile burned areas associated with the treatments are also prone to invasion (Korb et al. 2004). Annual grasses can invade treated areas if light levels are high enough, leading to increased likelihood of ignition, and more rapid spread of fire, which can further favor annual grasses (Mack and D'Antonio 1998). This type of feedback loop following the establishment of non-native plants may result in an altered fire regime for an impacted region, requiring extensive (and expensive) remedial action by land managers (Brooks et al. 2004).

Odion, Dennis. 2004. Declaration in NWEA v. Forest Service, citing Countryman, C. M. 1955. Old-growth conversion also converts fire climate. U.S. Forest Service Fire Control Notes 17: 15-19.

Theoretically, fuel treatments have the potential to exacerbate fire behavior. Crown fuel reduction exposes surface fuels to increased solar radiation, which would be expected to lower fuel moisture content and promote production of fine herbaceous fuels. Surface fuels may also be exposed to intensified wind fields, accelerating both desiccation and heat transfer. Treatments that include prescribed burning will increase nutrient availability and further stimulate production of fuels with high surface-area-to-volume ratios. All these factors facilitate the combustion process, increase rates of heat release, and intensify surface fire behavior.

...

Thus, treatments that reduce canopy fuels increase and decrease fire hazard simultaneously. Still unanswered are questions regarding necessary treatment intensities ... more information is clearly needed.

Omi, P.N., and Martinson, E. J. 2002. Effect of fuels treatment on wildfire severity. Final report. Western Forest Fire Research Center. Submitted to the Joint Fire Science Program Governing Board
<http://www.cnr.colostate.edu/frws/research/westfire/FinalReport.pdf>

EPA also recognizes that unmaintained fuel management zones can “increase the risk of fire as slopes are opened up to sunlight and undergrowth is stimulated.” See EPA 2-18-04 comments on the Biscuit Fire Salvage Project.

“Accelerating the development of multi-storied stands may increase the risk of wildfire.” Andrews, Perkins, Thrailkill, Poage, Tappeneiner. 2005. Silvicultural Approaches to Develop Northern Spotted Owl Nesting Sites, Central Coast Ranges, Oregon. West. J. Appl. For. 20(1):13-27.

The Forest Trust conducted a thorough literature review and found that:

- Although the assertion is frequently made that simply reducing tree density can reduce wildfire hazard, the scientific literature provides tenuous support for this hypothesis.

- The literature leaves little doubt, however, that fuel treatments can modify fire behavior. Thus, **factors other than tree density, such as the distance from the ground to the base of the tree crown, surface vegetation and dead materials play a key role. Research has not yet fully developed the relationship among these factors in changing fire behavior.**
- The specifics of how treatments are to be carried out and the relative effectiveness of alternative prescriptions in changing wildfire behavior are not supported by a significant consensus of scientific research at this point in time.
- Substantial evidence **supports the effectiveness of prescribed fire**, a treatment that addresses all of the factors mentioned above. Significantly, several empirical studies demonstrated the effectiveness of prescribed fire in altering wildfire behavior.
- By contrast, we found a limited number of papers on the effects of mechanical thinning alone on wildfire behavior. The most extensive research involved mathematical simulation of the impact of mechanical thinning on wildfire behavior. However, the results of this research are highly variable.
- A more limited number of studies addressed the effectiveness of a **combination of thinning and burning** in moderating wildfire behavior. The impacts varied, depending on the treatment of thinning slash prior to burning. Again, **crown base height appeared as important a factor as tree density. The research community is still building a scientific basis for this combination of treatments.**
- **The proposal that commercial logging can reduce the incidence of canopy fire was untested in the scientific literature. Commercial logging focuses on large diameter trees and does not address crown base height – the branches, seedlings and saplings which contribute so significantly to the “ladder effect” in wildfire behavior.**
- Much of the research on the effectiveness of fuel treatments uses dramatically different methodology, making a comparison of results difficult. To provide a basis for analysis, we structured our review of the literature into four general groupings: observations, case studies, simulation models and empirical studies. Empirical studies provide the strongest basis for evaluating treatments whereas personal observations are the least reliable.
- **We found the fewest studies in the most reliable class – empirical research. We found the greatest number of studies in the least reliable class of research – reports of personal observation. Several other reviews of the literature confirm this finding, stating that the evidence of the efficacy of fuel treatment for reducing wildfire damage is largely anecdotal.**
- The **results of simulation studies are highly variable**, in terms of such factors as fire spread, intensity and the occurrence of spotting and crowning.

- Scientists recognize **that large scale prescribed burning and mechanical thinning are still experimental and may yet reveal unanticipated effects on biodiversity, wildlife populations and ecosystem function.**

Henry Carey and Martha Schumann. Modifying WildFire Behavior – The Effectiveness of Fuel Treatments — The Status of Our Knowledge. April 2003; <http://www.theforestrust.org/images/swcenter/pdf/WorkingPaper2.pdf> This report also said:

Stephens [1998. "Evaluation of the effects of silvicultural and fuels treatments on potential fire behaviour in Sierra Nevada mixed-conifer forests." *Forest Ecology and Management* 105(1):21-35.] used FARSITE to investigate the interaction between slash from logging and fire behavior. When silvicultural treatments were conducted without reducing slash, the simulated fire behavior appeared more extreme than in the area that had not been harvested at all.

...

We did not find any empirical studies that evaluated commercial harvesting as a means of altering fire behavior. ... studies suggest that slash resulting from logging is a key factor in predicting subsequent fire risk and that removal of large diameter trees alone may contribute to increased fire severity.

...

A report prepared for Congress stated: "We do not presume that there is a broad scientific consensus surrounding appropriate methods or techniques for dealing with fuel build-up or agreement on the size of areas where, and the time frames when, such methods or techniques should be applied" (US GAO RCED-99-65. 1999:56). A research report by Omi and Martinson (2002:1) stated: "Evidence of fuel treatment efficacy for reducing wildfire damages is largely restricted to anecdotal observations and simulations."

Duke University issued an "expert advisory" May 24, 2004 with Professor Norm Christensen saying:

"...the practice of suppressing wildfires has allowed debris to accumulate to dangerous levels on the forest floor."

Indiscriminate logging aggravates the problem by thinning a fire-prone forest's canopy and littering its floor with sawdust and other combustible debris.

"Loss of canopy increases wind speed and air temperatures and decreases humidity in the forest," Christensen notes. "As a result, ground fuel fires that break out can spread faster and farther than they would normally."

<http://www.ascribe.org/cgi-bin/spew4th.pl?ascribeid=20040524.081406>

Studies have shown that thinned stands are warmer and windier than unthinned stands. Trevor D. Hindmarch and Mary L. Reid. Effects of Commercial Thinning on Bark Beetle Diversity and Abundance. PROJECT REPORT 1999-13. May 1999.

http://sfm-1.biology.ualberta.ca/english/pubs/PDF/PR_1999-13.pdf
(see figures 2&3, pp 14-15).

The 9th Circuit recently admonished the Forest Service to ensure the effectiveness of treatments before embarking on potentially irreversible treatment programs.

Just as it would be arbitrary and capricious for a pharmaceutical company to market a drug to the general population without first conducting a clinical trial to verify that the drug is safe and effective, it is arbitrary and capricious for the Forest Service to irreversibly “treat” more and more old-growth forest without first determining that such treatment is safe and effective for dependent species.

...

The EIS discusses in detail only the Service’s own reasons for proposing treatment, and it treats the prediction that treatment will benefit old-growth dependent species as a fact instead of an untested and debated hypothesis.”

Ecology Center v. Austin, 9th Circuit. Dec 8, 2005. <http://tinyurl.com/b37k4>

The NEPA document must acknowledge the paucity of scientific support for commercial logging to reduce fuels and reduce fire effects and fails to recognize that logging often increases fine fuel loads while removing the large logs that are relatively less prone to burn. Thinning also increases wind and light penetration of the canopy and causes fuels to dry out which make them more prone to burn and increases the time it takes woody material to decompose. Removing medium and large trees also removes shade and resource competition that helps suppress the growth of small trees and brush known as “ladder fuels.”

In a challenge to a timber sale in the Sierra Nevada Mountains, U.S. District Judge Morrison C. England Jr. found on July 1, 2003 that John Muir Project and Earth Island Institute had made a strong case that logging slash could fuel future fires and that logging would harm wildlife habitat by increasing the risk of fire. A stay to halt the fuels reduction project was granted. Judge England issued a temporary restraining order (TRO) in Earth Island Institute v. USDA Civ. No. S-03-1242 MCE DAD (Eastern District of California 2003) because logging would create “extreme levels of flammable slash.”

Consider these words from Mike Dombeck, former Chief of the Forest Service:

"Some argue that more commercial timber harvest is needed to remove small-diameter trees and brush that are fueling our worst wildlands fires in the interior West. However, small-diameter trees and brush typically have little or no commercial value. To offset losses from their removal, a commercial operator would have to remove large, merchantable trees in the overstory. Overstory removal lets more light reach the forest floor, promoting vigorous forest regeneration. Where the overstory has been entirely removed, regeneration produces thickets of 2,000 to 10,000 small trees per acre, precisely the small diameter materials that are causing our worst fire problems. In fact, many large fires in 2000 burned in previously logged areas laced with roads. It seems unlikely that commercial timber harvest can solve our forest health problems."

Dombeck on Fires in 2001 - How Can We Reduce the Fire Danger in the Interior West (Fire Management Today, Winter 2001, page 11).

As eloquently stated by Neil Lawrence:

We're a long way from a model that accounts for the drying affect of insolation and increased wind penetration, the loss of water from run-off on machine compacted soil, the increased availability of residual fine fuels post-thinning, the morbidity and mortality associated with diseases and pests imported by logging equipment, and all the other real world phenomena that cut against the ivory tower view that large fuel structure and crown bulk density are the sole significant drivers of fire occurrence, intensity, and spread.

Logging very likely will have little effect on the severity or controllability of large intense canopy fires that are of most concern both environmentally and economically. If proposed logging has any effect it will likely lead to increased controllability of low intensity surface fires, but these lower intensity fires are precisely the fires that are beneficial ecologically and should probably not be controlled. So logging will help control fires which should remain wild and free, while logging will fail to control that which is most destructive.

Logging also has many effects that fires do not have. Soil compaction, roads, weeds, etc.

It would be better to just do a controlled prescribed burn at the right time of year without logging. The EA should have considered such an alternative.

Landscape fire

We lack the resources to treat the landscape so we must be smart about it. Large fires are largely driven by weather conditions, and the behavior of wind-driven fires is not meaningfully affected by arbitrarily located fuel treatments. In such cases, commercial logging is highly unlikely to affect fire behavior at a landscape scale and will therefore fail to achieve this project's purpose and need.

In order to conserve scarce resources, we must endeavor to treat the fewest acres yet protect the most acres. The NEPA analysis must disclose and analyze spatial priorities for fuel treatments. Credible but highly theoretical simulation work by the Forest Service's Mark Finney shows that effective fuel reduction requires that we carefully consider how fire moves across landscape and spatially prioritize treatments to interrupt likely fire travel routes. The NEPA analysis must acknowledge that random/arbitrary placement of fuel treatments will have little effect on large fires unless high proportions of landscape are treated. The agency does not have the resources to treat a high proportion of the landscape and even if they did the ecological consequences would be unacceptable.

Here are some recommendations adapted from Finney:

- Identify main fire travel routes and block them. Using known topography and relatively predictable wind patterns, the likely travel routes of fire can be

somewhat readily predicted. With this as a starting point the agencies can identify treatment locations that have a high chance of forcing fire into a flanking pattern which reduces rate of spread and the intensity of the flame front which increases the chances of control.

- Treatments will be more effective if they partially “overlap” in the linear wind heading direction. Overlapping patterns should help split intense flame fronts into smaller units because the head of the fire would be split into smaller pieces as it crossed treated areas (and therefore would be forced to flank). See Figures 1, 5, and 7 in Mark A. Finney. 2001. Design of Regular Landscape Fuel Treatment Patterns for Modifying Fire Growth and Behavior. *Forest Science* 47(2): 219–228. <http://www.cnr.berkeley.edu/wfrg/main/lecture01/Finney.pdf>
- The pattern of effective treatments are theoretically scale-independent but the scale of treatment patterns should probably be finer than the scale of fire sizes.
- Recognize the tradeoffs between intensive and extensive treatment strategies. Prescribed fire would be an example of a treatment that is low intensity but could be applied relatively broadly, whereas commercial thinning can only be done on a small fraction of the landscape before the adverse effects (soil, water, wildlife, weeds, etc.) become unacceptable.
- Be flexible with spatial constraints. Choosing treatment locations will require consideration of many factors, fire travel routes being just one of them. The agency must not ignore and run rough-shod over other critical environmental considerations such as soil, wildlife habitat, water quality, recreation, roadless areas, etc.

The NEPA analysis must address this very important CAVEAT: “Spotting was excluded in the analysis. Spotting would create large fires regardless of treatment pattern if fire brands landed in untreated areas. Therefore spotting fires behave independent of treatment pattern unless whole-area treatment was utilized.” AND “Spotting was excluded from this analysis but would likely result in large fires, independently of any landscape fuel pattern except wholesale treatment..”

“The federal government reports that 70 million acres of federal lands need immediate thinning and another 140 million acres must be thinned soon. The president's plan to thin 25 million acres in the next 10 years will cost as much as \$4 billion yet leave nearly 90 percent of those acres untreated,” according to Jerry Taylor, the CATO Institute's Director of Natural Resource Studies, "A recent Forest Service report estimates there are just 1.9 million high-risk acres with homes and other structures near federal lands. To defend homes and communities, we should treat those acres and fireproof the homes. That could be done in just one or two years at a tiny fraction of the cost of the president's plan." (Administration's Forest Plan Doomed to Fail, *"Forests Initiative" Will Leave 90 Percent of Acres Vulnerable to Fires*, 5/20/03; <http://www.cato.org/new/05-03/05-20-03r-2.html>, <http://www.cato.org/dailys/09-07-02.html>)

It is arbitrary and capricious to spend billions on a program that essentially fails to address the problem. This timber sale project is a microcosm of the larger issue identified here. Until the larger issue is dealt with, this significant issue requires an EIS.

Given limited resources the agencies must focus on using the most cost-effective tools. Prescribed fire is typically the cheapest and most effective method of fuel reduction.

Prescribed burning affects potential fire behavior by reducing fuel continuity on the forest floor, thereby slowing fire spread rate, reducing fire intensity, and reducing the likelihood of fire spreading into ladder fuel and the crown.

Prescribed fire is typically cheaper per unit area than thinning and in some cases can be used to reduce stem density and ladder fuel by killing (mostly) smaller trees. This has proven to be effective as the sole means of fuel treatment in the mixed-conifer forest of the southern Sierra Nevada, California (Kilgore and Sando 1975, McCandliss 2002, Stephenson et al. 1991), and may be effective in other Western forests if carefully applied, particularly in stands with large, fire-resistant trees.

Peterson, David L.; Johnson, Morris C.; Agee, James K.; Jain, Theresa B.; McKenzie, Donald; Reinhardt, Elizabeth D. 2005. Forest structure and fire hazard in dry forests of the Western United States. Gen. Tech. Rep. PNW-GTR-628.

<http://www.treearch.fs.fed.us/pubs/viewpub.jsp?index=8572>

Effective fuel treatment programs must consider the spatial pattern of fuel across large landscapes (e.g., Hessburg et al. 2000). ... Treating small or isolated stands without assessing the broader landscape may be ineffective in reducing large-scale crown fire.

Id.

Fuel treatments are not likely to influence fire behavior at a landscape scale. The proposed action proposes to treat fuels at a landscape scale and cause significant soil damage, wildlife habitat disturbance, and hydrological effects, yet only reduce extreme fire hazard by a small degree across the project area. This fuel reduction benefit will only be realized during ideal weather conditions but will have virtually no effect during the most extreme fire conditions. This level of fire hazard reduction is a drop in the bucket, and the NEPA analysis fails to balance the minute level of benefit in terms of fire risk reduction against the great level of soil, water, and wildlife impacts.

The small amount of fuel reduction benefits from this project are also short-lived and will last only about 10-15 years at which point another entry will be required. So all the soil, wildlife, and watershed impacts will be repeated again and again and probably still not stop the big fire from burning it all down during extreme weather conditions that humans cannot control. We have to stop kidding ourselves. On the day of the big fire (and it will come), the difference between the action alternative and the no action alternative is almost nothing, but if the agency instead focused on careful and conscientious treatment in the community zone, maybe the homes and communities can be saved.

The agency should focus fuel reduction efforts within 1/4 mile of the homes and communities and prepare an EIS to more carefully balance the competing interests here (soils, fuels, etc). Jack Cohen's work clearly shows that the most important steps to be taken to protect home and communities are not at the landscape level but at the homesite

and immediately adjacent to the homesite. See USDA Forest Service Gen. Tech. Rep. PSW-GTR-173. 1999 and the publications listed here:

<http://www.firelab.org/fbp/fbresearch/wui/pubs.htm>

Outside the community zone the Forest Service should focus on restoration using non-commercial treatment using hand crews and prescribed fire. The Forest Service must focus on treatment that can be maintained, and do not required repeated entries with heavy equipment that will violate soil standards and exacerbate concerns about hydrology, wildlife, weeds and water quality.

The agency also seems to forget that much of the project area is made up of plant communities that naturally burn at high intensity. No amount of thinning is going to radically alter this natural phenomena over the scale of the next 50-100 years.

Since the benefits of fuel reduction will not be realized during the most extreme fire conditions. The agency must consider what is the likelihood that sometime during the next 50-100 years, there will be a large fire during extreme conditions. If there is a significant risk of that occurrence, then all the soil damage, hydrologic degradation, weed infestations, and wildlife disturbance (of this project and many that will be needed in the future) will be for naught. This is a very significant issue, not only for this project but for many others as well. The agency should do an EIS to consider these weighty issues.

The agencies are frequently citing the work of Mark Finney to justify fuel treatments but there are some significant caveats that must be considered:

1. some fuel treatments actually make fire hazard worse instead of better. (Finney says “some treatments in certain vegetation types have actually increased rate of spread by encouraging the growth of fine fuels.”); and
2. Finney’s modeling does not account for spotting. (Finney says, “Spotting was excluded in the analysis. [Spotting] would create large fires regardless of treatment pattern if fire brands landed in untreated areas. Therefore spotting fires behave independent of treatment pattern unless whole-area treatment was utilized.”

Mark Finney, Fire Behavior Modeling— Outline of the paper: "Design of Regular Landscape Fuel Treatment Patterns for Modifying Fire Growth and Behavior"

<http://www.cnr.berkeley.edu/wfrg/main/lecture01/Finney-Canright-Casey.doc>

Consider the Effects of Livestock Grazing on Forest Health

Livestock grazing has a direct influence on the vegetation structure that this project is designed to address. The agency must analyze the effect of past and future grazing which will tend to reduce palatable fine fuels like grasses and shift the plant community toward less palatable shrubs and trees which are more hazardous as ladder fuels. Livestock grazing probably contributed to the development of plant communities where grass and forbs are underrepresented and small conifers are over-represented. Grazing also likely contributes to the spread of juniper. Future livestock grazing will tend to cause these

same trends, so the NEPA analysis must consider the connected and cumulative impacts of livestock grazing.

This project does nothing to address the threat that livestock grazing causes to forest health. There is virtually no point in trying to mechanically reduce tree density unless you deal with other underlying causes of overstocking, e.g. livestock grazing. The NEPA document describes the effects “on” range resources (e.g., fences and transitory range) but fails to disclose or analyze the effects “of” livestock on forest health and the desired future condition of vegetation composition.

Grazing reduces the density and vigor of grasses which usually outcompete tree seedlings, leading to dense stands of fire-prone small trees. Cows also decrease the abundance of fine fuels which are necessary to carry periodic, low intensity surface fires. This reduces the frequency of fires, but increases their severity. See Belsky, A.J., Blumenthal, D.M., “Effects of Livestock Grazing on Stand Dynamics and Soils in Upland Forest of the Interior West,” *Conservation Biology*, 11(2), April 1997. <http://www.onda.org/library/papers/standdynamics.pdf> See also Wuerthner, George. *Livestock Grazing and Fire*. January, 2003. http://www.onda.org/library/papers/Livestock_Grazing_and_Fire.pdf

The NEPA document failed to address these issues and failed to consider alternative ways of avoiding these impacts by not grazing. The combination of fire suppression, past high-grading, and livestock grazing together caused the overstocked condition of the stands in the analysis area. Logging and prescribed fire will only partially address the problem. To be effective, livestock grazing must also be eliminated. Grazing and logging cause cumulative effects that must be considered together in one NEPA document.

The court’s decision in League of Wilderness Defenders v. USFS, Civil No. 04--488—HA. 2004 U.S. Dist. LEXIS 24413. November 19, 2004, makes clear that the agency has a duty to take a hard look at the effects of grazing in the context of making timber sale decisions. The agency must disclose cumulative impacts and cannot compartmentalize.

Further evidence of the adverse forest health effects of livestock are presented in Michael H. Madany, and Niel E. West. *Livestock Grazing-Fire Regime Interactions within Montane Forests of Zion National Park, Utah*. *Ecology*: Vol. 64, No. 4, pp. 661-667.

Abstract. Major differences were found between the vegetation structure of ponderosa pine-dominated communities on the Horse Pasture Plateau and those on the nearby but isolated Church and Greatheart Mesas in Zion National Park. The Horse Pasture Plateau was heavily grazed by livestock in the late 19th and early 20th centuries, while the mesas were never grazed. Conditions on the mesas now approximate the pre-European situation of the region as described in the earliest written accounts. Pine, oak, and juniper sapling density and cover were much higher on the formerly grazed plateau than on the relict mesas. Herbaceous species dominated the groundlayer in mesa ponderosa pine savanna stands, while grass and forb cover was low on analogous sites of the plateau. Age-class distributions of major tree species further substantiated that major physiognomic

changes have occurred on the plateau since the arrival of European man. Analysis of fire scars showed that prior to 1881, the mean fire-free interval for ponderosa pine stands on the plateau was 4 to 7 yr, while the interval for Church Mesa was 69 yr. Since there were no recorded fires on Church Mesa between 1892 and 1964, and yet no corresponding increase in sapling density, the increased understory density of plateau stands should not be attributed primarily to cessation of fires. Instead, heavy grazing by livestock and associated reduction of the herbaceous groundlayer promoted the establishment of less palatable tree and shrub seedlings, Fire, however, played an important secondary role in maintaining savanna and woodland communities.

Grazing is also known to have significant adverse impacts on ground nesting birds. Cattle Grazing in a National Forest Greatly Reduces Nesting Success in a Ground-nesting Sparrow. Glenn E. Walsberg. The Condor Volume 107, No. 3. August, 2005.

The agency often erroneously concludes that livestock grazing will not affect upland vegetation of fuel profiles because fire suppressed stands are too dense to allow livestock access, but this is a gross oversimplification. The agency is conducting so-called "restoration" projects to reduce fuels and vegetation density which has and will allow livestock use. The NEPA document must disclose how livestock grazing interacts with the so-called forest restoration projects. The goal of restoration is a more open stand, and the agency wants more grass and forbs and fewer conifers, but grazing in those "restored" stands will cause the opposite effect – more conifers and less grass and forbs – thereby conflicting with the restoration objectives.

Let's not pretend that historic fires were all low intensity.

"The Interaction of Fire, Fuels, and Climate across Rocky Mountain Forests," by Tania Schoennagel and Thomas T. Veblen of the University of Colorado and William H. Romme of Colorado State University, criticizes the view that decades of fire suppression have promoted unnaturally-large accumulations of fuel, and that these have fed unprecedentedly large, severe wildfires across Western forests. This philosophy, which grew mainly out of studies in ponderosa pine forests, is embodied in the US administration's Healthy Forests Initiative. But the BioScience authors' studies of fire types lead them to believe that the philosophy is being applied uncritically, including in places where it is inappropriate. Fuel types and amounts have less influence over the spread of fire in high-elevation (subalpine) forests than in low-elevation forests, for example. Climate has relatively more influence on spread of fire in subalpine forests. The authors, noting that previous fire suppression had only a minimal effect on the large Yellowstone fires of 1988, judge that "any recent increases in area burned in subalpine forests are probably not attributable to fire suppression." Schoennagel, Veblen and Romme conclude that a "one size fits all" approach to reducing wildfire hazards in the Rocky Mountain region is unlikely to be effective and could create new problems.

http://www.aibs.org/bioscience-press-releases/040702_articles_on_forest_fire_risks_published_in_bioscience.html

[Schoennagel, T., Veblen, T.T., and Romme, W.H., 2004. The interaction of fire, fuels, and climate across Rocky Mountain forests. *BioScience*, 54: 661-676.

http://www.colorado.edu/geography/biogeography/publications/Schoennagel_et_al_2004.pdf]

An emerging goal of ecosystem management is to maintain ecosystems within their range of natural variability, which requires attention to pre-EuroAmerican landscape-scale processes and corresponding landscape structures (e.g., old-growth forest distribution). The prevailing "equilibrium" view of ponderosa pine forest landscapes, for example, holds that frequent, low-intensity surface fires maintained open, park-like forests of large, old trees. Yet a contrasting "nonequilibrium" view suggests that some forest ecosystems are subject to unpredictable catastrophic disturbances that dramatically alter these ecosystems. To assess these views' relevance, we examined early historical accounts and records of natural disturbances in the ponderosa pine forests of the Black Hills in South Dakota and Wyoming (U.S.A.). There is evidence of frequent, low-intensity surface fires and large, catastrophic disturbances before EuroAmerican influence. Several large, stand-replacing fires occurred between 1730 and 1852, and, shortly after EuroAmerican settlement, a major outbreak of mountain pine beetles (*Dendroctonus ponderosae* Hopk.) occurred. The location of these severe disturbances coincides geographically with early explorers' reports of extensive tracts of relatively dense closed-canopy forests, including some very large patches (5000+ ha) of dense old growth. This contrasts with sparse, open-canopy forests thought to be maintained by periodic, low-intensity surface fires. We suggest that the cooler, moister, central and northern Black Hills and topographically protected areas may have been dominated by infrequent, catastrophic disturbances that maintained large patches of dense forests, including large, contiguous patches of old growth, in a relative state of nonequilibrium. The warmer and drier southern Black Hills, south-facing slopes, and exposed areas may have been dominated by frequent, low-intensity surface fires and other small disturbances that maintained open-canopy forests in a relative state of equilibrium. Proposed Black Hills National Forest management plans that exclusively endorse the equilibrium view are misdirected and will move the forest ecosystem farther outside its range of natural variability.

Douglas J. Shinneman¹ & William L. Baker. 1997. Nonequilibrium Dynamics between Catastrophic Disturbances and Old-Growth Forests in Ponderosa Pine Landscapes of the Black Hills. *Conservation Biology*. Volume 11 Page 1276 - December 1997.

Pierce et al dated fire-related sediment deposits in alluvial fans in central Idaho to reconstruct fire history in dry ponderosa pine forests and examined links to climate.

We find that colder periods experienced frequent low-severity fires, probably fuelled by increased understory growth. Warmer periods experienced severe droughts, stand-replacing fires and large debris flow events Our results suggest that given the powerful influence of climate, restoration of processes

typical of pre-settlement times may be difficult in a warmer future that promotes severe fires.

...

In the western USA, the [Medieval Climate Anomaly] included widespread, severe multi-decadal droughts, with increased fire activity across diverse northwestern conifer forests.

...

Fire management and ecological restoration strategies in ponderosa pine forests typically aim to prevent large stand-replacing fires by reproducing pre-settlement conditions with low tree densities. Climate exerts a powerful control on fire regimes, however, and the rapidity and magnitude of twentieth-century global climate change is probably greater than has occurred for millennia. Efforts to return to fire regimes typical of a generally colder pre-settlement era will need to adapt to changing vegetation and fire activity in a warmer and drought-prone future.

Jennifer L. Pierce, Grant A. Meyer, & A. J. Timothy Jull. 2004. Fire-induced erosion and millennial-scale climate change in northern ponderosa pine forests. *NATURE* |VOL 432 | 4 NOVEMBER 2004; pages 87-91. Cathy Whitlock had another paper published in the same volume 432 of *Nature* and she said “recent fires in low elevation forest near sizeable human populations have led to calls for draconian tree and understorey thinning. Yet the investigations of Pierce et al, and tree ring studies [11-13], suggest that fire activity in these forests has varied in the past and includes episodes of severe fire crown fires and large debris flows. We should consider this long-term perspective before embracing one-side-fits-all management strategies.” Whitlock, Cathy. 2004. Forests, fires and climate. *NATURE* |VOL 432 | 4 NOVEMBER 2004; pages 28-29. citing Pierce et al (2004) and 11. Grissano-Mayer, H. D. & Swetnam, T.W. *Holocene* 10, 213–220 (2000). 12. Veblen, T. T., Kitzberger, T. & Donnegan, J. *Ecol. Appl.* 10, 1178–1195 (2000). 13. Brown, P. M., Kaufmann, M. R. & Shepperd, W. D. *Landscape Ecol.* 14, 513–532 (1999). <http://epswww.unm.edu/facstaff/gmeyer/WhitlockNatureNewsViews2004.pdf>

Many in the timber industry and political circles like to pretend that virtually all historic fires were low intensity fires, and that low intensity fire reinforced an equilibrium pattern of park-like forests maintained by recurrent low-intensity fire. Many people then argue that fire suppression and lack of management have set the state for unnaturally intense fires. While there are grains of truth in this description, recent research is pointing to a much more complex picture of forest and fire regimes— one where eastside forests are dominated, not by an equilibrium pattern of low-intensity fire, but by a non-equilibrium pattern of mixed-severity fire.

While the self-reinforcing low-intensity fire feedback mechanism does operate in certain forests, it rarely dominates. There are several destabilizing forces at play, among them drought and high wind. Even dry Ponderosa pine forests experienced a wide continuum of mixed fire intensities, and canopy replacing fire was not an uncommon occurrence. (Hessburg, Barrett, Jones)

It is likely that the view of dry forest types tightly coupled with low severity fire regimes is oversimplified.

Mixed severity fire was in fact much more common than many people believe, especially in mixed-conifer forests. “We found that mixed severity fires were dominant in forests of all three ecoregions and more common than expected in the dry forests.”⁸ But that’s not to say that nothing has changed: This much is true, fire suppression and fuel build up have increased the spatial connectivity of relatively high fuel conditions, possibly leading to larger average sized patches of stand replacing fire events.

In landscapes, the spatial and temporal patterning of dry forest structure and composition that resulted from frequent fires reinforced low- or mixed-severity fires because frequent burning spatially isolating conditions that supported high-severity fires. These spatial patterns reduced the likelihood of severe fire behavior and effects at each episode of fire. Rarely, dry forest landscapes were synchronous in their conditions and affected by more severe climate-driven events.

Dry forests of the present day no longer appear or function as they once did. Large landscapes are homogeneous in their composition and structure, and the regional landscape is synchronized with a bias for severe, large fire events. At risk is the resumption of forest pattern and disturbance process interactions that are more characteristic of the actual interplay between the current climate and biophysical environments, and there is high uncertainty as to future trajectories for these ecosystems if characteristic pattern and process interactions are not restored.⁹

Hessburg 2005 says “... we theorize: 1) that present-day fire event areas may be larger on average, but individual event areas are not unprecedented; 2) that patches by fire severity class may be larger on average, but individual patches by severity class are not unprecedented in size; 3) that patches of mixed and high severity fire may be more abundant in environments that formerly supported more frequent low severity fire.”¹⁰

Over long-time frames, fires, insect outbreaks, disease epidemics, and weather events historically created and maintained patterns of dry forest structure and composition that supported an exceptional variety of plant and animal species, and a host of critical processes. The interplay between patterns and processes

⁸ Hessburg, Paul. Evidence for the Extent of Mixed Severity Fires in Pre-Management Era Dry Forests of the Inland Northwest. Proceedings: Mixed Severity Fire Regimes: Ecology and Management. November 17–19, 2004. Spokane, Washington.

<http://emmps.wsu.edu/fire/secondary/PROCEEDINGS.html#Abstracts/Hessburg.html>

⁹ Paul Hessburg. Pattern and process interactions of present-day ponderosa pine forest ecosystems: Spatial and temporal patterns matter. Risk Assessment for Decision-Making Related to Uncharacteristic Wildfire Summary notes of a conference held November 17-19, 2003. Portland, OR.

<http://outreach.cof.orst.edu/riskassessment/RiskAssesSummary.pdf>

¹⁰ Paul F. Hessburg, R. Brion Salter, and Kevin M. James. Variable Fire Severity and Non-Equilibrium Dynamics in Pre-Management Era Dry Forests of the Inland Northwest, USA. [pre-publication draft]

created a metastable patch dynamic. ... [P]atches of isolated stand replacement fire were common in historical dry forest landscapes, but today, entire landscapes are claimed by severe fires. Furthermore, present day large wildfires synchronize landscapes by creating very large patches with corresponding forest regeneration, species composition, structure, fuel beds, and size and age class distribution, thereby facilitating very large future wildfires. ... To create fire regimes that are more predictable and more consistent with environmental settings under the current climatic regime, we suggest that landscape patterns of fuel, forest structure, and composition will need to be created that are characteristically associated with those regimes. We further suggest, that to improve assurances that native species and processes will persist, it will also be important to restore forest landscapes that reflect some semblance of the spatial and temporal variation in patterns that species evolved with. ... once restored, dry forests should not only support the fire regime of interest, but also viable populations of native species in functional habitat networks across space and through time.¹¹

Our management objective therefore should NOT be to impose uniform low intensity fire regime by treating virtually every acre out there. To restore characteristic landscape patterns we should recognize the value of a great diversity of fire intensities. This may be accomplished by among other things, "desynchronizing" forest patches where fuel has built up. "A reasonable target of restoration would be to restore a more typical pattern of isolation to affected landscapes."¹²

"Key stand-level habitat elements, especially large trees, snags, and down wood, are critical in most cover types and current legacies may explain why many species are broadly distributed among cover types and structural stages. Management should attempt to restore the natural patterns and disturbance processes in mixed-severity forests, i.e. the mix of open and closed, early- and late-seral stand conditions, and associated snag and down-wood habitat elements, created by different fire intensities." John F. Lehmkuhl. Forest Wildlife Management in Mixed-Severity Fire Regimes in the Pacific Northwest. Proceedings. Mixed Severity Fire Regimes: Ecology and Management. November 17–19, 2004. Spokane, Washington.

<http://emmps.wsu.edu/fire/secondary/PROCEEDINGS.html#Abstracts/Lehmkuhl.html>

The scale of treatments is a key consideration. Fine-scale within-stand variability is essential. Raymond (2004) found that in a mixed-conifer forest in SW Oregon "untreated plots had the highest within treatment variability in fire severity. The fire heavily scorched some patches of trees, but left others undamaged, creating small-scale spatial variability in canopy structure and species composition in the untreated stands." Crystal L. Raymond. 2004. The Effects of Fuel Treatments on Fire Severity in a Mixed-

¹¹ Paul F. Hessburg, James K. Agee, Jerry F. Franklin. 2005. Dry forests and wildland fires of the inland Northwest USA: Contrasting the landscape ecology of the pre-settlement and modern eras. *Forest Ecology and Management* (in press).

¹² P.F. Hessburg, B.G. Smith, R.B. Salter, R.D. Ottmar, E. Alvarado. 2000. Recent changes (1930s-1990s) in spatial patterns of interior northwest forests, USA. *Forest Ecology and Management* 136 (2000) 53-83.

Evergreen Forest of Southwestern Oregon. MS Thesis.

http://depts.washington.edu/nwfire/publication/Raymond_2004.pdf

Once we have strategically broken up synchronous forest patches, the natural variables associated with fire behavior, patchy fuels, variable wind and moisture conditions, diverse topography and opportunistic organisms should do the rest, resulting in a mosaic forest pattern that should be self-similar at many scales. See Gisiger, T. 2001. Scale invariance in biology: coincidence or footprint of universal mechanism? *Bio. Rev.* (2001) 76 pp 161-209.

<http://www.pasteur.fr/recherche/unites/neubiomol/ARTICLES/Gisiger2001.pdf>

(“Evidence suggests that some ecological systems operate near a critical state. ... Two main forces appear to shape tree distribution in rainforests ... treefall and tree regeneration. ... The rainforest gap set possesses a whole spectrum of fractal dimensions which shows correlations of the gaps on all scales and ranges: it therefore seems to be a large living fractal structure. ... The presence of fractals and power-law distributions are strongly suggestive that the rain forest has evolved to a critical state where fluctuations of all sizes are present.”) See also and Sole and Manrubia

<http://complex.upf.es/~susanna/ABS1.html>

To the extent that current stand densities are thought to be above the historic range of variability, the agency should consider the cumulative contributions of fire suppression, higher ambient CO₂ levels, and native burning practices. These considerations could change our view of what caused the “historic range” and what “future range of variability” is possible given changed circumstances. Maybe the future fire regime will be different than the historic fire regime because fire are still being suppressed, native burning is not being practiced, and because CO₂ levels are higher and will remain higher for centuries. See

Managers should attempt to plan for climate change and manage forest and woodland resources for high native biodiversity and landscape heterogeneity to sustain landscape-level processes that may be more resilient in the face of these anticipated changes.

...

Our study highlights the fact that using a single pre-settlement reference point to guide restoration is flawed in several ways. First, we concede that prehistoric conditions at any single site can never be fully known or understood. Our research indicates that the pre-settlement model is biased to forest overstory structural components and neglects compositional elements of the understory and many important processes. Second, presettlement usually refers to before Anglo-American settlement, but our studies highlight the fact that landscapes throughout the West evolved in the presence of humans for thousands of years before Anglo settlement, and that the native inhabitants influenced these landscapes in a multitude of ways. Third, some processes that were important in pre-settlement landscapes are now difficult or impossible to maintain, such as the frequent low-intensity fires that were so important to these Western landscapes, the role of missing predators, and depletion of surface and ground water through human over-use.

Finally, such a retrospective view fails to account for several important modern influences on our landscapes, including pollution, exotic species invasions, habitat loss or fragmentation, or climate change.

Instead, we recommend expanding the restoration goal of pre-settlement reference conditions to a site-specific reference envelope, that incorporates information from a number of different data sources.

Gary Paul Nabhan, Marcelle Coder, Susan J. Smith, Zsuzsi I. Kovacs. Land use history impacts on biodiversity - Implications for management strategies (Western U.S.): Final Report. National Commission on Science for Sustainable Forestry.

<http://www.ncseonline.org/ewebeditpro/items/O62F5163.pdf>

Sincerely,

A handwritten signature in cursive script that reads "Doug Heiken". The signature is written in black ink and is positioned to the left of a vertical line.

Doug Heiken

Response to Oregon Wild Comments on Bald Angel Vegetation Management Project EA 2006/7

A. This project has not significantly changed since it was previously approved. The concerns raised in our appeal remain valid:

- The EA fails to adequately consider and evaluate a reasonable number and variety of alternatives, in violation of NEPA's requirements of examining all reasonable alternatives that meet project objectives.

Response: Although the respondent does not provide details on what type of action alternative would be appropriate for analysis, the planning team did consider four alternatives in detail and an additional two alternatives, EA pg 26-27 which were eliminated from detailed study because they did not meet the purpose and need. The range of action alternatives developed in detail reflect the issues identified by the public during the scoping for this project.

- The EA fails to adequately examine cumulative effects from past logging, grazing and adjacent private land management.

Response: Cumulative effects were analyzed for each resource area and documented in the EA, Chapter 3, pages 63-152 and in Appendix D: Bald Angel Cumulative Effects Analysis pages 2-34.

- The EA would further degrade already degraded big game habitat by constructing additional roads on an area that already exceeds LRMP standards for road density and removing cover.

Response: Reference Access and Travel Mgt., Road Density Table chapter 3, pg. 124. Exceeded densities are indicated for 13F MA 3, 29D MA 1&3, 29E MA 1, and 29F MA 1. The narrative immediately preceding and following table offers the rationale for the densities: MA 3 - all roads are effectively closed by snow as called for in the Forest Plan (page 4-60 and 4-62), 29F MA1 – density value skewed by the inappropriate (small) size of area (analysis this resource is intended to be generally accomplished at the full or near full subwatershed level), 29D MA 1 – concentration of local (ML 2) roads due to resource protection, permittee access, and public access and access to Eagle Creek, 29E – concentration of collector/arterial (ML 2/3) due to Balm Creek Reservoir and private land.

- The EA represents a flawed approach to protecting soil health, as directed by the LRMP.

Response: Soil quality is being maintained on approximately 96% of the project area in comparison to the Forest Plan guideline of maintain in at least a minimum of 80% of a project area in a non-detrimental soil condition. Implementation of any action alternative would increase DSCs up to 1.9% for all potential soil impacts (tractor logging, road construction, skyline yarding) – refer to Chapter 3 of the EA, pages 105-115.

- The EA fails to adequately protect snags and down wood to the degree required by the LRMP and indicated as proper under ICBEMP.

Response: An earlier addition of Chapter 2 was inadvertently mailed out to the public during the comment period. The primary change from the version of Chapter 2 mailed out to the final updated version is the treatment of snags within the project area. The previous version called for use of the District Snag Policy which had been changed to **“No snag**

removal of trees \geq 12 inches dbh". Chapters One and Three were correct in the mailing and already reflected the effects of this change in snag direction for the project. Effects on snag habitat and snag associated wildlife species are discussed on pages 128-132 in the EA. This project recognizes the value of larger snags and addresses this by retaining **all** snags \geq 12 inches dbh (EA, Chapter 2, page 35).

- The EA proposes to convert multi story old growth (MSLT) into single story old growth (SSLT) when the amount of old growth is below the HRV for both old growth types.

Response: The effects to old growth habitat are discussed in the EA on pages 68-76. The proposed treatments within 997 acres of multi-strata large trees common structural stage would reduce the quality of these stands for some wildlife species, but would restore or initiate development of single strata large trees common structure which is a more sustainable condition for these specific stands and important to species which rely on single strata old growth habitat. There will be no net loss of old growth with this project.

- The inadequate economic analysis violates NEPA.

Response: The first and second paragraphs of the economic effects document state the parameters and scope of the analysis and the purpose of the analysis: *"The Bald Angel timber sale will produce a quantifiable product that will be used to determine the "net value" of this project in terms of dollars and cents. Benefits in terms of dollars and cents, especially in natural resource management where the benefits may be increased resiliency to pathogens, increased mean annual increment, and reduced fire hazard are hard to define and outside the scope of this economic analysis."*

The qualitative and quantitative benefits of these treatments are described in the Alternative descriptions and in the other effects documents contained in this EA.

The effects analysis also states in the second paragraph: *"This analysis will assess how the alternatives relate to timber sale viability, economic efficiency and socio-economic impacts on a **relative basis between alternative**."* (emphasis added). What was quantifiable was considered, what was subjective in terms dollars and cents was not.

- The data gaps and lack of clear references to scientific information violates NEPA.

Response: References to scientific information used in the analysis for this project are located in the Specialist's Reports in the Project Analysis File as indicated in the Introduction of Chapter 3 of the EA on page 63.

- The EA will not ensure the viability of wildlife species and is a violation of NFMA.

Response: The effects of this project on wildlife species and their viability are discussed in Chapter 3 of the EA pages 68-80, 125-138..

B. Capturing mortality will make a bad situation worse for snag habitat - Page 130 of the EA indirectly admits that the proposed logging will make a bad situation worse for snag habitat, because past logging activity has resulted in a deficit of large snags and the current action will continue that negative trend. The EA then has two misleading statements: that thinning benefits large snags, and that this is a minor incremental effect.

Response: An earlier addition of Chapter 2 was inadvertently mailed out to the public during the comment period. The primary change from the version of Chapter 2 mailed out to the final updated version is the treatment of snags within the project area. The previous version called for use of the District Snag Policy which had been changed to **"No snag**

removal of trees \geq 12 inches dbh". Chapters One and Three were correct in the mailing and already reflected the effects of this change in snag direction for the project.

C. The EA does not consider or disclose the cumulative regional adverse impact of past, present and the foreseeable aggressive fuel reduction efforts on already degraded snag habitat. An EIS is needed to address this issue.

Response: Refer to response B above.

D. New information on Snags - An unavoidable impact of all commercial logging is to "capture mortality" which reduces valuable snag habitat in the short-term (via hazard tree felling) and in the long-term (via delayed recruitment and reduced overall recruitment).

Response: See response to comment above related to snags.

E. Inadequacy of Current Snag Guidelines and Current Postfire Management Decisions Related to Snag Retention - The bottom line is that current management at both the plan and project level does not reflect all this new information about the value of abundant snags and down wood.

Response: See response to comment above related to snags.

F. Consider the following before relying on DecAID - Although DecAID helps bring together lots of useful information about snag associated species, the agency must recognize and account for the short-comings of DecAID and cannot rely on DecAID to provide the project-level snag standards because: DecAID is a tool designed for plan level evaluations, because DecAID itself has not been subjected to NEPA analysis and comparison to alternatives, and because DecAID is an inadequate tool for the purpose.

Response: These were considerations in developing the snag and green tree retention levels for this project. DecAID was used as one source of technical information, not in place of existing Forest Plan direction. The Bald Angel project retains "...all existing snags greater than 12" d.b.h...", and "the only snags that would be cut in any action alternative would be due to operational needs such as landing or skid trail placement and safety concerns. Retention of all existing snags retains current snag habitat to the greatest level possible." (Bald Angel Wildlife Effects Analysis page 22)

G. Snag retention standards overestimate habitat capability - The traditional snag habitat model used by the agency is based on outdated science which vastly overestimates habitat capability for snag-dependent species because it fails to consider important factors such as:

The agency's analysis of snag retention and habitat for cavity dependent species is faulty at both a programmatic level and at a project level. The agency must defer any decision on this project until it reviews all the available new information and amends its management plan standards to provide adequate snags for wildlife and all other ecosystem functions.

Response: See responses to comments B and C above related to snags.

H. New information on Pileated Woodpeckers indicates Standards & Guidelines are Inadequate.

- The NEPA analysis failed to consider significant new information on pileated woodpeckers including:
- Pileated woodpeckers need more and larger roosting trees than nesting trees. They may use only one nesting tree in a year, they may use 7 or more roosting trees.
 - West of the Cascades, pileated woodpeckers tend to prefer nesting in decadent trees rather than snags.
 - West of the Cascades, standing snags are important foraging sites because down wood may be too wet to harbor carpenter ants (the favored foods of the pileated woodpecker).
 - West of the Cascades, Pacific silver fir is often used for nesting (but not roosting).

- e. West of the Cascades, western redcedar is often used for roosting (but not nesting).

Response: Information from local research by E.Bull (1977, 1980, 1983, & 2001) and Nielsen-Pincus (2005) was used in planning and the analysis of effects for this project. Bull's research is in the DecAID advisor, and Nielsen-Pincus' research is still in unpublished form. However, these sources of information are much more applicable to the Bald Angel project than the "West of the Cascades" references you provide. Known pileated nests are protected and large snags and logs are retained at existing levels, so these structures will not be reduced from current levels. Roost trees are impractical to inventory over areas as large as the Bald Angle project. However, decadent live trees with signs of woodpecker use will be retained as green tree replacements or as snags when existing snag numbers are below the recommended levels.

I. Temporary Roads - The agency assumes that temporary and semi-permanent new roads will have no effect because they are temporary. The agency has shown no scientific evidence for this assumption.

Response: This project does not indicate in any way that temporary roads have no effect, in fact, the effects of temporary roads in this project are described throughout Chapter Three of the EA and in Appendix D.

J. Don't focus on reducing canopy fuels. - Before embarking on an aggressive strategy of crown fuel reduction, the agency must address the responsible opposing viewpoints regarding the manifold values of retaining more canopy to retain cooler temperatures and moisture.

Response: This project does not focus on only reducing canopy fuels, it is an integration of treatment of surface, ladder, and canopy fuels. Refer to the fuels treatment/prescription description in Chapter 2, pages 29-31 of the EA.

K. Disclose the effect of removing trees over 12 inches. - Please place a diameter limit on trees to be cut. We suggest a 12 inch maximum diameter cap. The best available information indicates fire hazard can actually be increased by the removal of trees that form the canopy (generally over 12 inches in diameter).

Response: This project is not solely focused on fire hazard reduction (see Purpose and Need Chapter One) but also maintaining stocking at a level that will promote tree growth and vigor, decrease susceptibility to insects, and reduce fire risk. Therefore, a 12" diameter cap will not achieve the silvicultural needs of the stands slated for stocking density reduction and in turn, not meet the Purpose and Need of this project.

L. Concerns about Fuels Management Effectiveness - The most significant effect of this type of heavy thinning is to increase the warming and drying of ground fuels and to increase the growth of ladder fuels, both of which significantly detract of the risk reduction objectives and are expensive to treat. The NEPA analysis must address the complex effects of thinning including tendencies to reduce and increase fire hazard.

It would be better to just do a controlled prescribed burn at the right time of year without logging. The EA should have considered such an alternative.

Response: The silvicultural approach for managing harvest units in the analysis area describes treatment objectives, methods and anticipated outcomes for the vegetation management (Chapter II, pg 27-29, Prescriptions / Objectives). Thinning, slash treatment, and prescribed burning of harvest units are all parts of an integrated silvicultural prescription that will be initiated and maintained over the implementation timeframe.

The potential increase in fire hazard created by logging is addressed by the FS in the EA on page 88 of Chapter 3 and incorporated into the analysis of each alternative on pages 89-91 of the EA.

An alternative that would consider only prescribed burning was considered in the project (EA, Page 26-27) however, it did not meet the purpose and need.

M. Landscape fire - The NEPA analysis must disclose and analyze spatial priorities for fuel treatments. Credible but highly theoretical simulation work by the Forest Service's Mark Finney shows that effective fuel reduction requires that we carefully consider how fire moves across landscape and spatially prioritize treatments to interrupt likely fire travel routes. The NEPA analysis must acknowledge that random/arbitrary placement of fuel treatments will have little effect on large fires unless high proportions of landscape are treated.

The proposed action proposes to treat fuels at a landscape scale and cause significant soil damage, wildlife habitat disturbance, and hydrological effects, yet only reduce extreme fire hazard by a small degree across the project area. This fuel reduction benefit will only be realized during ideal weather conditions but will have virtually no effect during the most extreme fire conditions. This level of fire hazard reduction is a drop in the bucket, and the NEPA analysis fails to balance the minute level of benefit in terms of fire risk reduction against the great level of soil, water, and wildlife impacts.

Response: The effects of fuels reduction work on soils, water, and wildlife are described in the EA, pages 105-115 (soils), 97-105 (water) 68-80, 125-138 (wildlife).

N. Consider the Effects of Livestock Grazing on Forest Health - The agency must analyze the effect of past and future grazing which will tend to reduce palatable fine fuels like grasses and shift the plant community toward less palatable shrubs and trees which are more hazardous as ladder fuels.

The NEPA document describes the effects "on" range resources (e.g., fences and transitory range) but fails to disclose or analyze the effects "of" livestock on forest health and the desired future condition of vegetation composition.

Response: Livestock grazing within the project area will be analyzed in a separate document beginning in 2007 and is outside the scope of this analysis. Treatments proposed within the Bald Angel Project are not connected to the ongoing livestock use within the project area. Permitted grazing is administered to meet Wallowa-Whitman Forest Plan LRMP standards and guides. Where livestock grazing is found to not meet LRMP standards and guides, modification of the timing, duration or intensity of grazing is made to allow accomplishment of these standards through the administration of the permit. Livestock grazing activities was incorporated into the cumulative effects analysis as described in Appendix D pages 6-34 and in Chapter 3.

O. Let's not pretend that historic fires were all low intensity.

Response: We are in complete agreement with Oregon Wild that historic fires were a complex combination of fire intensities creating a mosaic across the landscape of varying disturbance levels. We also acknowledge that in the event of a wildfire this would remain true today. However, because fire return intervals are so far outside of their historic ranges, fuel loadings across large landscapes are well above their historic levels as well. It is our intent, to minimize the extent and number of resources lost in the event of a wildfire by providing areas where the fire will drop down out of the canopy and flame lengths will be reduced so that firefighters can safely attack the fire and stop it from consuming more acres than would have historically occurred. We recognize that there will still be a mosaic of fire intensities and resources lost within the fire perimeter; however, it is our desire to keep that perimeter smaller than what it could become in the absence of treatment.

Response to HCPC Comments on Bald Angel Vegetation Management Project EA 2006/7

A. The EA did not address any harvest before 1978 which likely highly impacted the species mix and age of existing trees in the area. It is very likely that the area was completely logged from the 1800's up until 1978 at least once. The impacts of this earlier logging have left their mark on the present stand of trees and need to be analyzed.

Response: Appendix D reflects all of the records we have. Historic documentation found on the Umatilla National Forest's website (<http://www.fs.fed.us/r6/uma/publications/history/>) provided additional information on activities and timber types within the project area in 1917. The document *Powder River Timber Survey Project* (Griffin and Conover, 1917) was considered by the planning team for this project and is reflected in the specialist's Existing Condition reports. Their reports reflect the effects of all activities, including those prior to 1978. Therefore, the effects of these projects are being adequately analyzed in the cumulative effects analyses for this project (see Chapter 3 and Appendix D).

B. "The proposed treatments are prescribed to address needs within the project area for the next 10+ years." P.3. The key issues seem to cover a time frame much longer than 10+ years, p. 10. These conflicting time frames blur the objective of this proposal.

Response: Current conditions within the project area related to the key issues took many decades to get where they are today. It will likewise take multiple decades to trend the area toward the desired conditions for all resources. The purposes of the actions in this project are to begin that trend because there are no one treatment/one time solutions to the issues within this project area.

C. The proposed action p. 3, is unclear and does not detail proposed actions.

Response: The proposed action as described on page 3 of the EA is not intended to be a detailed description. It is intended to provide an overview of the original proposal that came out of the purpose and need which was then scoped with the public to determine the issues, concerns, and opportunities associated with it (the proposed action). The full description of the Proposed Action can be found in Chapter 2 of the EA under Alternative 2 – The Proposed Action. Pages 27-39, 46-57, and 60-62 of the EA describe this alternative (the Proposed Action) in depth.

D. The 36,700 acre Bald Angel project area may or may not be effectively treated to decrease the possibility of a high severity fire. Climate has been and will likely continue to be the primary factor in large scale wildfires of high severity. Typically only a small portion of any fire has high severity impacts to the soil. So the public wants to know, what are the costs in terms of taxpayer dollars and to the environment and what are the benefits of this proposal? This EA fails to give a clear picture of this proposal in these terms. For example, what is the probability of a high severity fire in the next 10 years with no action and what would be the probability after the treatment? How will global climate change effect fire behavior in this project area?

Response: Chapter 3 (Environmental Consequences) which includes an analysis of Economics for this project, describes what the costs and benefits are in terms of taxpayer dollars and resources. The Fire Hazard Assessment (Chapter 3, pp. 82, 88-92) evaluates three critical elements: fire occurrence, hazard, and consequence. Fire Occurrence is the total number of fire ignitions during a selected timeframe, within a determined location. Hazard is assigned a value derived from the existing fuel model; the hazard value also considers percent slope, aspect, elevation, and stand structure. Consequence is assigned a value based on resources or areas of concern if exposed to high intensity fire. For example, a high numeric value would be mapped old growth, municipal watersheds, and private lands. Risk is the summary value of the three inputs. Risk is defined as the

potential for resource loss or “damage” due to high intensity fires. Therefore, this analysis provides the risk of potential loss due to high intensity fires of No Action and after treatment.

E. “HRV is important to wildlife populations because the distribution, quality and quantity of habitat largely determine the potential for a wildlife species to exist at viable levels. As habitat was converted, fragmented and opened to motorized access, many species were reduced in number and others were precluded from portions of their geographic range altogether” p. 12. The EA supplies no population data to confirm or deny this statement. Managing habitat is important for the viability of species but without population data the public does not know what the past impacts have been or will be into the future. With the continued loss of habitat it is likely to expect declining wildlife populations for MIS and other species.

Response: The statement on page 12 is based on the premise that if habitat is reduced, eliminated, or compromised then the wildlife populations associated with that habitat will also be reduced, eliminated or compromised. Population data on each species or even representative species is not necessary to support this assertion.

F. Elk, a MIS, will likely continue to experience population declines if this proposed moves forward. The HEI standard is not being met. The management objectives set by ODFW are not being met. Considering that motorized use is continuing to occur on closed roads and there is no proposal to increase enforcement, what makes you believe closing more roads will keep motorized traffic from using this area?

Response: Reference EA, pg. 33 Closure Area. This yearlong closure will be implemented in a manner consistent with recent revisions to regulations 36 CFR parts 212, 251, 261, and 295 (New Travel Management Rule). Forest Service thinking is that most users try to comply with regulations and therefore the majority of the closure benefits will be realized through use of a ‘Motor Vehicle Use’ map and sign plan, to be produced for this area; with these directions available law enforcement will be able to focus on the few users who intend to violate the law. Enforcement will be more effective and efficient in a “closed unless signed open” scenario than under the current situation.

EA page 77 points out that alternative 3 of Bald Angel would initiate a slight upward trend in the overall HEI value for this area (.43 to .45), but would remain below the recommended minimum level of .50 from the Land and Resource Management Plan. Your assertion that “...motor access and lack of security cover” will be degraded by this proposal is unsupported in your letter. The area closure and specific roads identified for closure will create substantial security areas for elk, which is likely to improve the distribution of elk in this planning area as discussed in the EA pages 76-80.

G. The impacts of OHV use on closed roads is not considered in the HEI analysis so the HEI is inaccurate in estimating effects of motorized use on elk populations. Unregulated motorized use will continue to degrade elk habitat and degrade other resources such as snag retention by firewood cutters unless action is taken to correct the problem.

Response: This is acknowledged on page 13 of the wildlife inventory, “Unregulated use of off highway vehicles likely has a deleterious effect on elk distribution in this area, particularly during elk hunting seasons. Impacts of off highway vehicle use on closed roads and cross country travel are not considered in the HEI analysis. As a result, the HEI variable (by either the density or distance band method) cannot be considered an accurate measure of habitat effectiveness for elk.” The HEI model is not capable of reflecting site specific effects of unregulated OHV use of closed roads or cross country travel. Even if the model could use such data, we do not have data on these uses nor is it practical to collect these data. See item “F” for further discussion of how this project addresses unregulated motorized access.

H. The consequences of fuel management are not well described in the EA. For example, what are the increased erosion factors from increased driving on roads and disturbing ground when reducing fuels? An EIS could explore more of these impacts in detail.

Response: The effects of timber harvest, roads and prescribed fire activities on soils are described in detail on pages 105-115 in the EA.

I. The impacts to water quality as discussed on pages 18-20 point out the poor health of the watersheds in the analysis area. Proposed action alternatives will likely further degrade water quality. According to the analysis file, "All streams within the project area are well below the objective of 96 pools/mile and are considered in poor condition."

Response: The effects of the action alternatives on water quality are fully disclosed on pages 97-101 and 103-105 in the EA. This project will not retard or prevent attainment of riparian management objectives, including those for pools/mile.

J. The EA fails to discuss how grazing has replaced native perennial grasses with annual non-native grasses and the impacts this has on the ecosystem. An EIS could explore this issue.

Response: Livestock grazing within the Bald Angel Project area has been an ongoing resource use since before the turn of the century. Much of the lands located in the southern portion of the project were privately held until the mid 40's. During this period of private ownership, clearcutting and heavy equipment disturbance affected most of the area. Livestock were grazed on the established NFS lands as well as the private lands but in much greater numbers than are currently permitted. Areas of primary range were depleted and ranked poorly during the 1957 range inventory. A comprehensive inventory has not been conducted since that time.

Currently, livestock grazing is managed more intensively with fewer livestock. More recent timber harvest, road construction/decommissioning and seeding for erosion control and forage grasses have permitted the introduction of non-native grasses in some locations. There are some areas where disturbance from past timber harvest and to a smaller extent, livestock grazing, has contributed to a shift from native perennial grasses to annual grasses. Overall, the area has not shown a large shift from native perennial to non-native annual grasses. In areas where this may have occurred, livestock grazing takes place during the summer months when annual grasses have already senesced and are unpalatable.

In general, any changes, due to livestock grazing, are small and isolated and have not led to any measurable cumulative effect on the ecosystem. See also Appendix D.

K. Pileated woodpecker, northern goshawk and American marten, all MIS, depend on old growth and mature forests. P. 21. Unfortunately there is not data on population trends of these species in the analysis area or on the forest as a whole. Without population data, habitat for these species is critical for gauging the viability of these species. Unfortunately the action alternatives will decrease habitat for these species, likely adversely impacting the population viability.

Response: Effects to MIS are discussed in the EA in several locations. Pileated woodpecker and marten are covered in the old growth habitat section (pages 69-76), primary cavity excavators in the snag/log section (pages 128-132), elk in the big game section (pages 76-80), and goshawk in a specific section for this species (pages 125-128). Monitoring of MIS can be done at many levels that range from very simple cursory monitoring for specific projects (like this one) to intense research that covers larger geographic areas. The wildlife effects analysis meets the letter and intent of NEPA by disclosing the potential effects of this project commensurate with the scale, nature, and complexity of the project. No further monitoring is necessary in order to make an informed decision regarding this proposal.

L. Neotropical birds have experienced population declines in many areas of North America (Finch, 1991) and likely declines in the analysis area also but there is no data offered for the Bald Angel area.

Response: Neotropical migratory birds are addressed on pages 132-135 of the EA and pages 26-28 of the Bald Angel Wildlife Effects analysis. These species are not monitored at the project level. Broader scale efforts such as the breeding bird survey and Christmas bird count provide us with trend data for various birds, neotrops included.

M. NOAA recommends less than 2 miles per square mile and no valley bottom roads for steelhead. It seems rational to use this same recommendation for wild native trout in the analysis area to redband trout, a sensitive species.

Response: There are no steelhead within the project area. Forest plan open road densities of 1.5 and 2.5 miles per square mile area appropriate for the species you reference. The roads analysis for this project examined in depth road which may have an effect on fish bearing streams and the decisions related to that are reflected in the Post Sale Road Management Plan and the Area Closure.

N. The table on page 23 shows many areas violating the Forest Plan road density guidelines. Illegal user-created roads add to the actual miles and densities that further put a strain on the ecosystem and are not accounted for in figuring road density numbers.

Magistrate Judge Papak ruled in the recent NF Burnt River case on the WWNF wrote:

“Forest Plan Open-Road Density Standards

Plaintiffs argue that the Forest Service's authorized mining plans fail to comply with the open-road density standards of the WWNF Forest Plan. This open-road density guideline provides that the Forest Service must “[m]eet the specific open-road density guidelines found in the direction for individual management areas unless a specific exception is determined, through the Forest Service NEPA process, to be needed to meet management objectives.” AR 00227

Given this ruling, the WWNF needs to re-assess the road density issue in Bald Angel and clearly give reasons why an exception is warranted. Without more analysis the court is likely to take a hard look at the Bald Angel proposal. Table on page 104 discloses several watersheds are out of the Forest Plan compliance.

Response: Reference Access and Travel Mgt., Road Density Table chapter 3, pg. 124. Exceeded densities are indicated for 13F MA 3, 29D MA 1&3, 29E MA 1, and 29F MA 1. The narrative immediately preceding and following table offers the rationale for the densities: MA 3 - all roads are effectively closed by snow as called for in the Forest Plan (page 4-60 and 4-62), 29F MA1 – density value skewed by the inappropriate (small) size of area (analysis this resource is intended to be generally accomplished at the full or near full subwatershed level), 29D MA 1 – concentration of local (ML 2) roads due to resource protection, permittee access, and public access and access to Eagle Creek, 29E – concentration of collector/arterial (ML 2/3) due to Balm Creek Reservoir and private land.

O. Alternative A was eliminated because it did not adequately reduce tree densities in overstocked stands. No data is offered by the EA to confirm that thinning of small diameter would not achieve the objective. Again, an EIS could be necessary to shed light on this issue.

Response: The project Silviculturist did not consider any materials less than 5" dbh in his density calculations. All overstocked stands were overstocked because of trees >5-7" dbh, therefore, all materials <5-7 inches could be removed and the area would remain severely overstocked.

P. Cutting commercial logs within the riparian areas would violate the INFISH no-cut buffer guidelines and decrease the large woody recruitment in riparian zones. Non-commercial thinning could reduce stand density with less disturbances to streams.

Response: 80% or more of RHCA stands are in an overstocked condition. Thinning of dense, overstocked stands will improve crown density to achieve the fastest growth for obtaining the desired crown density and species composition, enhancing large wood recruitment and conifer stream shade in the long term. In addition, thinning of overstocked stands will result in trees much more resistant to insects, disease, and fire. INFISH direction allows for entrance into RHCAs when treatment will not retard or prevent the attainment of Riparian Management Objectives and when silvicultural practices are applied to acquire desired vegetation characteristics in order to meet or accelerate attainment of RMOs (Analysis of Effects on Fisheries and Watershed Resources, Specialist Report, pages 6, 7, 8, and 12).

No activity INFISH buffers of 300 feet will be implemented on all fish bearing streams adjacent to harvest units. Ground cover in the form of grasses, forbs, shrubs, and down wood in combination with the 300 foot distance to fish bearing streams will prevent any sediment from reaching fish habitat. With the preferred alternative, RHCA modifications are proposed in two units adjacent to intermittent non-fishbearing streams where a 10 foot no activity buffer will be implemented. There will be no measurable change in sediment delivery rates with RHCA modifications in these two units due to gentle slopes ranging from 5 to 25%, abundant grass and forb cover, and sufficient down wood in and around the stream channel, which will trap and retain sediment before reaching fish habitat. RHCA modification units were visited and analyzed on a site specific basis to meet silvicultural objectives and minimize impacts to streams and improve RMOs at the site level. There will be no measurable changes to sediment delivery rates and no direct impacts to stream shade and bank stability due to site specific marking and layout of modified RHCAs by watershed specialist and fisheries biologists. (Analysis of Effects on Fisheries and Watershed Resources, Specialist Report, pages 6, 7 and 8)

Q. The EA does not adequately demonstrate that thinning MSLT will help old growth dependent species in the Bald Angel area. Again the need for an EIS is warranted.

Response: Thinning from below (focusing on the smaller commercial sized trees for mechanical removal) and using prescribed fire to reduce densities of smaller trees will reduce tree stocking, increase the average diameter of trees, allow the remaining trees to put on growth at a faster rate, and to be more resistant to insects, pathogens, and fire. Thinning of drier forested stands will move them toward "single-stratum large trees common" structural stage which is severely deficient in this area. Wildlife species including white-headed woodpecker, pygmy nuthatch, and flammulated owl would benefit from a return of these ponderosa pine stands to a condition more reflective of historical conditions.

R. Alternative 2, the proposed alternative, and Alternative 3, the preferred alternative, are supposed to improve long term forest health, protect and increase LOS, protect and increase big game security and return fire intervals to natural levels. P. 35. Unfortunately this can not be expected for several reasons. First, "The proposed treatments are prescribed to address needs within the project area for the next 10+ years." Not for the long term. Second, the EA fails to demonstrate how LOS will be protected by thinning old growth and what are the consequences of thinning on wildlife and other resources such as water quality? Third, big game security will be degraded by logging and the roads closed alone will not effectively stop motorized use of the closed roads. Fourth, fire return intervals will only return to natural levels if the WWNF is committed to

prescribed burning every 20 years which is beyond the scope of this project or natural fire is allowed to return to its normal process in the area.

Response: See responses to Comments B, F, and Q. The effects to old growth habitat are discussed in the EA on pages 68-76. The proposed treatments within 997 acres of multi-strata large trees common structural stage would reduce the quality of these stands for some wildlife species, but would restore or initiate development of single strata large trees common structure which is a more sustainable condition for these specific stands and important to species which rely on single strata old growth habitat. There will be no net loss of old growth with this project.

S. The EA states that stocking levels exceed recommended numbers in approximately 25% of the stands across all biophysical groups in the Bald Angel Planning area. No data is offered as to what the natural levels of overstocked stands were historically. It is impossible for the decision maker and the public to compare the differences.

Response: The 25% overstocking level found on page 63 of the EA was a typo. The numbers were inadvertently transposed and should have read 52%. This has been corrected in the EA. Historical stocking levels are not discussed in the Forest Plan or the Screens amendment. Historic ranges focus primarily on structures, disturbance regimes, and riparian objectives. The Bald Angel project responds to the direction for all of these recommendations and requirements.

T. Throughout the EA there are many references to allowing mature stands to progress toward LOS habitat for wildlife but there is no proposal to designate these stands as replacement old growth and protect them from future logging. Perhaps there should be a forest plan amendment to change or create a new management area designation to protect these places from development and take them out of the timber base.

Response: The Forest Plan does not call for the designation of additional MA15 areas unless there is a compelling need to treat within existing MA15 area. If the treatment would take the area out of an old growth condition, then the Forest Plan calls for the designation of a replacement old growth stand within a reasonable distance of the original MA15 area. Regional Forester's Forest Plan Amendment #2 (Screens) provides for guidelines to maintain and enhance LOS stands.

U. The EA claims there will be no measurable changes to sediment delivery rates as well as no direct impacts on stream shade and bank stability but gives no data or analysis as to why this might be true. Again, an EIS is needed

Response: It is generally held and supported by the scientific literature (Burrows and King 1988 and Belt et al. 1992) that the road related actions proposed in the Bald Angel EA with the appropriate design criteria and constraints implemented will not have a measurable increase in sediment delivery. The actions proposed for treatment use the standard INFISH mitigation measures of 300, 150 and 100 foot buffers to maintain existing shade and bank stability. On the treatment units where RHCAs will be treated no reduction in crown density will take place to reduce stream shade. These measures are based on scientific literature (Brazier and Brown 1973, Beschta et al. 1987) on those same units there are required protection buffers which will protect streambanks from any action induced instability.

V. Other benefits of trees left on site have not been analyzed in terms of soil health or wildlife needs. Again, an EIS is needed.

Response: The effects of trees left on site as described above are analyzed in the Soil Quality and Productivity effects pages 105-115 and for Wildlife in the Elk (pages 68-80), LOS, and Management Indicators/Neotropical Migratory Bird Species pages 125-137. Leaving all trees on site would be reflected in the No Action Alternative which would retain all trees.

W. The top of page 122 refers to INFS with no explanation as to what it is?

Response: This was a typo which was intended to be INFISH. It has been corrected in the EA.

X. The 4 of 6 grazing allotments in the project area are overdue for NEPA analysis as mandated by the Rescissions Act. Without this analysis, cumulative impacts on wildlife are unknown and provide no information on forage, weed spread by livestock or adverse water quality impacts from grazing.

Response: Livestock grazing within the project area will be analyzed in a separate document beginning in 2007 and is outside the scope of this analysis. Treatments proposed within the Bald Angel Project are not connected to the ongoing livestock use within the project area. Permitted grazing is administered to meet Wallowa-Whitman Forest Plan LRMP standards and guides. Where livestock grazing is found to not meet LRMP standards and guides, modification of the timing, duration or intensity of grazing is made to allow accomplishment of these standards through the administration of the permit. Livestock grazing activities was incorporated into the cumulative effects analysis as described in Appendix D pages 6-34 and in Chapter 3.

Y. In December 2006 I requested to know if the WWNF Roads Analysis is final?

Response: No, as of this response the WWNF Roads Analysis is still in draft format. No estimated date of completion was available. For further information related to that analysis contact Nola Driskell, Forest Engineer at the Forest Headquarters in Baker City.

Z. I also requested any new additions to the analysis file for this project. Please confirm that I have the complete analysis file.

Response: Yes, at this time you have the complete Analysis File for this project.