United States Department of Agriculture

Sheep Creek Vegetation Management

Preliminary Environmental Assessment

Forest Service
La Grande Ranger District

September 2021

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Introduction

The La Grande Ranger District (the district) proposes a combination of management activities on National Forest System (NFS) lands to improve multiple resource conditions. The district prepared this assessment using direction from Council on Environmental Quality's (CEQ) regulations at 40 CFR 1500-1508 (1978 Rule), Forest Service National Environmental Policy Act (NEPA) Regulations at 36 CFR 220, and Forest Service Manual direction at 1909.15, 41.2. As a project initiated and analyzed under the 1978 Rule, this analysis will not adopt the 2020 revised CEQ regulations.

In summary, these regulations state that an environmental assessment (EA) must include the (1) Need for the Proposal, the (2) Proposed Action and Alternatives, (3) Environmental Impacts of the Proposed Action and Alternatives and the (4) Agencies and Persons Consulted. We have included additional subsections and appendices to provide context for management rationale. This environmental assessment will determine whether the district should prepare an environmental impact statement or a finding of no significant impact.

Proposed Project Location

The La Grande Ranger District of the Wallowa-Whitman National Forest manages the Sheep Creek Vegetation Management project (Sheep Creek project) area; located at Townships 5S and 6S, Range 35E and approximately 22 air miles southwest of La Grande, OR. The project boundary spans both the Chicken Creek and Sheep Creek Subwatersheds. This project is accessible by National Forest System Road (NFSR) 51 to the East and NFSR 5160 to the Northwest (see Figure 1).

The project area, approximately 29,953 acres, is located within Union County and divided by private land. Approximately 705 acres of this project are within the Blue Springs Wildland Urban Interface.

Appendix C contains additional maps to help review project elements.

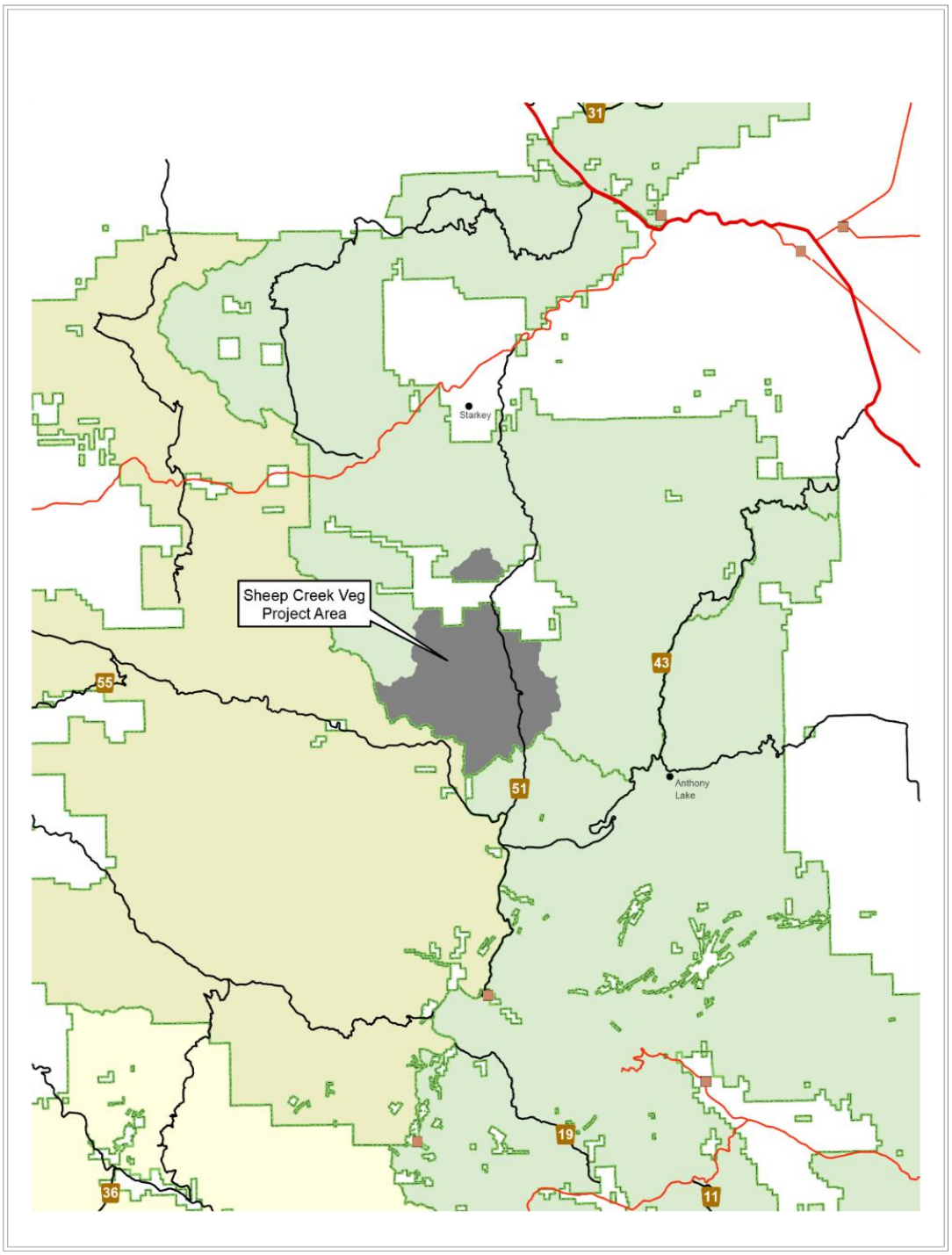

Figure 1. Vicinity map (Sheep Creek project area)

Land Management Plan Direction

The 1990 Wallowa-Whitman National Forest Land and Resources Management Plan (Forest Plan), as amended by Pacific/Inland Native Fish Restoration Strategy (PACFISH/INFISH) and Eastside Screens, forms the foundation for analysis of this project. The Sheep Creek project tiers

to the Forest Plan for forest-wide management goals and objectives, standards and guidelines and special considerations listed under designated management areas. The following management areas are included in this project area:

MA1 – 17,828 acres. Emphasizes wood fiber production on suitable timberlands while providing relatively high levels of forage and recreational opportunities.

MA1W – 7,482 acres.

MA3 – 3,744 acres. Provides a broad array of Forest uses and outputs with emphasis on timber production. Timber management should be designed to provide near-optimum cover and forage conditions on big game winter ranges

MA 3A – 101 acres. Same as MA3.

MA 15 – 761 acres. These areas are designated 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.

Agencies or Persons Consulted

Public and interagency involvement has been an integral component of Sheep Creek project development. The Forest Service consulted the following individuals, Federal, State, Tribal, and local agencies during the development of this EA.

Public Involvement

The district and Northern Blues Forest Collaborative (NBFC) conceptualized a restoration strategy for the Sheep Creek project area in 2017. The Collaborative visited the project area during five field trips from 2017-2021.

The district, in collaboration with the NBFC, developed a purpose and need for management actions in the Sheep Creek project area on 05/21/2019.

The district invited the NBFC to attend our proposed action development meeting on 10/22/2019. Four NBFC members participated.

The district presented a summary of the proposed action to the NBFC on 1/23/2020 and a summary of alternative development on 09/24/2020 and 05/26/2021.

The district hosted a meeting with two representatives from the Northwest Trail Riders Association and one member of the Eastern Oregon All-Terrain Vehicle Association on 12/18/2019 to discuss safety improvements and trail access in the project area.

The district mailed a scoping letter detailing the Sheep Creek project proposed action to 113 interested individuals (see Appendix E for mailing list) for a 30-day scoping period beginning on 02/15/2020. We received 11 letters from interested parties. The Observer published a legal notice establishing the start of the scoping period on 02/15/2020. On 02/24/2020 Forest Public Affairs distributed a press release on social media to share information about the scoping period and

upcoming open house. The district hosted an open house to discuss the proposed action on 02/27/2020. Three participants attended.

Interagency and Partner Involvement

National Oceanic Atmospheric Agency Fisheries and Trout Unlimited

08/14/2019	Field tour

Tribal Government Involvement

Forest archaeologists routinely met with the Confederated Tribes of the Umatilla Indian Reservation (CTUIR) to discuss project development. This project was also presented in the 2020 and 2021 Program of Work workbooks.

12/17/19	USFS & CTUIR Natural Resource, Wildlife, and Cultural Committees Program of Work Staff Meeting
07/10/19	USFS & CTUIR Natural Resource Committee Program of Work Staff Meeting
04/18/19	USFS & NPT Program of Work Distribution
08/16/18	USFS & CTUIR Board of Trustees Government-to-Government Meeting
06/19/18	USFS & CTUIR Wildlife and Cultural Committees Program of Work Staff Meeting
03/26/18	USFS & CTUIR Natural Resource Committee Program of Work Staff Meeting
09/06/17	USFS & CTUIR Board of Trustees Government-to-Government Meeting
08/08/17	USFS & CTUIR Wildlife and Cultural Committees Program of Work Staff Meeting
05/30/17	USFS & CTUIR Natural Resource Committee Program of Work Staff Meeting
05/03/17	USFS & NPT Program of Work Staff Meeting

Purpose and Need

The district and Northern Blues Collaborative identified a set of resource conditions within the planning area departed from desired future conditions outlined in the Forest Plan, as amended. They include:

1. The departure of current forest structures, densities and compositions from expected natural ranges of variation reflect landscape conditions at increased risk to future disturbances indicates a need to restore, maintain and promote spatial and temporal forest structural and compositional conditions reflective of natural resilient ranges of variation across the landscape.

2. Assessment of current and desired watershed conditions indicate a need to restore watershed conditions that promote processes and habitat conditions to support sustainable fish and wildlife populations and improve water quality.

3. Based on the difference between current and desired terrestrial habitat conditions, there is a need to maintain or enhance the diversity and quality of wildlife habitat conditions including maintaining and promoting a diversity of vegetation structure, density and composition in a manner that provides for connectivity and permeability of wildlife populations within and across the project area.

4. The departure of current vegetation and fuels conditions and associated fire regimes from expected natural conditions indicate a need to promote vegetation and fuels conditions across the project area that provide increased opportunities to utilize fire from both planned and unplanned ignitions to restore appropriate fire regimes and reduce potential for wildfire impacts to private lands.

5. Consideration of the current socioeconomic conditions indicate a need to support local community's economies and wellbeing by providing diverse ecosystem-based benefits, including forest and non-forest products for sale and personal use, recreation and tourism and other ecosystem services that contribute to local socioeconomic needs.

6. The Sheep Creek project offers an opportunity to address the need to build trusting relationships, learn and enhance understanding of the short, mid and long term social, economic and ecologic effects of alternative forest management approaches on complex landscapes.

Issues

The district received 11 comment letters during the scoping period. We identified issues and refined treatments into Alternative 2 (modified proposed action) and Alternative 3 using feedback within these comment letters. The following issues helped assess how the action alternatives relate to potential significance and ability to meet the purpose and need.

Treatments in Old Forest and Moist Forest

A century of wildfire suppression and exclusion, grazing, and extensive timber harvest have interacted to alter the structure, composition, and density within the project area. As a result shade tolerant species have increased on dry forest sites and moist and dry forest vegetation groups have a reduced distribution of large and old early seral trees, deficient patches of old forest, and reduction in early successional communities. Across the project area these activities have simplified species diversity and transformed single layer forest structure to multi-layered stands(see Forest Health and Sustainability assessment p. 39).

Stand resilience in the face of climate change is an issue we should consider. Treatments in Old Forest and Moist Forest were of particular concern with some comments favoring treatments to enhance deficient Old Forest stands and other comments preferring preservation of all Old Forest .

Treatment in Riparian Habitat Conservation Areas

Riparian Habitat Conservation Areas (RHCAs) are a dynamic element within a watershed's chain of ecosystem processes. High stand densities within RHCAs can disrupt these processes and contribute to the decline of watershed health and resilience.

Both the Chicken Creek and Sheep Creek Subwatersheds have undergone extensive stream restoration projects to improve habitat for Endangered Species Act listed fish and regionally sensitive aquatic species. Thinning in the upland riparian areas, as well as meadow systems, may complement channel restoration activities by reducing potential fire behavior and promoting the growth of larger trees to provide shade and large wood recruitment in the future.

Multiple site visits, followed by scoping comments, provided both support and concern for commercial harvest treatments within RHCAs. We adopted RHCA management as an issue to assess the complex factors involved with RHCA thinning.

Potential Fire Behavior

Aggressive fire suppression and timber management policies of the early 1900's have affected our current forest structure and composition. These strategies removed most of the large diameter ponderosa pine enabling lodgepole pine to become overrepresented across the project area. Subsequent management beginning in the 1960s resulted in widely spaced overstory trees with a dense layer of young understory trees.

Today there are fewer large and old resilient trees compared to historic averages in the project area. There is also a higher density of young trees with less species diversity. These overcrowded stands create continuous fuels on the forest floor and into tree canopies contributing to a shift in disturbance regimes toward less frequent, larger and more severe events. These conditions put large portions of the project area at high risk for an uncharacteristically large and severe fire.

A portion (705 acres) of the Blue Springs Wildland Urban Interface (a zone where human development intersects with vegetative fuels) is within the project area. The Blue Springs Summer Home Tract was established in 1954 to provide the opportunity to build recreational cabins on public lands near Fly Creek. There are currently 9 summer homes and several outbuildings on 0.4 acre lots administered by special use permits. The cabin owners assume all risk of loss to the improvements resulting from wildfire. All the land surrounding the cabins is maintained as National Forest and must follow the regulations that apply to that area.

Stand conditions that promote large fire growth across the project area was an issue raised by both the public and agency specialists. This project area is within a watershed that supports Endangered Species Act listed fish, regional avian focal species, regional sensitive plants, and Wildland Urban Interface making this an area to focus fuels treatments to mitigate habitat fragmentation and property damage from stand replacing fire.

Economics

Ninety-seven percent of the Sheep Creek project area is classified as a management area suitable for timber production (MA1, 1W, 3, 3W) with a goal of regularly scheduled timber harvests, as outlined in the Forest Plan.

To meet project needs for landscape resiliency and reduced fuel loadings we prioritized treatments in strategic fuel break locations where effective treatments require removal of small diameter materials that have low market value. Small diameter tree removal is often expensive and may impact the economics of a timber sale. Another factor increasing harvest expenses is tree removal on steep slopes. Skyline units require a larger volume of timber removal to make viable. One potential mitigation to reduce the expense of harvest on steep slopes is tethered logging.

Tethered logging uses a cable fixed to an object or another piece of heavy equipment to help harvesting equipment navigate steep ground. This enables harvesting equipment to travel on slopes otherwise too steep for most ground-based equipment (30% slope or greater), increasing access to areas previously restricted due to slope. Traditional steep slope cable logging relies on workers cutting trees by hand and manually setting chokers, exposing themselves to falling trees and other hazards. The tethered logging method allows workers to operate inside the cab of a machine mitigating some of those risks. Safety, improved economics and increased accessto areas of restoration are potential benefits of this method.

This logging system is becoming more common on public lands, but minimal research exists on the effects to soils. Hydrologists and soils scientists alike are interested in learning how tethered logging might affect the physical soil/hydrological conditions on steep slopes, and how project design criteria play a role in reducing unwanted effects.

The district recognizes the complex relationship between forest management for ecological benefit and economic need for forest products and strives to find places where the two objectives overlap. The key issue of economics was raised during the scoping period, which resulted in the proposal for a project-level Forest Plan Amendment for using mechanical equipment on slopes greater than 30%.

Access

The Winom-Frazier trail system is a popular destination for Off-Highway Vehicle (OHV) travel. This trail system was created in the early 1990s, with many routes travelling through both the Umatilla and Wallowa-Whitman Forests. The ABC trails are a particularly well used subset within the Winom-Frazier trail systemthat have not been formally integrated into the Forest's database or adequately signed reducing user safety and the overall riding experience. Other routes within the project area are shared with unauthorized full-sized vehicles and could benefit from repaired breaches, maintenance, and route designation.

This issue was developed in response to public support for formalizing regularly used and existing routes within the project area.

Connectivity

The transformation of forest structures away from historic ranges impacts habitat for all pre-forest, early-, mid-, late-successional and old forest dependent species. In addition to improving components of the historic range of variation for wildlife habitat, permeability is an important consideration for animal movement both within and outside of the project area.

The desired condition for landscape patterns is spatial and temporal diversity creating a positive influence on overall ecological functions, scenic values, and providing for connectivity by allowing animals to move across landscapes.

Connectivity is a standing issue that generates analysis from the stand to watershed level.

Table 1. Issues, Indicators and Measures

Issue	Indicator/Measure
Treatment in OFMS/Moist	Total Acres of Treatment in OFMS Acres of Treatment in Moist OFMS Acres of OFMS restored to OFSS
Treatment in RHCAs	Acres of Commercial harvest in RHCAs Acres of non-commercial treatment in RHCAs Change in percent canopy closure from densiometer measurements
Fire Behavior Potential	Size of fire one hour after ignition Rate of spread Flame length Crowning index Fire type
Access	Miles of Roads Closed by Project Miles of Roads Gated Miles of OHV trail designated
Economics	Investments Wages Employment Economic Output
Connectivity	Acres of quality connectivity before and after treatment

Alternatives Analyzed in Detail

The La Grande IDT developed alternatives to address issues concerning the proposed action's potential for undesirable effects on the natural and human environment. The National Environmental Policy Act directs the agency to conduct a full and fair discussion of relevant issues and identify and eliminate from detailed study insignificant issues or issues that do not comply with laws, regulation and policy. Refer to the project record for a complete description of comments and issues, and how we used them for project development.

We analyzed the potential effects from Alternatives 1 (no action), 2 (modified proposed action), and 3 (reduced action) in this EA. For a numerical comparison of treatments proposed under each alternative, refer to Table 7 (p. 20).

Alternative 1

No action. Under this alternative, we would not pursue any prescribed activities and ecological succession would continue along its current trajectory. This alternative demonstrates the baseline for conditions to compare action alternatives, resource effects and trends.

Actions Common to Alternatives 2 and 3

Unit Selection Criteria

Treatments are focused on previously managed stands

Most units have records of previous management. Units with no documented management records have scattered large diameter stumps, indicating historic removal of large diameter early seral species.

Treatments are located adjacent to existing open and closed roads for unit access

No new system roads are proposed.

Unit proximity to high-use National Forest System (NFS) roads prevents these areas from functioning as satisfactory security habitat for big game species. We determined the project area includes sufficient cover and foraging habitat for big game species away from roads, and we do not plan to treat these critical habitat areas.

Units close to roads may serve as strategic fuels breaks. Treatment along these roads would improve fire management options and create conditions that reduce risk to firefighter safety.

Units have soil types and topographic positions that are likely to experience droughty conditions into the future

Droughty Soil Probability identifies soil types that have a thin organic layer, a high bulk density, and parent material with decreased available water capacity (see soil map in Appendix B). Available water capacity is the maximum amount of water soil can provide to plants. Areas with droughty soil probability above 60% do not provide water for plants during drought. Lack of available water decreases plant vigor and reduces the ability to mount a defense against insect and disease.

Areas with droughty soils can occur in both dry and moist PVGs. Drought tolerant species have a competitive advantage growing on these soil types, because they are adapted to maintain vigor throughout drought periods (summer months). Planned treatments will favor retention of more drought tolerant species such as ponderosa pine.

Treatments proposed within fire regime condition class 2 or 3

Most commercial treatments are proposed in stands with moderate to high departure from historic conditions. Moist forest treatments focus on areas where remnant fire-tolerant western larch and ponderosa pine indicate large-diameter, widely spaced, and early seral species existed historically.

Management strategies in dry pine dominated forest benefit dry and moist mixed conifer forest

Protecting old trees, reducing surface fuels, reducing overall forest density, and shifting composition from fire intolerant to fire tolerant species benefits both pine dominated forest and mixed conifer forest. Wildlife use and ecological processes that were historically characteristic of moist mixed conifer forests were compatible with lower densities and basal area than exist today (Margolis and Malevich, 2016). Intermixed moist and dry mixed conifer forest experienced similar fire disturbance regimes as ponderosa pine stands in the past and are likely to experience

similar fire disturbance regimes in the future (Johnson, 2017).

Dry forest management actions support habitat conservation strategies

Avian focal species strategies support ecosystem management, because conservation is directed at the range of important habitat conditions for birds within the ecosystem. Two avian focal species that prefer dry forest habitat were identified within the project area (White-headed woodpecker, Flammulated owl). To support these species, we designed restoration strategies to enhance dry forest habitats. These treatments promote large tree, single-layered canopy with an open, park-like understory dominated by herbaceous cover, scattered shrubs, and patches of pine regeneration. Restoring dry forest to promote these conditions would positively impact conservation strategies for theses focal species (Altman and Bresson, 2017).

Commercial Activities

HTH – Commercial Thinning

Thinning of overtopped, suppressed, and co-dominant trees to reduce competition for site resources and remove ladder fuels to the canopies of mature trees. This prescription retains drought and fire tolerant species where possible.

- Thinning stand densities to the Lower Management Zone (HTH-LMZ) stimulates residual tree growth facilitating development of Stem Exclusion and Understory Reinitiation stand stages into large tree structures.
- Biomass Thinning (HTH-Biomass) modifies the original HTH prescription by including smaller diameter material. Commercial removal depends on the market value of small diameter wood.

Units with residual fuel loading after harvest maybe treated with prescribed burning to reduce fuel loads and promote healthy understory vegetation.

HIM – Improvement Thinning

Improvement thinning targets overly dense stands dominated by late seral species. This prescription removes trees with poor form and/or damaged condition to increase residual tree quality and diameter, promote ecologically appropriate species and create growing space for desired regeneration.

- Improvement thinning encourages tree diameter growth in understory reinitiation and stem exclusion, and prepares the stand for natural regeneration or planting.
- Biomass Improvement Thinning (HIM-Biomass) modifies the original HIM prescription by including smaller diameter material. Commercial removal depends on the market value of small diameter wood.

HPO – Patch Openings

Patch openings transition patches of Stem Exclusion and Understory Reinitiation structures at high risk for mountain pine beetle mortality into Stand Initiation structures. Patches consist of irregularly shaped openings, 3-5 acres each, across 30-40% of proposed units. Treatments retain desired species (western larch, Douglas-fir and ponderosa pine) and trees suitable for snag recruitment within the openings.

This treatment mimics patch disturbances observed within mixed severity fire regimes and promotes regeneration of early seral species. Planting may occur in areas where natural regeneration of desired species is unlikely. Variable thinning in stands adjacent to patches would promote large tree development and structural diversity.

- Habitat enhancement (HBT ENHANCE) utilizes the HPO treatment to create biologically appropriate conditions for dry forest avian focal species. This treatment maintains all large trees and snags and promotes development of early seral species with wide spacing. Openings, approximately 2.5 acres in size, create grassy areas for foraging. This treatment also includes skipped areas (SKIP) where no treatment would occur. Skips will be, approximately 1.5 acres in size and comprised of dense saplings/regenerating trees, provide wildlife hiding cover on up to 12% of the treatment area.
- Biomass Patch Opening (HPO-Biomass) modifies the original HPO prescription by including smaller diameter material. Commercial removal depends on the market value of small diameter wood.

Non-Commercial Fuels Reduction and Vegetation Management Treatments

FUM-Mechanical thinning/FUH-Hand thinning

Both mechanical and non-mechanical thinning reduces fire behavior potential by increasing canopy base height, removing ladder fuels, decreasing tree density, and enhancing fire tolerant species composition. Fuels reduction units are located to create strategic fuels breaks.

- FUM treatments masticate *or* hand thin trees less than 9” DBH, followed by machine grapple piling of slash and natural fuels
- FUH treatments exclusively hand thin trees less than 9” DBH, followed by hand piling and burning or lopping and scattering slash.

PCT - Precommercial Thinning

Precommercial thinning decreases densities in young planted or naturally regenerated stands. Thinning enhances growth and promotes drought and fire tolerant species. Treatments involve thinning trees smaller than 9” DBH and leaving selected trees at variable spacing (approximately 14 - 20ft apart).

- Mechanical treatments (PCT-M) use a slashbuster on slopes of 30% or less
- Hand treatments (PCT-H) thin with chainsaws on slopes >30%.
- Slash may be treated (piled and burned or lopped and scattered) if located in a strategically important area

RCHA PDC - Riparian Habitat Conservation Area Project Design Criteria

Treatment would be limited to non-commercial hand thinning up to 9” DBH. This prescription prioritizes ladder fuel removal around early seral species or mid seral Douglas-fir, and reduces stand density to minimize intertree competition. This treatment follows the sideboards found in the Blue Mountain Project Design Criteria for hand thinning.

- Slash from thinning activities may be hand piled and burned with a maximum size of 4 feet in height and 6 feet in diameter following the guidelines below.
- Broadcast burning may occur using hand applied ignitions.

- No treatment buffers would occur directly adjacent to the stream channel following the guidelines described below.

Table 2. Pacfish treatment guidelines following the Blue Mountain PDCs.

Pacfish/Infish Category	Fish Bearing (Category 1)	Permanently Flowing non- fish Bearing and Ponds, Lakes and wetlands > 1 acres (Category 2)	Seasonally Flowing or Intermittent Streams, wetlands < 1 acres, landslides and landslide- prone areas
Activity	**Default Limited Activity Buffers**		
Thinning in RHCAs	100’	75’ on slopes < 30%	50’ on slopes < 30%
Prescribed Fire in RHCAs	100’	75’ on slopes < 30%	50’ on slopes < 30%
Slash Pile Burning	100’	75’	50’

RHCA-Wetland enhancement

The main objective for this treatment is to promote establishment, growth, and cover of cottonwood, willow, sedge and rush communities, and other native deciduous vegetation. This would be achieved through removing young conifers in the open meadow adjacent to Sheep Creek. Trees that would be thinned include lodgepole pine, and grand fir. Native hardwoods, western larch, Engelmann spruce, ponderosa pine and Douglas fir (particularly in RHCAs outside of the floodplain) would be retained. No trees providing shade to channel would be removed in this unit. Only understory trees <12” diameter at breast height (DBH) that are 50 feet or father from streambank would be thinned and left on the floodplain to leave roughness and nutrients and to assist in retaining water on the floodplain during spring runoff and high flows. Excess debris would be reduced through handpiling and burning, placed in streams, or left on site where fuels conditions allow. Shade-contributing vegetation would remain untreated. Additional restoration work includes fencing around meadows and planting native broadleaf vegetation.

Prescribed Burning

Prescribed burning reduces surface fuels, thins suppressed trees, and increases canopy base heights. Planned ignitions, when appropriately timed for moderate fuel moistures, generally burn with lower intensity and severity than wildfire. Control lines include roads, natural barriers and brush removal rather than bare mineral soil line construction, where possible. Snags >12” DBH would be protected during firing operations through avoidance or advanced fuels reduction around snags.

Post Sale Road Management Plan

District specialists developed a road management plan for the Sheep Creek project area. The following changes are proposed for the existing open road system:

Table 3. Post-sale road management plan

Road Number	Proposed Change	Distance
5160-030	Close at the 033 junction	0.4 mile
5160-039	Close	0.02 mile
5160-050	Decommission from 5160 to junction of 5160-051	0.16 mile
5160-140	Close with gate for administrative use	0.4 mile
5175-020	Close at the 030 junction	0.4 mile
5178	Close by moving existing gate to junction of 083/050	1.6 miles
Total	Closure	3.45 miles
Total	Decommission	0.16 mile

The district plans to implement existing management direction for the following roads (refer Rooster Vegetation Management Project for the Environmental Assessment) in conjunction with Sheep Creek project activities.

- 5160-020: Reinforce closure barrier
- 5175-000: Reinforce breached gate
- 5175-020: Close with gate at the 5175-030 junction
- Remove culverts on all closed roads used for the sale

Opportunities for Enhancement

The following proposed enhancements would improve the forest user experience and promote the health and safety of selected areas within the project area boundary.

The district proposes the following changes to the Winom-Frazer OHV trail system:

Table 4. OHV Enhancements

Road Numbers	Proposed Change	Distance
5164, 5164-180, 5164-182, 5164-200, 5182-580	Formalize existing ATV routes	6.3 miles
Loop including 5160-012, 5160-014, 5160-043, 5160-045	Designate new OHV routes along closed roads	6.98 miles
Loop including 5175-010, 5182-800		
Loop including 5182-035, 5182-040		
Popular access points and intersections	Create and post maps	N/A

The district proposes the following elk security enhancement measures to address increased motorized use during the archery season that is compromising big game security and distribution objectives for the Trail Cooperative Travel Mangement Area (TMA):

- Re-establish barriers at breached access points to the closed 5182-800 road system

Extend the Trail Cooperative TMA closure to begin 3 days prior to archery season. This closure currently operates annually from 3 days prior to opening Rocky Mountain rifle bull elk first season through the close of Rocky Mountain bull elk second season.

The district also proposes to install the following informational signs near busy intersections:

- Interpretive signs on benefits of riparian treatments
- Signs near gates to describe resource benefits, closure timeframes and resource objectives for the closure.

Alternative 2 – Modified Proposed Action

The La Grande IDT modified the proposed action to create Alternative 2. This alternative responds to all six key issues (see Table 1 for list of Key Issues).

Forest Plan Amendment

The district proposes a project level plan amendment to the Wallowa-Whitman National Forest Land and Resource Management Plan (Forest Plan), to include ground-based equipment on slopes greater than 30% in select areas.

We developed this project-level plan amendment in response to an issue raised during the scoping period. Advancements in logging technology have outpaced our Forest Plan updates and have become more accessible within our local economy. This amendment would allow us to closely monitor and understand the capabilities and limitations of tethered logging on our forest and aligns with purpose and need elements 5 (Economic Support) and 6 (Forest Partnerships). The La Grande IDT identified specific units that make good candidates based on economic feasibility (those originally proposed for skyline harvest) and low-risk soil types.

When proposing a Forest Plan amendment, the 2012 Planning Rule (36 CFR 219), as amended, requires the responsible official to identify the substantive requirements of the rule that are likely to be directly related to the amendment (36 CFR 219.13(b)(5)). The substantive requirements that are likely to be directly related to the proposed amendment for the Sheep Creek project are:

1) 36 CFR 219.8(a)(2)(ii) Soils and soil productivity, including guidance to reduce soil erosion and sedimentation. (*Ecological sustainability*);
2) 36 CFR 219.8(b)(3) Multiple uses that contribute to local regional, and national economies in a sustainable manner. (*Social and economic sustainability*);
3) 36 CFR 219.10(a) (7) The responsible official shall consider: Reasonably foreseeable risks to ecological, social, and economic sustainability. (*Integrated resource management for multiple use*)
4) 36 CFR 219.11(d)(2) Timber harvest would occur only where soil, slope, or other watershed conditions would not be irreversibly damaged; and 36 CFR 219.11(d)(3) Timber harvest would be carried out in a manner consistent with the protection of soil, watershed, fish, wildlife, recreation, and aesthetic resources. (*Limitations on timber harvest*)

Following the consideration of public comments, if the decision is to pursue a Forest Plan amendment, the Wallowa-Whitman Forest Supervisor will be the responsible official for this project. If the decision is not to pursue a plan amendment, the La Grande District Ranger will be the responsible official.

Commercial Activities

HSH – Two aged Shelterwood Establishment and Removal Cut

Shelterwood harvest facilitates the establishment of a new cohort of trees within diseased and compositionally departed stands. This treatment transitions Stem Exclusion and Understory Reinitiation to Stand Initiation structures with scattered large healthy and mature trees for snag recruitment and natural seed source.

District specialists selected this prescription for units affected by Armillaria (root disease) and site potential for whole tree extraction to help fulfill the demand for woody materials in nearby stream restoration projects.

HTH – Commercial Thinning (OFSS and UMZ)

Thinning of overtopped, suppressed, and co-dominant trees to reduce competition for site resources and remove ladder fuels to the canopies of mature trees. This prescription retains drought and fire tolerant species where possible.

- Thinning (HTH-OFSS) in dry Old Forest Multi Stratum (OFMS) stands removes one or more lower canopy layers resulting in a single overstory layer.
- Thinning to the upper management zone (HTH-UMZ) contributes to large tree development and meets wildlife habitat requirements for species dependent on higher canopy closures.

HIM – Improvement Thinning (OFSS)

Improvement thinning targets stands dominated by late seral species. This prescription removes trees with poor form and/or damaged condition to increase residual tree diameter, promote ecologically appropriate species and create growing space for desired regeneration.

- Improvement thinning in OFMS can convert OFMS to OFSS by removing one or more lower canopy layers (HIM-OFSS).

RHCA- HTH Riparian Thinning

Variable thinning, up to 50’ around deficient broadleaf and early seral conifer species to improve riparian stand resilience to disturbances. Riparian thinning removes ladder fuels and overrepresented trees by hand, unless material can be removed with total suspension and equipment does not leave existing roadbeds.

This prescription focuses treatment to riparian areas topographically shaded by north aspects and retains vegetation providing shade to the stream. Commercial and non-commercial treatment may occur within an RHCA buffer on the upstream side of a roadbed with total suspension, where practical and approved by district specialists.

The district may reduce thinning debris by handpiling and burning or placing woody materials in stream channels to improve aquatic habitat and stream function.

Changes from the Proposed Action

We propose a Forest Plan Amendment for use of ground-based equipment on slopes >30%

- Tethered logging may replace skyline harvest methods with appropriate Project Design Criteria in place (see PDCs on p. 24)

We included a new prescription

- RHCA-PDC is a non-commercial treatment based on guidelines outlined for RHCA treatments in the Blue Mountains Project Design Criteria (PDCs).

We added acres within the following prescriptions

- HIM, HIM-OFSS, HIM-Biomass, HTH, HTH-OFSS, HTH-RHCA, FUM

There are fewer acres of treatment with the following prescriptions

- HTH-UMZ, HPO, HPO-Biomass, HSH, FUH, PCT-Mechanical

The following prescriptions do not change from the proposed action

- HTH-Biomass, HBT Enhance, PCT Hand, RHCA-Wetland, Prescribed Fire

Table 5. Alternative 2 Treatment Summary

Alt 2 Treatment Type	Units	Acres
HTH	6, 7, 8, 10, 11, 14, 15, 16, 19, 26, 32, 35, 46, 54, 55, 56, 63, 69, 75, 85, 86, 91, 105, 125	624
HTH-OFSS Acres of OFMS	4, 17, 18, 20, 27, 29, 34, 36, 47, 61, 70, 72, 77, 87, 90, 92, 96, 97, 99, 101, 106, 107, 124	1,005 167
HTH-UMZ	53	10
HTH-Biomass	13, 57, 76, 80, 81, 82	251
HIM	22, 23, 24, 25, 37, 48, 49, 51, 58, 74, 89, 95, 123, 126	280
HIM-OFSS Acres of OFMS	21, 28, 31, 33, 40, 41, 43, 52, 73, 78, 79, 83, 84, 122	490 33
HIM-Biomass	30, 45, 59	39
HSH	39, 42	115
HPO Acres of OFMS	2, 3, 5, 65, 66	235 207
HBT-Enhance	109, 112, 113, 114, 115, 116	16
Skips	110, 111, 117, 118, 119, 120, 121	13
HPO-Biomass	1, 44, 50	41
RHCA-Wetland	102	36
RHCA-HTH	12, 38, 62, 64, 68, 71, 88, 100, 103, 104, 108	261
RHCA – PDC		1,118

FUM	205, 206, 209, 211, 212, 216, 217, 221, 225, 228, 229, 230, 231, 232, 233, 235, 236, 237, 240, 245, 246, 247, 250, 251, 252, 253, 257, 258, 262, 264, 266, 267, 274, 276, 281, 284, 286, 287, 288, 289, 291, 292, 294, 295, 297, 298, 300, 303, 315, 318, 328, 330, 361	3,897
FUH	200, 201, 202, 203, 204, 207, 208, 210, 214, 215, 218, 219, 220, 222, 224, 227, 234, 238, 239, 242, 243, 244, 248, 249, 254, 255, 259, 260, 261, 263, 265, 268, 269, 270, 271, 275, 290, 293, 296, 301, 302, 335, 345, 362, 363, 364, 365, 366, 367	2,433
PCT-H	223, 305, 307, 309, 311, 312, 313, 325, 326, 327, 329, 331, 332, 336, 337, 338, 339, 343, 347, 348, 349, 350, 353, 356, 357, 358, 359	938
PCT-M	256, 272, 279, 282, 299, 304, 306, 308, 310, 314, 319, 320, 321, 322, 323, 324, 333, 340, 341, 342, 344, 346, 351, 352, 354, 355, 360	996
Fuels Blocks	601-612	9,521
Project Design Criteria for Richardson's Needlegrass Project Design Criteria for all other listed sensitive plants	Areas to Protect: • Commercial units: 1, 5, 8, 13, 22, 24, 40, 82, • Noncommercial units: 204, 215, 276, 279, 282, 287, 288, 353, 360, 361 Areas to protect: • Commerical units: 54, 65, 112 • Noncommerical units: 71, 222, 227, 230, 259, 260, 282, 324, 361, 364 Reseed units: 8, 14, 15, 25, 28, 80, 114, 115, 355	153 2 To be determined on post-implementation detection surveys
Project Design Criteria for Whitebark Pine (see p. 29)	Areas to Protect: 72, 92, 257, 258, 262, 267, 272	To be determined on pre-implementation detection surveys
Total Volume (MBF)	Saw Timber (MBF)	8.9
	Non-Saw Timber (MBF)	4
Yarding Systems (Acres)	Commercial Harvest Tractor Acres	2,956
	Tethered Logging OR Commercial Harvest Skyline Acres	411
Road Work	Reconstruction (miles)	24
	Culvert Replacement	9
	Miles of Stored Roads Opened for Harvest (miles)	40
	Temporary Roads (miles)	4.45

Alternative 3

We developed Alternative 3 in response to the key issues of treatments in OFMS, treatments in RHCAs, and connectivity. It differs from the proposed action by reducing the total acres of treatment and eliminating prescriptions that remove the highest basal area, commercial treatments in RHCAs, and commercial harvest in connectivity corridors. No Forest Plan Amendment is proposed under this alternative.

Changes from the Proposed Action

The following prescription increased in acreage from the proposed action:

- HIM-Biomass, RHCA-PDC

These prescriptions have fewer acres than the proposed action:

- HIM, HIM-OFSS, HTH, HTH-OFSS, HTH-Biomass, HPO, HPO-Biomass, HBT-Enhance, FUH, FUM, PCT-Mechanical, PCT-Hand

We eliminated the following prescriptions from analysis under this alternative:

- HSH, HTH-UMZ, HTH-RHCA

The following considerations remain unchanged:

- Post-sale road management plan
- Opportunities for Enhancement

Table 6. Alternative 3 Treatment Summary

Alt 3 Treatment Type	Units	Acres
HTH	6, 8, 10, 14, 15, 19, 32, 56, 63, 69, 75, 85, 86	347
HTH-OFSS	17, 18, 20, 34, 36, 77	205
HTH-Biomass	13, 76, 80, 81, 82	212
HIM	22, 23, 37, 74, 89	100
HIM-OFSS	21, 31, 33, 41, 52, 73, 78, 79, 83, 84, 122, 126	332
HIM-Biomass	30, 45	33
HPO	2, 3, 65	43
HBT-Enhance	112, 113, 116	7
Skips	111, 118, 119, 120, 121	10
HPO-Biomass	1, 44	29
RHCA-Wetland	102	36
RHCA-PDC		1118
FUM	205, 209, 211, 212, 216, 217, 221, 225, 228, 229, 230, 231, 232, 235, 237, 240, 245, 246, 247, 250, 251, 252, 253, 257, 258, 262, 264, 266, 267, 274, 276, 281, 284, 286, 287, 288, 289, 291, 292, 294, 295, 297, 298, 300, 318, 328, 361	3,371
FUH	200, 201, 202, 203, 204, 207, 208, 210, 214, 215, 218, 219, 220, 222, 224, 227, 234, 238, 239, 249, 254, 255, 259, 260, 263, 265, 268, 269, 270, 271, 275, 290, 293, 296, 302, 363, 364, 365, 366	2,042
PCT-H	305, 307, 327, 336, 337, 343, 347, 349, 350, 353, 356, 357	264
PCT-M	256, 272, 279, 282, 299, 323, 354, 360	424
Fuels Blocks	601-612	9,521

Project Design Criteria for Richardson's Needlegrass	Areas to Protect: 1, 8, 13, 22, 204, 276, 282, 287, 288, 360, 361	104
Project Design Criteria for all other listed sensitive plants	Areas to protect: • Commerical units: 65, 112 • Noncommerical units: 71, 222, 227, 230, 259, 260, 282, 361, 364	2
	Reseed units: 8, 14, 15, 25, 28, 80, 114, 115, 355	To be determined on post-implementation detection surveys
Project Design Criteria for Whitebark Pine	Areas to Protect: 257, 258, 262, 267, 272	To be determined on pre-implementation detection surveys
Total Volume (MBF)	Saw Timber (MBF)	3.4
	Non-Saw Timber (MBF)	1.6
Yarding Systems (Acres)	Commercial Harvest Tractor Acres	1,218
	Commercial Harvest Skyline Acres	90
Road Work	Reconstruction (miles)	8
	Culvert Replacement	1
	Miles of Stored Roads Opened for Harvest (miles)	19
	Temporary Roads (miles)	3

Table 7. Action Alternative Comparison			
Sheep Creek Vegetation Management Project Area Boundary: 29,935 Acres			
Chicken Creek Subwatershed: 10,974 Acres/Sheep Creek Subwatershed: 18,961 Acres			
Alternative Elements		**Alternative 2**	**Alternative 3**
Total Harvest/Noncommercial Treatment Acres		**12,785**	**8,320**
Harvest Treatment Acres (total)		**3,367**	**1,308**
Total Acres Treated by Prescription Type	HIM (Improvement Cut)	280	100
	HIM – OFSS	490	332
	HIM – Biomass	39	33
	HTH (Commercial Thin)	624	347
	HTH – OFSS	1,005	205
	HTH - Biomass	251	212
	HTH – UMZ	10	0
	HTH – RHCA	261	0
	HPO (Patch Opening)	235	43
	HPO – Biomass	41	29
	HSH (Shelterwood Cut)	115	0
	HBT Enhance (Habitat)	16	7
Noncommercial Treatments		**9,418**	**7,012**
Total Acres Treated by Prescription Type	FUH – Hand Fuels	2,433	2,042
	FUM – Mechanical Fuels	3,897	3,371
	PCT – Mechanical	996	424
	PCT – Hand	938	264
	RHCA – Wetland	36	36
	RHCA – PDC	1,118	1118
Post-Treatment Activities			
Post-Harvest Treatment Activities (Acres)	Whipfell	11,760	7,409
	Grapple Pile	7,952	5,067
	Hand Pile	11,760	7,409
	Underburn	11,760	7,409
	Plant	1,480	528
Prescribed Fire	Natural Fuels Burn Blocks	9,521	9,521
Sensitive Habitats			
Treatments within RHCAs (Acres)	Commercial (<15% of unit), rest noncommercial (RHCA-HTH)	261	0
	Non-Commercial Hand Thinning RHCA-PDC	1,118	875
	Non-Commercial Meadow Restoration (RHCA Wetland)	36	0
Old Forest Treatment Acres	OFMS Restored to OFSS	654	94
Connectivity Acres Treated		187	89
Economic Considerations			

Total Volume (MBF)	Saw Timber (MBF)	8.9	3.4
	Non-Saw Timber (MBF)	4	1.6
Yarding Systems (Acres)	Commercial Harvest Tractor Acres	2,956	1,218
	Commercial Harvest Skyline Acres	411	90
Road Work (Miles)	Reconstruction Stored Open	 22.38 0.68	 7.1 0.68
	Temporary Roads - Total Miles of Non-system Miles of New	4.45 0.44 4.01	3.03 0.44 2.59
	Miles of Stored Roads Maintained for Implementation Miles of Open Roads used for haul	39.72 61.8	19.0 56.5
	Decomissioning	0.16	0.16
	Total Culvert Modifications Removed Replaced with Aquatic Organism Passage Replace with Trail Bridge	11 5 3 1	1 5 3 1

Alternatives Considered but Eliminated from Detailed Study

Resource specialists will not perform an in-depth analysis on alternatives that do not meet the purpose and need, actions that are illegal, or activities that violate National Forest Management Act standards.

Cut large trees (>21”)

Historic harvest in the Sheep Creek project area removed many large trees and created a deficiency of trees larger than 21” DBH across the landscape. Removing large trees, regardless of species, would not move the forest toward desired conditions (Forest Plan) or meet purpose and need elements #1 and #2 (restore HRV and wildlife habitat).

Limit restrictions on logging equipment and timing of operations

The Forest Plan restricts logging systems and operational periods to equipment and seasons that reduce impacts to resources. Soils and wildlife both have sensitive periods, and planning for use around those times preserves the integrity of forest components. We have proposed a Forest Plan amendment to authorize a very specific type of new logging system to operate, following stringent PDCs and monitoring protocol.

Project level travel management

- Designate NFS Road 51 as mixed use
- Apply Subpart A of Travel Management and adopt all MRS recommendations

Mixed use and cross-country travel are complex travel management issues best addressed in an analysis dedicated to forest-wide travel management. We do focus road management actions on improving effectiveness of past analyzed closures that have been breached and currently function as open roads.

Allow fire to burn naturally on landscape

The proximity to Wildland Urban Interface makes this project area a poor location to utilize wildfire for resource benefit. We intend to improve fuel loading and other fire prone conditions within this project area to set up the landscape for natural processes within the confines of strategic fuels blocks (see fuels effects).

Limit ground disturbing activities to previously disturbed soils

The Sheep Creek project area has an extensive history of past harvest activities. We would reuse old skid trails and landings where practical. However, many past activities in the project area occurred before the forest implemented best management practices. The past harvest network system may be located on sensitive soils and riparian. Most disturbances don't follow unit boundaries. For this reason, there likely would be new equipment trails and landings used throughout the project area.

Avoid treatment around all known occurrences of *Acnatherum richardsonii*

This regional forester's listed sensitive grass exists within the project area on a large scale. Due to its abundance in the project area, avoidance precludes us from executing management strategies that meet the purpose and need. Instead, we would focus on mitigations and monitoring to see what effect different disturbances have on the grass, and collection of seed to utilize as part of our revegetation and rehabilitation actions..

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.

Best management practices (BMPs) are forest management practices designed to prevent the degradation of forest lands and water quality during and after timber harvest. Forestry BMPs have been shown to be effective at controlling sediment, erosion, and nutrients from forest management activities (Lynch and Corbett 1990; Stuart and Edwards 2006).

Table 8. Project Design Criteria

Soils	
Implement Region 6 Soils Quality Standards and the 1990 Wallowa-Whitman Land and Resource Management Plan (LRMP) **Minimize detrimental soil conditions with total acreage impacted (compaction, puddling, displacement, and severe burning) not to exceed 20 percent of the total acreage within the project area including landings and system roads.** **The 1990 Wallowa-Whitman Forest Plan (4-21) states: give maintenance for soil productivity and stability priority over uses described or implied in all other management direction, standards, or guidelines. The following table of project design criteria (PDC) would ensure project activities meet these management goals.**	
SQ-1 Greater than 20 percent Detrimental Soil Conditions	In areas where **more than 20 percent** detrimental soil conditions exist from prior activities, the cumulative detrimental effects from project implementation and restoration must, at a minimum, not exceed the conditions prior to the planned activity and should move towards a net improvement in soil quality (R6 Soil Quality Standards)) by rehabilitating landings and used skid trails as needed through de-compacting to bring post-activity DSCs to acceptable levels in each activity area.
SQ-2 Less than 20 percent Detrimental Soil Conditions	In areas where **less than 20 percent** detrimental soil conditions exist from prior activities, the cumulative detrimental effect of the current activity following project implementation and restoration must not exceed 20 percent. In units expected to exceed 20 percent detrimental soil conditions: 1. Rehabilitate landings and used skid trails as needed thru de-compacting to bring post-activity DSCs to acceptable levels in each activity area. 2. If de-compacting is not feasible (i.e., shallow, clayey, rocky and/or topographic constraints) restrict harvest activities to winter harvest conditions. 3. If none of the above actions are feasible, then the particular treatment area should be excluded from mechanical activities.
SQ-3 Seasonal Conditions	Limit equipment operations to frozen, snow-covered or acceptable soil moisture conditions. Limit machine pivots and turns, where possible. During the winter season ground conditions shall meet at least one of the following criteria for machine operations: 1. Six inches of frozen ground, 2. Four inches of frozen ground with one foot of snow, 3. Two feet (>24 inches) or more of snow, 4. One foot (>12 inches) slash mat in combination with one foot of snow, or 5. Soil moisture conditions acceptable for minimizing rutting or puddling of soils Some “watch-out” situations include: 1. Machine break-through begins to occur 2. Equipment tracks sink deeply (half the width of the track) below the soil surface with one or two passes 3. Ruts greater than six inches deep form 4. Mid-day temperatures are forecast to rise above freezing 5. Surface melt occurs over still-frozen subsurface
SQ-4 Shallow Soils	Avoid operating on shallow soils (<25 cm soil depth) and meadows unless over frozen ground/snow. Shallow soils and clayey soils should not be used for temporary roads, skid trails, slash piles, or log landings; unless no other location is practical and there is an existing prism in which case equipment activity should remain within existing prism as much as possible.
SQ-5 Udic Soils	Avoid early summer equipment operations on units with udic moisture regime (moist soils with inherent excess soil moisture either yearlong or on a seasonal basis). If this is not possible or there is evidence of lingering moisture present, operate on a bed of slash maintained at >12 inches to mitigate compaction and rutting.
SQ-6 Soil mitigations during ground-based operations	Ground-based equipment should not operate on sustained slopes exceeding 30%, unless reviewed by soil specialist or hydrologist. Prioritize areas of slopes greater than 30% as leave areas within units. Designated skid trails should be spaced on average 100 feet apart, and the trails should average no more than 12 feet in width. Closer spacing due to complex terrain will be with Timber Sale administrator approval. Existing skid trails will be used as much as possible. 1. If equipment must leave designated trails for operational purposes, no more than two passes over any

	piece of ground is permitted. 2. Ensure that water control structures (water bars or slash surfacing, as approved by the Sale Administrator or COR) are installed and maintained on skid trails that have gradients of 10 percent or more; Ensure erosion control structures are stabilized and working effectively before spring runoff. When cut to length harvest systems are used, maintain an appropriate slash mat of at least 12" when possible during operations to prevent equipment weight from altering soil bulk density and causing displacement of effective ground cover. If unable to maintain an appropriate slash mat, impacts are expected to be the same as tractor logging.
SQ-7 Shallow and Nutrient Poor Soils	Whole-tree yarding methods should be avoided in shallow soils (<25cm), nutrient-poor (granitic soil, glacial outwash sands, many coarse-textured soils) soils or in sensitive areas. If not possible, backhaul slash and redistribute on skid trails to an average depth of 6 inches within the harvest area, and extend the time period for reentry to allow more time for nutrient inputs.
SQ-8 Soil mitigations for slopes >30%	Use advanced logging systems where treatment is planned for continuous slopes greater than 30%. Advanced logging systems may include a variety of techniques including, but not limited to, cable yarding or other advanced logging systems where adequate protection against soil compaction and displacement can be demonstrated. 1. Use directional hand falling of trees and winching on slopes greater than 30% that cannot be reached by harvesting equipment from designated skid trails, as much as possible. Leading end suspension should be implemented when cabling or skidding material. 2. Skid trails or yarding corridors on slopes greater than 30% used by the purchaser should be reclaimed by applying appropriate erosion control measures such as the placement of effective ground cover in conjunction with, or in place of, water bars for rehabilitation. Tethered logging harvest systems: 1. Short discontinuous pitches exceeding 30 percent should be discussed with a soil scientist or hydrologist but can be approved by the sale administrator. 2. Treatment units where steep (>30%) slopes are continuous require field verification for activity approval by a soil scientist or hydrologist. Sale administrators may receive instruction for basic slope approval for sales. 3. Ground equipment activity on continuous slopes exceeding 30 percent must be designed to function on steep slopes either on its own or tethered by a separate machine. If steep slope vehicles are not able to maintain traction and soil displacement from slipping tracks occurs regularly on a slope, steep slope activity shall stop. Limit side tracking and turning of equipment to limit soil displacement. 4. Single passes with felling equipment on slopes 30 to 50 percent are acceptable. Preferably, single passes should be done over slash, but not required. If additional passes are needed, maintain a minimum of 8 to 12 inches of slash. 5. Cutting, bunching and skid trail spacing should be more than 50 feet apart edge to edge, except when converging at landings or avoiding obstacles. 6. Equipment trails should avoid concentrating runoff and provide breaks in grade. They should be reclaimed by applying appropriate erosion control measures such as the placement of effective ground cover in conjunction with, or in place of, water bars for rehabilitation. 7. Slash and organic material in trails should not be intentionally burned.

<table>
<tr><td>SQ-9
RHCA Treatments</td><td>Commercial RHCA treatments will stay on existing roads and total suspension will be used to remove forest materials. Non-commercial RHCA treatments will be all hand thinned.

1. Slash should provide at least 65% effective ground cover and up to 8 tons of slash per acre. Slash piles should be burned when soil moisture is high, and piles are small (max size 4ft in height and 6ft in diameter) (Blue Mountain PDCs).</td></tr>
<tr><td>SQ-10
Slope Instability & Mass Movement</td><td>Signs of slope instability and mass movement include cracks in soil, tilted or bent trees, increased spring activity or newly wet ground, hummocky or uneven terrain, sunken or broken road beds, and/or a recent sag pond has formed that isn’t human created. Consult engineering and soil resource specialist if these signs are present. Units identified as having slope instability will be field validated before implementation. If there are signs of slope instability or mass movement, these areas will receive a buffer in accordance to Blue Mountain PDCs.</td></tr>
<tr><td>SQ-11
Organic matter mitigation</td><td>Strive to maintain fine organic matter (commonly referred to as the duff layer) over at least 65 percent of an activity area following both harvest and post-harvest operations. Keep fine organic matter disturbance to a minimum if the potential natural plant community on site is not capable of producing fine organic matter over 65 percent of the area (Regional Soil Quality Guidelines / FSH 2090.11).</td></tr>
<tr><td>SQ-12
Soil erosion mitigations</td><td>Prior to the seasons ending precipitation event, ensure necessary water control structures are installed and maintained on skid trails over 10% slope after all ground-disturbing activities. Ensure erosion control structures are stabilized and working effectively and ensure that effective ground cover is left.

1. In areas of general disturbance in ash soils, the top layer (A Horizon) should be pulled back over any disturbed surface to prevent permanent loss of productivity. (Pull berms back over disturbed surfaces)

2. After completion of land management activities, the minimum effective ground cover (EGC) within each activity area within disturbed areas shall be in place to prevent erosion from exceeding background erosion rates for each of the four established erosion hazard classes: low, medium, high or very high (table below). Effective ground cover is defined as the basal area of perennial vegetation, plus duff, litter and coarse fragments (greater than 2mm sizes), including tree crowns and shrubs that are in direct contact with the ground.
<table>
<tr><th rowspan="2">Erosion Hazard Class</th><th colspan="2">Minimum Effective Ground Cover</th></tr>
<tr><th>1st Year</th><th>2nd Year</th></tr>
<tr><td>Low</td><td>20-30%</td><td>30-40%</td></tr>
<tr><td>Medium</td><td>30-45%</td><td>40-60%</td></tr>
<tr><td>High</td><td>45-60%</td><td>60-75%</td></tr>
<tr><td>Very High</td><td>60-90%</td><td>75-90%</td></tr>
</table></td></tr>
<tr><td>SQ-13
Soil rehabilitation</td><td>In areas where de-compacting is prescribed, de-compact to a depth sufficient to ameliorate the presence of detrimental soil compaction (usually between 2 and 12 inches). Discontinue de-compacting where large rocks are continually brought to the soil surface. If a change in soil color is noticed by the operator, operate at a shallower depth that prevents topsoil and subsoil from mixing. Skid trails requiring rehab on slopes > 30% should use erosion control methods that prevent channelized flow. Picking up ripping tines periodically down the slope.

1. Effective ground cover for all de-compacting treatments should take advantage of harvest slash. If no suitable organic material is available, then weed free straw or other equivalent erosion control measures should be applied on slopes exceeding 15%, adjacent to waterways and ditches (within 100 feet), prior to seasons ending precipitation event. See BMP AqEco-2 for additional information.</td></tr>
<tr><td>SQ-14
Roads</td><td>Non-system or legacy road templates will be used for temporary roads to the greatest extent possible. Creation of new temporary roads will be minimized. Where needed, locate to fit the terrain, and follow natural contours and minimize adverse effects to soil, water quality and riparian resources. Placement of new temporary roads should be on deep soils, as possible and avoid temporary roads on clay-dominated soils. Any new temporary roads within RHCAs will be approved by a hydrologist and sale administrator prior to constructing.

Temporary road mitigation measures include:</td></tr>
</table>

	• Locate temporary roads on flat terrain and benches where possible to reduce cut/fill construction and sedimentation risks • Provide adequate drainage through proper location, out sloping and installing water bars as appropriate • Install suitable storm water and erosion control measures (water bars, out slope) to stabilize disturbed areas and waterways before seasonal shutdown of project operations or when severe or successive storms are expected. • Upon completion of use, rehabilitate temporary roads by removing any culverts, decompacting the road surface and covering all disturbed areas with slash. Rehab may also include re-contouring the natural slope profile as possible, masking entrances, and seeding with native plant seed to promote effective ground cover. • Avoid burning of slash and organic material incorporated into road rehabilitation during prescribed fire activities.
SQ-15 Fire and Fuels	Grapple pile operations would use the same skid trails as harvest operations where possible. Mechanical fuel operations would adhere to ground-based equipment PDCs mentioned above. Where feasible, pile slash on sites already disturbed by logging activities (e.g. skid trails, landings, and roads) in order to minimize additional detrimental soil impacts from burning. Avoid locating slash piles on shallow soils (<25cm). Piling slash should not occur above or below culverts or drainages to prevent sediment delivery. If piling fuels near a culvert or drainage, pile fuels away from the culvert or drainage high water flow. Limit hand pile size to less than 50 square feet to reduce organic horizon loss and limit soil heating. Pile burning when duff is moist or wet can reduce organic matter loss and soil heating. When using a boom-mounted equipment, operator shall plan off-trail travel paths to make full use of the machine's capability (e.g., using the full boom reach of the machine) to limit ground disturbance and minimize the number of off-trail passes. Reclaim all machine-built fire lines by redistributing displaced topsoil and unburned woody debris over the disturbed surface as needed after burn has been completed. Install water bars on fire lines using the following guideline: 5-15% slope every 150 feet, 16-35% slope every 40 feet, 36-60% slope every 30 feet, and >60% slope every 15 feet. On slopes less than 15%, water bars may not be needed if adequate amounts of slash are available. Slash and organic material incorporated into road rehabilitation should not be intentionally burned. Slash and organic material in trails from tethered harvest systems should not be intentionally burned.
SQ-16 Low productivity soil mitigation	Adequate amounts of slash should be left within the unit in order to retain fine organic matter on low productivity soils with inherently lower ability to retain adequate organic matter reservoirs. If Regional Soil Quality Standards and Guidelines are unable to be met because the stand is incapable of producing enough slash, all slash should be left untreated.
Wildlife	
WL-1 Down Woody Material	Provide dead and down woody material to meet habitat requirements for management indicator and regionally sensitive species (WW LRMP 4-46). Within all units, where available, retain the minimum standard linear feet of logs per acre (all decay classes) the minimum diameter at the small end and the minimum piece length as described below. Leave more where doing so does not present an excessive fuel hazard. Where minimum diameter logs are not present within the unit, the largest available logs should be targeted for retention. Down woody material already on the ground should be retained and protected to the greatest extent possible during all activities. Leave down wood in current lengths: do not cut them into pieces (East Side Screens). This retention standard also addresses soils objectives for long-term nutrient cycling and microbiotic habitat. Retain all downed wood greater than 20 inches in diameter at large end in its existing location (i.e. do not pile). During prescribed burning operations, use preventative measures (i.e. placing a line around) and/or light in a manner (i.e. back-burning from the log) as to prevent the burning and consumption of snags and down woody material needed to meet minimum standards. This applies to all decay classes. Also avoid direct lighting of stumps and logs greater than 8 inches in diameter. Where feasible, consumption should not exceed 3 inches total (1 ½ inches per side) diameter reduction of retained down wood (see table below). Coordinate with the project wildlife biologist when burning. This standard also addresses soils objectives for long-term nutrient cycling, microbiotic habitat, and effective ground cover.

<table>
<tr><td></td><td>Where material is available, all treatment units (harvest and prescribed burn) would exceed the minimum levels for down woody material described in the table below for each species.
<table>
<tr><th>SPECIES</th><th>PIECES PER AC</th><th>TONS PER AC</th><th>PIECE LENGTH AND DIAMETER SMALL END Diameter | Min Length</th><th>TOTAL LINEAL LENGTH</th></tr>
<tr><td>Ponderosa Pine</td><td>3-6</td><td>5-10</td><td>12” | 6ft</td><td>20-40 ft</td></tr>
<tr><td>Mixed Conifer</td><td>15-20</td><td>7-15</td><td>12” | 6ft</td><td>100-140 ft</td></tr>
<tr><td>Lodgepole pine</td><td>15-20</td><td>7-15</td><td>8” | 6ft</td><td>120-160 ft</td></tr>
</table></td></tr>
<tr><td>WL-2
Snags</td><td>All snags would be retained unless identified as posing a safety hazard. Snags felled for safety reasons would be retained onsite to contribute to coarse wood where coarse wood amounts are deficient.
To reduce the potential for loss of snags during prescribed burning, employ passive lighting techniques near snags larger than 12 inches.
• Techniques should consider slope, wind, and fuel characteristics to encourage a backing fire.
• Unit prep should include scraping down to bare mineral soil around the base of large snags (> 21 inches dbh) at higher risk due to heavy fuels accumulations at the base, pullback of fuels may be necessary prior to prescribed burning.</td></tr>
<tr><td>WL-3
Green Tree Replacement (GTR)</td><td>Sufficient green trees of adequate size are to be retained in harvest units to provide replacements for snags and logs through time. GTRs need to be retained at a rate of 25-45 trees per acre, depending on vegetation group.
• All harvest prescriptions in the project would retain GTRs within or above this range. See the WWNF Green Tree Snag Replacement Guidelines for details associated with managing for induced mortality.
No live trees greater than or equal to 21 inches DBH would be cut unless they create a safety hazard during logging operations.</td></tr>
<tr><td>WL-4
Raptors and Cavity Nesters</td><td>Active raptor nest sites found during field reconnaissance for this project would be protected during project activities. If active raptor nests are located during layout, marking, or project activities, appropriate protection measures would be prescribed as described in the Wildlife Inventory document in the project file. One great gray owl nest was discovered within the project area. A 600 ft no touch buffer was created around the nest tree and timing restrictions (February 1- July 1st) apply to treatments directly adjacent to the buffer. This nest tree also occurs within an identified goshawk PFA so timing restrictions will overlap.</td></tr>
<tr><td>WL-5
Goshawk Nest Sites</td><td>Surveys were completed within the primary goshawk habitat of the project area. Two Goshawk nests were discovered. In accordance with the Eastside Screens two 30 acre no treatment zones and 400 acre post fledging areas were created for each nest. Timing restrictions (March 1st - August 31st) will apply for any treatment within the PFA.</td></tr>
<tr><td>WL-6
Big Game Winter Range</td><td>Logging operations would be avoided during the period between December 1 through April 1 in the project area units. This is to ensure protections for big game during a sensitive period. Waivers to operate during this time period may be requested and would be evaluated on a case by case basis by the District Ranger.</td></tr>
<tr><td>WL-7
Management Indicator and Neotropical Migratory Species</td><td>If management indicator species are discovered within prescribed burning units the following protective measures could be applied, either separately or in combination, to reduce possible impacts to snags with nest cavities and to protect other nest sites during burning:
• Prep around snags to bare mineral soil and eliminate ladder fuels
• varied lighting techniques (use a backing fire)
• fall burning or deferred burning until after the unit is no longer being used during the reproductive period
• To reduce the potential for impacts to nesting land birds, prescribed burning activities projected to occur on or after May 20, and/or past the onset of vegetation leaf-out, would be reviewed by a district or forest</td></tr>
</table>

	wildlife biologist. The District Biologist would then provide recommendations concerning prescribed burning after May 20 and/or past the onset of vegetation leaf-out.
Invasive Plants	
INV-1 Roadside populations	Treatment of the noxious weed sites located along roads should be a high priority, along with monitoring. Chapter 1: Rock pit and sources should be inspected and cleared prior to use of any materials. Chapter 2: Before road maintenance activities on roads with active infestations occurs the contracting officer (COR) will contact the District Noxious Weed Coordinator, to inform them 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.)
INV-2 New populations	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.
INV-3 Known Populations	All mapped weed sites will be designated as "Areas to Protect" and include in the contract package for use by the contract administrator. Chapter 3: Staging areas should not be built on or near sites of noxious weed infestation.
INV-4 Post-treatment	Highly disturbed areas 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 Coordinator. 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. Chapter 4: Seed will be certified weed free, per the Wallowa-Whitman INWMP protocol. Chapter 5: All hay or straw used for mulching, erosion control, or other rehabilitation purposes will be weed free (per the Wallowa-Whitman INWMP protocol).
INV-5 Equipment Requirements	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. 1) This requirement does not apply to passenger vehicles or other equipment used exclusively on roads. Cleaning, if needed, will occur off National Forest System lands. 2) Cleaning will be inspected and approved by the Forest Officer in charge of administering the project.
Native Plants	
NP-1 Avoidance	Exclude known sensitive plant population locations from ground disturbing treatments by implementing a no-disturbance buffer around each site. Avoid ground disturbing activities on previously undisturbed non-forested terrain.
NP-2 RHCAs	Allow hand applied ignition within limited activity buffer of Riparian Habitat Conservation Areas (see Blue Mountain PDCs). Allow low intensity prescribed fire to back into these areas. Follow Forest Plan standards and guidelines for protecting RHCAs from ground disturbing activities.

NP-3 Sensitive Habitats	Plant communities adjacent to sensitive/unique habitats would be protected by maintaining vegetative structure characteristic of the edge inherent to these areas. These areas include cliffs, caves, talus, natural openings, and meadows. • Buffer widths for sensitive habitats would be at least 100 feet, possibly more on some habitats. The degree of activity allowed within these buffers would vary depending on the type of sensitive habitat. Natural openings would generally not receive a buffer but would have prescription modifications to retain basal areas in the upper half of the management zone to maintain the integrity of the inherent edge for these areas. • Grassy scabs and meadows would 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. • To protect potential sensitive plant habitats, avoid ground disturbing activities (piling slash, decking, motorized travel, parking, staging operations) on previously undisturbed non-forested terrain. To protect native plant habitat and potential habitat for sensitive plant species from competition with undesirable non-native species, follow Forest Plan and Regional guidelines for including weed spread prevention measures in implementation contracts and for utilizing native species for restoration and erosion control work.
NP-4 Sensitive Plants	To protect sensitive plant species, known population locations would be excluded from ground disturbing treatments by implementing a no-disturbance buffer around each site of a size adequate to provide protection from implementation impacts. The size of buffer would be determined based on the species and size of the population. Known occurrences would be depicted as Areas-to-Protect on implementation maps. These areas would be identified on the ground as needed for project implementation.

NP-5 Whitebark Pine	Populations of whitebark pine seedlings and saplings, ranging in height from less than 1 foot to 15-feet tall, were discovered in subalpine habitat during 2020 field surveys. There were no mature, cone producing whitebark pine located. A review of the habitat, and a possible additional site visit to locate undetected whitebark pine individuals, will be conducted pre-implementation by the project silviculturist and botanist in the following units: 72, 92, 257, 258, 262, 267, and 272. This will be used to evaluated project-level impacts to whitebark pine to ensure consistency with the **Beneficial Impact** determination of effects in the Biological Evaluation. The following mitigation measures may be implemented based on the specialists' reviews.
	• Whitebark pine protection areas will be identified prior to implementation of treatment.
	  • Areas will be marked in a manner that they are visible during treatments.
	  • Directional felling will be required within 50 feet of designated areas.
	  • Harvest equipment will not be permitted to enter these areas.
	  • Cut trees within protection areas are permitted to be removed if equipment can reach in from the boundary and remove the cut tree with full suspension.
	  • Follow up hand thinning may be permitted.
	  • Harvest slash will be mechanically piled on slopes less than 30% and hand piled on slopes greater than 30% and then burned.
	  • Creating slash piles within these areas will be permitted, however avoided to the amount practical and will not occur on or within 10 feet of whitebark pine.
	• With mitigations < 20% of whitebark pine's known area of occurrence within the project area would be negatively influenced by project activities.
	Plans to plant priority management units with rust resistant whitebark pine seedlings will be developed and implemented.

NP-6 Richardson's Needlegrass	• ATPs: 1, 4, 5, 8, 13, 22, 24, 40, 82, 204, 276, 282, 287, 288, 360, 361 • Reseed units: 8, 14, 15, 25, 28, 80, 114, 115, 355 • Photo monitoring: 279 • Adaptive Management: 204 ○ Burn in both spring and fall then monitor to understand which has a better response Seed collection for reseeding burned areas
Fisheries	

FISH-1 Protection of Fish Habitat	Design fuel treatment to minimize disturbance of riparian ground cover and vegetation. Strategies should recognize the role of fire in ecosystem function and identify those instances where fire suppression or fuel management actions could perpetuate or be damaging to long-term ecosystem function, or designated critical habitat / or inland native fish. Follow Blue Mountain PDCs (USDA BLM 2015) for fuels; no activity buffers are 100 feet Cat 1, 75 feet slopes less than 30% Cat 2, 50 feet slopes less than 30% Cat 4. Beyond these buffers: **Prescribed Fire** • Treatment by hand only • All shade providing, instream and long term wood recruitment trees retained • Full stoked canopy retained • Hand applied ignition (such as drip torch or fusees) within the outer part of the RHCA (beyond the no activity portion of the RHCA). **Slash Pile Burning** • Piles located outside the limited activity RHCA buffer width and in locations that avoid damage to remaining overstory canopy • Hand piling only (no mechanical treatments) • Maximum size four feet in height and six feet in diameter • Piles burned when there is high soil moisture content In fuels block units, low to moderate intensity fires to back in to the outer edges of RHCA buffers When drafting water, sources would be monitored for reduced flow. During low flow conditions (less than 5 cfs), spring fed ponds would be used as sources prior to the use of stream sources whenever feasible. Fell and leave hazardous trees that compromise operator or public safety during implementation. • Maintain natural LWD and trees needed for future recruitment to protect or enhance stream channel and bank structure, enhance water quality, and provide structural fish habitat within all stream systems.
FISH-2 Roads	State of Oregon in-stream work window (July 1 thru July 31) will be followed for all road maintenance activities occurring within stream banks. Temporary culverts will be installed during dry conditions on Category 4 streams. After completion of the project, these structures will be removed and hauled from the project area. Banks of crossings will be reshaped to match undisturbed sections adjacent to the crossing. Slough and waste materials removed during road maintenance activities, including ditch and culvert cleaning, would be deposited in approved disposal sites outside RHCAs. For erosion control and stabilization, the disposal site would be seeded with native seed. During road maintenance and snow plowing, side cast of materials would not occur where these materials could be directly or indirectly introduced into a stream, or where the placement of these materials could contribute to the destabilization of the slope. Road reconstruction would limit vegetation modification to the road prism, road surface, and ditch lines to that work necessary to maintain a safe travel way and functional drainage system. • Ditches would only be maintained where the water captured by the ditch is not able to be transported to the adjacent drainage structure that carries the water across the road.
FISH-3 Stream Temperature	Prevent measurable (greater than 0.5°C change) temperature increases in Category I streams. Temperatures on other streams may be increased only to the extent that water quality standards on downstream, fish bearing streams would not be affected.Stream shade management on Category 2 streams would differ little from treatment on Category I streams.
Range	
RANGE-1 Improvements	All range improvements must be protected during project activities. If fences are damaged, repairs must be made immediately to prevent livestock from entering areas outside of established allotments. Any damage occurring to existing range improvements should be reported to the District range manager and/or private landowner. No trees used as anchor trees along a fence line shall be marked for harvest.

RANGE-2 Livestock	• All gates must be closed while livestock are within the allotment adjacent to the harvest units. • Treatments located within Grazing Allotments would be coordinated with the District Range Management Specialist prior to treatment to adapt the administration of the allotment (if needed). The allotments would be administered to standard following treatment to ensure the Forest Plan Standards and Guidelines set for allowable use (Wallowa Whitman Land and Resource Management Plan 4-51 to 4-54) are met.
Fuels	
FUELS-1 Smoke Management	Burns which consume more than 10 tons of fuel must follow requirements in the State of Oregon Smoke Management Plan. Smoke Management forecasts would be obtained through Oregon Department of Forestry, the morning of ignition, and each subsequent day of ignition. Forecast must be favorable or reviewed with forecaster for the burn to proceed to assure air quality standards for personal health are met. All smoke generating project activities would comply with the Clean Air Act.
FUELS-2 Prescribed Burn	Prescribed fire ignition will not occur within 300 feet of Category 1 streams, 150 feet of any Category 2 streams, and 100 feet of Category 4 streams. Low and moderate intensity backing fires will be allowed within the no ignition buffers. Design fuel treatment to minimize disturbance of riparian ground cover and vegetation. Strategies should recognize the role of fire in ecosystem function and identify those instances where fire suppression or fuel management actions could perpetuate or be damaging to long-term ecosystem function, or designated critical habitat / or inland native fish. When drafting water, sources would be monitored for reduced flow. During low flow conditions (less than 5 cfs), spring fed ponds would be used as sources prior to the use of stream sources whenever feasible. Water sources needed during prescribed fire operations would consist of temporary sumps. Avoid impacting live or dead trees associated with temporary roads, culverts, or maintenance on existing roads in RHCAs. If safety or other hazardous trees are observed during implementation, work with a District Fish Biologist or Hydrologist to place the tree in the stream to help move large wood RMOs towards Forest Plan standards. If large diameter trees are identified before or during burning operations, pull back fuel accumulations from the base of trees to limit overstory mortality from prescribed fire. Follow recommendations in RMRS-GTR-238. No direct ignition would occur immediately adjacent to large down logs or large snags. Sites to be identified at a later date would be constrained by the following: • Locate site to minimize washout and erosion potential. • Springs and elk wallows would be avoided. • Avoidance of potential habitat of PETS plant species.
FUELS-3 Fireline	Brushline (no mineral soil exposed) would be constructed if necessary within RHCAs to keep fires within prescription parameters. Rehab firelines that have the potential to promote off-road motor vehicle travel as necessary to ensure created firelines are near natural appearing, and do not pose potential for increase public off-motor vehicle and/or forest resource long-term adverse impact.
Logging Sale and Design	
LSD-1 Operating Restrictions	Pine Engraver. Restricts the creation of pine engraver breeding habitat (ponderosa pine) slash from December 1 to June 30. Applies to harvesting and road construction/reconstruction/maintenance to prevent outbreak of pine engraver beetles. In harvest units of greater than 2 MBF per acre gross harvest volume of ponderosa pine, avoid leaving 4” diameter or larger green ponderosa pine slash in the woods from December 1 through June 30th. Applicable units would be based upon the cruise volume. Should green ponderosa or lodgepole pine slash be created during this period, Pine Engraver breeding habitat (green cambium) should be destroyed prior to July 1st. Log decks containing any ponderosa pine logs should be hauled prior to July 1st.
LSD-2 Danger Trees	Danger trees (as identified by a qualified person using the Field Guide for Danger Tree Identification and Response) would be removed or felled and left onsite to protect the public and forest workers. Trees selected for retention under the Tree Improvement Program would be protected during project activities.

LSD-3 Slash Piles	Slash piles would not be constructed or burned on scablands. In order to protect sensitive plant species units identified in the PETS section below would be coordinated with the District Botanist and would have areas designated to protect (ATP) during layout and implementation on the contract maps.
LSD-3 RHCA-HTH Units	**Unspecified areas within the following units will follow Blue Mountains PDCs** **UNIT 12:** Allow equipment to go above the 5160 rd (to the west side). • 5182.800 rd bed will be utilized to harvest trees on both side of road. Equipment would be allowed to move into unit 287 from the 5160. Forwarding (transporting) harvested trees would be allowed to the 5160. • 5182 will be utilized to harvest trees on the south end of roadbed with equipment staying on the roadbed. **UNIT 38** • 5182.448 rd bed will be utilized to harvest trees on the south end of the unit. Equipment will stay on road prism and reach within the unit. • 5182.230 rd will be utilized to harvest trees on the north end of the unit. Equipment will stay on road prism and reach within the unit. • 5182.305 rd will be utilized to harvest trees on east end of the unit. Equipment will stay on road prism and reach within the unit. • Unit 230 will be utilized to harvest trees on north end of the unit. Equipment will stay within the boundary of the 230 unit and reach within the unit. **Unit 62**: Areas above the 5182 road bed will be treated with equipment staying on the roadbed. • 5182.400 will be utilized to harvest trees on the south end of roadbed with equipment staying on the roadbed. • 5182 will be utilized to harvest trees on the south end of roadbed with equipment staying on the roadbed. **Unit 64**: 5182.526 rd bed will be utilized to harvest trees on the west side of the unit. Equipment will stay on road prism and reach within the unit to harvest trees. **Unit 68**: (middle priority) The 5184.009, 5184.350, 5184.200, 5184.100 and the 5184.250 roads will all be utilized to harvest trees within the RHCA-HTH unit with equipment staying on the road. This will tie in units 218 and 249 and 65 into the road bed to achieve strategic fuel break objectives. • Unit 65 will be utilized to harvest trees on south west end of the unit. Equipment would be allowed to enter from 65 and forward trees to the 5184.350. **Unit 71**: This RHCA-HTH treatment would allow commercial harvest treatment units 69 72, 75, 90 and 91 tie into established road beds. No treatment riparian buffers will leave strips of untreated area above roads which will compromise the success of creating a strategic fuel break. • Highlighted areas within the RHCA-HTH unit following along the 5182077 rd will be treated with equipment staying on the roadbed. The northwestern boundary of unit 91 and 69 will be utilized to harvest trees within the RHCA-HTH unit boundary, with equipment staying within the unit boundary and reaching within. • Trees will be harvested south of the 5182.100 rd with equipment staying on the road bed and reaching within the unit. • Trees will be harvested north of the 5182 rd with equipment staying on the road bed and reaching within the unit. • This RHCA-HTH treatment would allow unit 73 to tie into the 5182034. Equipment will be allowed to forward harvested trees from unit 73 to the 5182.034 road. Equipment will stay on the road bed of the 5182.034 rd and reach within the treatment unit that is not bordering unit 73.. • It will also allow units 90 and 72 to tie into the 5182.050 rd and 5182.040 and 5182.035. Equipment will be allowed to forward harvested trees from unit 90 to the 5182.040 road. **Unit 88**: This RHCA-HTH treatment would allow commercial harvest treatment unit 48 to tie into a riparian area. This would help promote the vigor of trees surrounding the riparian area. Equipment would be allow to reach into the riparian area from unit 48 and harvest trees without their tracks going into the riparian area. • The 5160.032 rd will be utilized to also harvest trees within the riparian area. Equipment will stay on road prism and reach within the unit to harvest trees. **Units 100/ 108**: Highlighted areas will be treated. The 5164.101 rd bed will be utilized to harvest trees north of

	unit 100. The 5164.101 jnct. will also be utilized to harvest trees on both sides of the road. No harvest will occur to trees directly over streambed (50' away from the channel). The 5160 rd jnct. will be utilized trees on the west end of the unit. Equipment will stay on road prism and reach within the unit. • The spur road off the 5164.101 rd heading south will be used to harvest trees in Unit 108. The road prism will be used to reach within the unit and harvest trees. **Unit 103**: This RHCA-HTH treatment would allow commercial harvest treatment units 41 and 126 and mechanical fuel harvest 212 tie a meadow surrounding Sheep Creek that has experience conifer encroachment from past disturbance. No treatment riparian buffers will leave strips of untreated area above meadows and will allow conifer encroachment to continue. • The RHCA-HTH unit area north of the 5164 will allow mechanical equipment above the road bed tying into unit 211. **Unit 104**: This RHCA-HTH treatment would allow the hand treatment 215 to tie into the 5182 rd. This will help with the objective of creating a strategic fuels break along the 5182rd. Left un-treated, this strip in the riparian area would leave a higher density of built up fuels. The 5182 rd or the 5182.680 to harvest trees within the RHCA-HTH unit with equipment staying on the road.
Transportation	
TRANS-1 Maintenance	System roads planned for project use would be maintained to a standard needed for project use. Maintenance activities would be in accordance with the Wallowa-Whitman standard specifications for timber sales. Typical maintenance activities include; blading and shaping roadbeds, cleaning ditches and culverts, installing and replacing temporary culverts, removal or ramping over of small slumps and slides, road-side brushing of overhanging limbs and small diameter trees, logging out blow downs and felling danger trees. Haul activities may include; dust abatement on primary haul routes, and snow removal for winter haul. Post-haul maintenance includes; water barring and blocking closed roads; re-establishing and adding to cross ditches on lower standard open and closed roads, and final blading and shaping of all roads, as necessary. Road maintenance would maintain existing drainage features. Post-haul maintenance would protect the road surfaces during future periods of inactivity and may require construction of additional drainage features. Cross drains would not discharge onto erodible slopes or directly into stream channels, including ephemeral drainages.
TRANS-2 Reconstruct	System roads needing work beyond the intent of the road maintenance specifications would be reconstructed to the minimum standard needed to support haul. Typical reconstruction work includes heavy clearing, drainage work (springs, culvert replacements), removal and stabilization of landslides, relocating road segments, placing rock subgrade reinforcement and surfacing. Nontypical reconstruction included removal and replacement of a bridge structure.
TRANS-3 Temporary Roads	Existing roads that are not system roads would be used for the project under the timber sale contract terms for temporary roads. Location, clearing width, and any special requirements (including post-haul treatment) would be agreed to in writing approval prior to construction and they would be closed and stabilized after use. Temporary roads would be constructed and then stabilized and blocked under the terms of the contract. Location, clearing width and any special construction requirements (including post-haul treatment) would be agreed to in writing prior to construction.
TRANS-4 System Roads	System roads that are closed would be opened for project use only and re-closed. Open and closed (ML1 and 2) system roads not necessary for public access may be closed to the public and signed for project use only during project operations.
TRANS-5 Operating Restrictions	Culverts in live streams would be installed during the instream work window. Culverts to be installed on Category 4 streams would occur during dry channel conditions. To prevent road damage and maintain water quality, road use would be restricted to the normal operating season. If road use is approved outside the normal operating season, drainage structure would be kept in a functional condition, and daily operations would be managed to minimize sediment transport from roads. Operations would cease when roads turn muddy and/or rutting occurs, resulting in sediment transportation.

TRANS-6 Material and Water Source

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

- All gravel and fill stockpiles, quarry sites, and borrow material will be inspected for invasive plants before use and transport. Only gravel, fill, sand and rock that is judged to be weed free by the district or forest weed specialists would be used.
- Water sources are available in the project area. They will be agreed to in writing prior to use with the appropriate state permits.

Source	Road Access	Township and Range	Material
West Chicken Creek	5164180	T6S R35E Sec 22	Pit Run, Rip Rap
Sheep Creek Tributary	5182800	T6S R35.5E Sec 10	Pit Run, Rip Rap
West Chicken Creek #2	5175020	T6S R35.5E Sec 15	Pit Run, Rip Rap
Upper Chicken	5100700	T6S R35.5E Sec 35	Pit Run, Rip Rap
Chicken Creek Tributary	5178000	T6S R36E Sec 19	Crushed Aggregate, Pit, Rip Rap
West Chicken	5175319	T6S R35.5E Sec 22	Pit Run, Rip Rap
Meadowbrook Creek	5178085	T6S R36E Sec 19	Pit Run, Rip Rap
Little Fly Creek	5160157	T6S R35E Sec 3	Crushed Aggregate, Pit Run, Rip Rap
Sheep Creek Tributary	5160140	T6S R35.5E Sec 4	Pit Run, Rip Rap
Sheep Creek	5182000	T6S R35E Sec 26	Pit Run, Rip Rap

Heritage and Cultural

HC-1 Fire/Fuels

Historic sites that could potentially be damaged by fire or associated preparatory activities would be avoided and/or protected. During the layout and development of prescribed burn plans, district fuels specialists would work with forest heritage staff to determine the location and appropriate protection measures for known heritage sites.

Wooden structures are at the greatest risk of damage or loss during burning activities. In order to eliminate the risk of damage from fire an appropriately sized buffer zone around structures would be excluded from areas to be burned. Depending upon the size of the buffer zone and the fire behavior anticipated and observed during burning operations, additional protection from embers may also be required. In some instances unit boundaries would be modified to provide the necessary buffer zone, in others fire control methods would be identified and applied prior to or during burn operations in order to prevent fire spread into buffer zones. Fire control methods include the construction of control lines, by hand or with machinery, around historic sites (generally done prior to burning) and the use of wetlines, hoselays, engines or hand crews to prevent fire spread into buffer zones. If previously unknown historic sites are identified during implementation of burning, protection actions would be developed and implemented, including if necessary the delay of burn activities.

Linear features (such as ditches) and other historic evidence of human occupancy are at risk of some damage during burning activities, generally through the construction of control lines. Linear features would be identified in burn plans. Pre-burn fireline construction would be limited to the use of handlines and/or wetlines where potential exists to impact historic linear features. A dozer boss would be present to assist in identifying and avoiding historic sites when machinery is used in fireline construction.

HC-2 General	Several existing historic and prehistoric sites are located within the project area. Sites requiring protection have been mapped and avoidance areas and buffer zones for site protection for Sheep Creek Vegetation Management Project activities would be flagged by the WWNF South Zone Archaeologist prior to the onset of project activities. Activities are excluded from any known archaeological sites, except on established (open) roads; or allowed with coordination with the archaeologist and consulted upon with the Oregon State Historic Preservation Office (SHPO). It is recognized that even the most intensive field surveys may not locate all heritage sites therefore, if cultural resources are located/relocated during implementation of any of the action alternatives, work would be halted and the District Archaeologist would be notified. The cultural resource would be evaluated and a mitigation plan developed in consultation with the Oregon SHPO if necessary.
Recreation	
REC-1 Dispersed Camping	Maintain the character of dispersed camping sites by cleaning up project-created slash. Maintain access to dispersed sites on roads should remain open. Leave adequate space for camping at the point where roads are closed.
Range	
Range-1 Fences	All improvements should be protected during vegetation management activities. No trees used as fence support structures will be marked for harvest. If it is necessary to cut range fences, the contractor must be required to immediately repair them to Forest Service standards. These standards are available and should be made a part of the restoration contract. Fence line right of ways must be kept cleared for eight feet on each side of the fence following treatment, regardless of application.
Range-2 Water Sources	All improvements should be protected during vegetation management activities. Spring sources shall be buffered by 50 feet to reduce disturbance to the vegetation and water collection point.
Range-3	No more than a total of 10% of the available forage would be burned per year within the project area.

Improvement-Mitigation Measures with KV or Appropriated Funds

The following projects and opportunities have been identified as possible candidates to receive funding under the Knutsen-Vandenburg Act. These are commonly referred to as KV funds and are collected from timber sale receipts. If KV funds are limited, appropriated and/or partnership funding would be pursued for the implementation of these activities.

KV/Sale Area Improvement (SAI) projects associated with the implementation of Alternatives 2 and 3 are incorporated in the environmental effects analyses section of this document.

Table 9. KV priorities, actions, and costs

Type	Priority	Action	Cost
Essential	1	Planting	$300/Acre
Essential	1	Stocking survey	$25/Acre
Essential	1	Certification of artificial or natural regeneration	$0/Acre
Non-essential Mitigation	2	Noxious weed control	$175/Acre
Non-essential	2	Noxious weed monitoring	$25/Acre

mitigation			
Non-essential enhancement (BD)	3	Noncommercial thinning within tractor harvest units	$200/Acre
Non-essential enhancement	3	Jackpot burn in commercial units	$100/Acre
Non-essential enhancement	3	Grapple piling of noncommercial units	$200/Acre
Non-essential enhancement	3	Whipfelling in noncommercial units	$200/Acre
Non-essential enhancement	3	Noncommercial thinning in skyline units	$200/Acre
Non-essential enhancement	4	Noncommercial thinning units (including habitat restoration units)	$200/Acre
Non-essential enhancement	4	RHCA-Wetland enhancement work (thinning, whipfelling, lop and scatter)	$200/Acre
Non-essential enhancement	4	Informational RHCA treatment signs (2)	$5,000/Each
Non-essential enhancement	4	RHCA noncommercial thinning (thinning, whipfelling, lop and scatter)	$200/Acre
Non-essential enhancement	4	Piling slash in noncommercial thinning units	$400/Acre
Non-essential enhancement	5	Road decommissioning	$2,434/Mile
Non-essential enhancement	5	Revegetation of decommissioned roads with native seed	$60/Acre
Non-essential enhancement	5	Informational road closure signs (5)	$5,000/Each
Non-essential enhancement	5	Gate installation (1)	$2,500/Each
Non-essential enhancement	5	Soil Rehabilitation of non-system roads (30 miles)	$40/Mile
Non-essential enhancement	5	Aquatic Organism Passage installment (3): FSRs 5182-500, 5184-000 lower & upper	$180,000/Each
Non-essential enhancement	5	Culvert removal and ford construction (1): FSR 5182-034	$50,000/Each
Non-essential enhancement	5	Old log bridge removal (2): FSR 5182-100 and 5100-372	$15,000/Each
Non-essential enhancement	5	Remove culverts on stored roads (15)	$4,000/Each
Non-essential enhancement	5	Remove fish passage barrier and replace with trail bridge (1): FSR 5182-500	$80,000/Each
Non-essential enhancement	6	Post-harvest monitoring	$20/Acre
Non-essential enhancement	6	Monitor noxious weeds outside of units	$25/Acre
Non-essential enhancement	6	Treat noxious weeds outside of units	$175/Acre

Monitoring Plan

Monitoring specific to project activities 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 would be accomplished:

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

For example, monitoring of sale layout and timber designation would occur to assure proper application of all identified resource objectives, constraints, and mitigation measures. Monitoring would also consist of timber sale contract administration and firewood cutting and effects 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 species are discovered in the area during project activity they would 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 would be undertaken to assure compliance with water quality standards, hydrology, and soil parameters.

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

A walk-through survey of the project area during implementation and after sale closure to evaluate application and effectiveness of BMP's would 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 would cease or be modified to correct problems.

Table 10. Monitoring

Resource	Type	Activity Monitored	Frequency and Timing	Responsible Person
Fuels	I	Prescribed burning	During burn period	Fire manager
	I and E	Smoke dispersal	During burn period and after lighting is complete	Fire manager or burn boss
Invasive Species	I	Noxious weed inspections, equipment cleaning, weed infestation avoidance, weed inventory, documentation and communication.	Daily during active operations near noxious weed infestations.	Sale Administrator
	E	Noxious weed survey and inventory	Annually for 3 years following project end.	Zone Invasive Plant Coordinator
	I	Noxious weed treatment/ EDRR of disturbed ground	Annually for 3 years following project end.	Zone Invasive Plant Crew
	I	Broadcast seeding of disturbed soil	Immediately	Sale

Resource	Type	Activity Monitored	Frequency and Timing	Responsible Person
		along roads, skid trails and landings.	following soil disturbance	Administrator and Road Maintenance Foreman or COR
	I	Broadcast seeding of burned landing piles and grapple piles.	Earliest appropriate seeding opportunity after the piles are burned up.	Zone Invasive Plant Crew
	I	Road rock sources, pits and/or quarry noxious weed inspections	Prior to use for road construction, reconstruction, or maintenance	Zone Invasive Plant Coordinator; Zone Engineer
	I	Noxious weed avoidance while prescribed burning	Prior to lighting burn	Fire management
Soils	I and E	Sale layout and contract administration to ensure best management practices and mitigation measures are being followed (described in mitigations section above). Ensure DSC levels remain within Forest Plan standards.	Active operations and post-harvest	Sale administrator, soil scientist, or hydrologist
		Tethered logging: 41, 47, 48, 49, 56, 61, 74, 79, 84, 87, 91, 96, 125		
	E	Water bar construction and spacing	Post-harvest	
	I	Ground-based harvest units to ensure adequate spacing and use of skid trails, prevention of equipment operations during moist ground conditions, and subsoiling of compacted skid trails and landings.	Active operations	
Range	I	All activities to avoid damage to range improvements	Daily during active operations.	Sale Administrator or fuels manager
	E	Forage utilization and administration to standard	Following Treatment in active pastures	Range manager
	E	Burning activity	Following prescribed fuels treatments	Fuels manager

Resource	Type	Activity Monitored	Frequency and Timing	Responsible Person
Heritage	E	Areas to protect	Following protective treatments and upon completion of the project	Sale administrator or heritage personnel
Native Plants	I and E	Areas to protect for Whitebark Pine	Active operations	Botanist
	E	Richardson's Needlegrass • Adaptive Management: 204 • Photo monitoring: 279	Burn in both spring and fall then monitor to understand which has a better response	Botanist
Timber and Silviculture	I and E	Vegetation response to silvicultural and fuels prescriptions	During sale prep, logging, and post-sale	District silviculturist and Fuels planner
Recreation	I	No project activities within 25 feet of dispersed sites	During logging	Sale administrator
Wildlife	I and E	Adequate snags, logs, and green trees are retained	During logging and one year after sale	Sale administrator and wildlife personnel

Environmental Impacts

This section incorporates by reference Sheep Creek project specialist reports located in Appendix B of the EA. These reports contain the data, methodologies, analysis, maps, literature cited, and technical documentation each specialist relied on to reach the conclusions discussed in this section.

Forest Health and Sustainability

Table 11. Forest health and sustainability indicators and measures

Key Issue: Treatment in Old Forest and Moist Forest	
Indicator	**Measure**
Old Forest	Acres of OFMS restored to OFSS

Density	Acres restored to recommended stocking levels
Composition	Acres restored to HRV
Structure	Acres restored to HRV
Insect and Disease Susceptibility	Acres restored to HRV

Historical Range of Variation Guidance for Forest Vegetation Planning

District specialists assessed the historic range of variability (HRV) to compare the project area's current conditions against what ecologists believe existed during the pre-settlement era (Sheep Creek project file). When assessed at the watershed scale, HRV informs land managers about inherent variations in species composition, forest structure, and stand density to provide the framework for understanding the structure and behavior of contemporary ecosystems and is the basis for predicting future conditions (Powell, 2019). HRV is a tool that helps ensure management activities restore conditions under which native species, gene pools, communities, landscapes and ecosystem processes evolved. HRV represents a state of increased ecological resilience and adaptive capacities and is measured by forest structure, species composition, and density.

Forest Structure

The Oliver and Larson (1996) system has five classes of structural variation which include stand initiation, stem exclusion, understory reinitiation, old forest multi strata, and old forest single strata (Powell 2019). Each type of forest structure supports wildlife habitat and ecological processes across all potential vegetation groups (PVGs).

Potential Vegetation Groups

Potential vegetation (PV or PVG) is defined as the community of plants that would become established if all successional sequences were completed without interference by humans. This implies that over the course of time, and in the absence of future disturbances, similar types of plant communities will develop on similar sites (Powell, 2019). PV is an aggregation of plant association groups (PAGs) with similar environmental regimes and dominant plant species. They indicate the rate vegetation changes on a site (Powell 2019).

Table 12. PVG Groups within the Sheep Creek Project area

PVG Groups within the Project area *(Upland Forest Only)*		
PVG	Acres	% of project area
Cold Upland Forest	14,192	49
Dry Upland Forest	8,214	28
Moist Upland Forest	6,155	21
Other	614	2
Total	29,175	100

Species Composition

Cover types are expressed as percentages of each PVG. Cover types may have a majority of one species (e.g., grand fir comprises more than 50% of trees in the stand, coded as grand fir) or if less than 50% of a species is dominant a cover type is named for the species existing at the highest percentage within the stand.

Tree Class Density

Disturbance processes regulate stand density by periodically killing trees and maintaining stocking levels within a range of variation that differs for each combination of species and plant association. Tree density is a characterization of tree stocking for an area. It expresses the number of tree stems occupying a unit of land. Stocking can be expressed as a "stand density index" or in some other measure of relative density, or it can be quantified in absolute terms as a number of trees per acre or as the amount of basal area, wood volume, or canopy cover on an area (Powell 1999).

Stand density index (SDI) helps managers predict forest health concerns, including, but not limited to, competition, fire hazard, insects and diseases (Cochran et al. 1994, Powell 1999). Published stocking guidelines (Powell, 1999) are used for evaluating stand density levels. The following distinguish stands with different density levels:

- High stand density class: Stands at or above full stocking or normal density benchmark.
- Moderate stand density class: Stand within the lower and upper limits of a management zone where partial to full competition occurs, and inter-tree competition and mortality agents are less common.
- Low stand density class: Stands at or below the lower limits of the management zone.

Insect and Disease Susceptibility

Susceptibility is defined as a set of conditions making a forest stand vulnerable to substantial injury from insects or diseases. Susceptibility assessments do not predict when insects or diseases might reach damaging levels; rather, they indicate whether stand conditions are conducive to declining forest health, as reflected by increasing levels of tree mortality from insect and disease organisms. To provide a process for evaluating insect and disease susceptibility, range of variation information was developed for different insect and disease agents, and three classes of susceptibility (high, moderate, low) stratified by potential vegetation group (Powell 2019).

Alternative 1

Summary: This alternative represents existing conditions within the project area and serves as the baseline for analysis of the two action alternatives. Alternative 1 would perpetuate changes in overall forest health as described by stand density, composition and structure.

In the short term, distribution of forest cover type, forest structural stages and tree density class under alternative 1 would be similar to existing conditions (see forest structure, density and composition tables below). Alternative 1 does not meet the purpose and need for the project because there would be no restoration of structure, density and composition towards HRV or associated restoration of disturbance processes at the landscape scale. Disturbances would likely continue to increase in severity and potentially size depending on conditions (fire weather/drought).

Tree Class Density

Tree density classes per species within each Plant Vegetation Group, are defined as follows:

- Low Tree Density – within the lower management zone

- Medium Tree Density – between the lower and upper management zones
- High Tree Density – near or above the upper management zones

Table 13. Stand Density Class HRV Analysis within the Sheep Creek Project Area for Dry, Cold and Moist Upland forest as expressed as percentages by potential vegetation group.

Stand Density Class (Expressed as basal area, in ft2/acre at 10" QMD)	Potential Vegetation Group Range of Variation (Percentage)			Current Conditions Range of Variation (Percentage)		
	Dry UF	Moist UF	Cold UF	Dry UF	Moist UF	Cold UF
Low (dry: <55; moist: <100; cold: <80)	40-85	20-40	15-35	30	48	28
Moderate (dry:55-85; moist:100-150; cold: 80-120)	15-30	25-60	20-40	34	22	24
High (dry:>85; moist: >150; cold: >120)	5-15	15-30	25-60	36	30	48

Notes: plant vegetation groups shaded in grey are within the range of variability. Low and moderate densities are within HRV for Moist and Cold Upland forest. High density stands are over represented in Dry and Moist Upland forest but are within HRV for Cold Forest.

Cold Upland Forests

Current stand densities are, in part, a result of past management. Under alternative one, 48% of this forest type would remain with high stocking densities and is within HRV15-30%. 24% of this forest type would remain in moderate stand density class, below HRV 25-60%. Overstocked conditions would continue. Tree growth would continue to slow, and density related mortality would increase. These high and moderate stand density conditions prevent the regeneration requirements of early seral species, and as such, regeneration is dominated by late seral species such subalpine fir and Engelmann spruce. All trees, especially early seral species are experiencing intertree competition resulting in elevated moisture stress across stands and decreasing vigor of codominant and dominant trees (Cochran et.al 1994, Powell 1999). As stand density increases, the intensity of disturbance is likely to increase (Powell 2019). The no action alternative would leave roughly 72% of cold forest stands in the project area are at an elevated risk to high intensity disturbance, and as such, more area is expected to transition into lower density classes through time.

Approximately 28% of cold forest would remain in the lower stand density class, which is also within the HRV (15-35%) and would be expected to experience ingrowth through time creating denser conditions. Cold forest stands in this lower density class are the result of past wildfire disturbance within the project area such as the Meadow and Boundary fire. These fires burnt at high intensities resulting in high mortality. These stands are recovering slowly due to a short growing season and harsh site conditions.

Moist Upland Forest

Under alternative one, 30% of this forest type would remain with high stocking densities which is within historic conditions (15-30%). Absence of fire has allowed thin-barked species, late seral species (grand fir, Engelmann spruce, and subalpine fir) to persist in these locations. These stands exhibit a two to multi-storied vertical structure where shade-tolerant late-seral and climax species often dominate. Horizontal structure varies from somewhat uniform to aggregated but commonly

exceeds the lower limit of imminent competition mortality. If stands in this density class were to experience a disturbance, such as bark beetle outbreak or wildfire, existing vegetation may experience significant mortality reducing stand densities .

22% of moist forest would remain in the medium stand density class which below historical reference conditions (25-60%). Stands within this density class are fully stocked and do not create regeneration conditions conducive to promoting early seral species establishment. Nor do current stand densities favor retaining the vigor of existing early seral species (Cochran et al. 1994, Powell 1999). The no action alternative would leave roughly 52% of moist forest stands in the project area are at an elevated risk to high intensity disturbance, and as such, more area is expected to transition into lower density classes through time. Directional climate change will increase the intensity and frequency of disturbances to these sites jeopardizing sustainability of vegetation on the landscape (Johnston 2017).

Currently, 48% of this forest type would remain in the low stand density class and is aboveaHRV (20-40%). This area would transition into a denser stand condition through time. Only areas in this density class may have existing conditions conducive for promoting the vigor of existing early seral species, however canopies may still be too dense to establish early seral species. Re-establishing early seral species and allowing them to gain a competitive advantage and achieve free-to-grow status, requires visible sky created through canopy openings (Jain et al. 2004).

Dry Upland Forest

Under alternative one, over 36% of this forest type would remain with high stocking densities representing double the expected amount on the landscape when compared to HRV (5-15%). These forests historically had frequent fire disturbance to regulate the density class (Powell 2014). Douglas-fir and grand fir have encroached underneath existing overstory canopies creating ladder fuels that may transition wildfire from the ground to the canopy. These later seral species are not as drought or fire resilient as early seral species and are susceptible to competition induced mortality. Projected impacts from climate change indicate that this forest type will experience the longest period of water deficit (Powell 2014, Halofsky et al. 2017). This will greatly impact trees resources to defend themselves increasing the risk of insect outbreaks.

The moderate stand density class represents 34% of upland forest (HRV 15-30%). This level of stocking is too dense to promote establishment of early seral species, and exposes overstory canopy to competition induced mortality. The no action alternative would leave roughly 70% of dry forest stands in the project area are at an elevated risk to high intensity disturbance, and as such, more area is expected to transition into lower density classes through time.

Approximately 30 % of dry upland forest is in the low density class which is below HRV (40-85%). This departure from HRV is largely attributed to past management in the project area. Stands in this density class experience the least amount of inter-tree competition and are expected to grow into denser stand classes through time.

Species Composition

Table 14. Vegetation Cover Type HRV Analysis for Moist Upland forest-current and desired species composition expressed as a percentage of the Sheep Creek landscape.

Vegetation Cover Type for Moist PVG	Range of variation for cover types (percentages)	Existing range of cover types (percentages)
Ponderosa Pine	5-15	< 1

Douglas-fir	15-30	4
Western Larch	10- 30	< 1
Lodgepole Pine	25-45	21
Grand Fir	15-30	73
Subalpine fir and spruce	1-10	2

Notes: Vegetation Cover Type HRV Analysis for Moist PVG. The gray shading indicates Vegetation Cover Types within HRV, lodgepole pine and subalpine fir and spruce. Early seral species and mid seral species (ponderosa pine, western larch, and Douglas-fir) are below. Equally significant, is the over representation of the Grand Fir Cover Type. Grand fir encroachment can attribute to fire suppression. Regeneration harvest in the 70's and 80's within Moist PVG regenerated with lodgepole pine due to cold temperatures.

Table 15. Vegetation Cover Type HRV Analysis for Dry Upland forest- current and desired species composition expressed as a percentage of the Sheep Creek landscape.

Vegetation Cover Type for Dry PVG	Range of variation for cover types (percentages)	Existing range of cover types (percentages)
Ponderosa Pine	50-80	2
Douglas-fir	5-20	16
Western Larch	1-10	<1
Lodgepole Pine	0	11
Grand Fir	1-10	71
Subalpine fir and spruce	0	<1

Notes: The gray shading indicates Vegetation Cover Types within HRV, Douglas-fir and subalpine fir and spruce. Early seral species Cover Types (ponderosa pine, western larch) are below HRV and late-seral Grand Fir and lodgepole pine Cover Type are overrepresented. Grand fir encroachment can attribute to fire suppression. Regeneration harvest in the 70's and 80's within Dry PVG regenerated with lodgepole pine due to cold temperatures.

Table 16. Vegetation Cover Type HRV Analysis for Cold Upland forest current and desired species composition expressed as a percentage of the Sheep Creek landscape.

Vegetation Cover Type for Cold PVG	Range of variation for cover types (%)	Existing range of cover types (%)
Ponderosa Pine	0-5	<1
Douglas-fir	5-15	<1
Western Larch	5- 15	<1
Lodgepole Pine	25-45	46
Grand Fir	5-15	38
Subalpine fir and spruce	15-35	16

Notes:The gray shading indicates Vegetation Cover Types within HRV, Douglas-fir and subalpine fir and spruce. Early seral species Cover Types (ponderosa pine, western larch) are below HRV and late-seral Grand Fir and lodgepole pine Cover Type are overrepresented. Regeneration harvest in the 70's and 80's within Dry PVG regenerated with lodgepole pine due to cold temperatures. Grand fir encroachment can attributed to fire suppression.

Results from the Cover Type HRV Analysis are consistent with the management history of the Sheep Creek project area. Across Moist and Dry Upland Forest late seral (shade tolerant) and fire intolerant species (e.g Grand Fir) are overrepresented across the landscape. Conditions would continue to favor Douglas-fir and grand fir. Seral species (ponderosa pine and western larch) would continue to decline moving farther outside RV.

Moist Upland Forest

Moist upland forest contains a mix of species and size classes, many exhibiting a two to multi-storied vertical structure where shade-tolerant late-seral and climax species often dominate. Late seral species cover (grand fir, subalpine fir and Engelmann spruce) is overrepresented, occurring across roughly 75% of the PVG (HRV 16-40%). These sites have the most water availability of all upland forest, and because of this, these forests have undergone the greatest magnitude of vegetation change over the last 150 years (Johnson 2017). These mid-to-late successional layer types are at greater susceptibility to two defoliators, Douglas-fir tussock moth and spruce budworm. These defoliators can increase to outbreak levels and cause substantial damage to host species across the landscape and have done so in or within the vicinity of the project area from 1954-1957 and 1981-1991 (ADS 1947-present). In part, this is because host trees are a major component of the stands in contrast to early successional layer types dominated by non-hosts or a mix of host and nonhost species (Clausnitzer 1993). Although these two defoliators were not observed at the time of our reconnaissance they present a risk to this forest type.

With the no action alternative, existing early seral species that are contributing to species diversity would continue to lose dominance to shade tolerant species in partial shade (Johnson 2017, Powell 2014). Currently early seral species dominate less than 2% of the project area in moist forest, which is severely underrepresented compared to HRV (15-45%). Dwarf mistletoe infections are severe in western larch in some locations, decreasing larch's vigor even further predisposing it to mortality (Hawksworth and Wens 1996).

Dry Upland Forest

Historically, large diameter and old ponderosa pine, and to a lesser extent western larch and Douglas- fir, dominated these sites. Due to fire suppression, Douglas-fir and grand fir have encroached into sites with greater water supply capacity covering 83% of this forest type compared to HRV (6-30%). Early seral cover type currently represents 3% of the dry forest in this project area and is significantly below HRV (51-90%). Lodgepole pine cover exists primarily from past regeneration harvests occurring in the 1970-early 90's. Removal of large overstory trees altered the microclimate on lower slopes resulting in cold air pockets that favored regeneration of lodgepole pine over other species. . As such it covers 11% of the Dry Upland forest type and is overrepresented when compared to HRV (0%).

With the no action alternative and directional climate change into hotter drier periods, this upland forest type is at risk to substantial mortality from insect outbreaks and fire. Early seral species will continue to lose dominance to shade tolerant species in partial shade (Johnson 2017, Powell 2014). Furthermore, Dwarf mistletoe infections are severe in Douglas- fir in some locations, decreasing vigor and predisposing it to insect, fire and competition related mortality (Hawksworth and Wens 1996).

Cold Upland Forests

Cold upland forests contain a mix of species and size classes, many exhibiting a two or more layered vertical structure where shade-tolerant late-seral and climax species dominate. Wildfire and timber harvest removed overstory canopy promoting natural regeneration with lodgepole pine. Fire suppression has allowed late seral climax species to persist and encroach on early seral species. With the no action alternative, lodgepole pine and late seral species (grand fir and subalpine fir/Engelmann spruce) would continue to be over-represented across the landscape while early seral species would be largely under-represented and continue to decrease (Johnson 2017). Currently, early seral species cover is below HRV covering less than 2% of moist upland forest (HRV 10-35%). Both late seral species and lodgepole pine vegetation cover types are

overrepresented in the project area compared to HRV. Late seral species covers 54% of this forest type (HRV 20-50%) and lodgepole pine covers 46% (HRV 25-45%).

The current percentage of subalpine fir is within HRV. Many of the remaining subalpine fir exhibit severe infestations and damage from balsam woolly adelgid. Lodgepole pine stands characteristically develop outbreaks of mountain pine beetle particularly in stands greater than 80 years old, with an average tree diameter greater than 8 inches DBH and densities over 100 sq. ft. of basal area per acre (Gibson et al. 2009). Roughly 46% of the cold forest that has lodgepole pine cover is at risk to mountain pine beetle mortality.

Forest Structure

Early logging on fForest Service lands was focused on removal of commercially valuable stands of old ponderosa pine (Powell 2014). As the drought tolerant/shade intolerant ponderosa pine was harvested, it was replaced in many areas by less drought tolerant more shade tolerant species such as grand fir and Douglas-fir. Historic open, single-storied ponderosa pine stands have converted to multi-storied stands. As stand densities increased and species compositions and forest structures were altered, the frequency and intensity of insect outbreaks and vulnerability to wildfire increased.

Table 17. Present and historical conditions of forest vegetation types in Sheep and Chicken Creek watersheds (HUC 12)

PVG	Existing Acres	% of PVG	Historical Range %
Old Forest Multi Stratum (OFMS)			
moist upland	1191	19%	15-20%
dry upland	1119	14%	1-15%
cold upland	2422	17%	10-25%
Old Forest Single Stratum (OFSS)			
moist upland	0	0%	10-20%
dry upland	0	0%	40-65%
cold upland	1	<1%	5-20%
Understory Reinitiation (UR)			
moist upland	2755	45%	15-25%
dry upland	4085	50%	0-5%
cold upland	8106	57%	10-25%
Stem Exclusion (SE)			
moist upland	1,941	32%	20-30%
dry upland	2727	33%	10-20%
cold upland	3233	23%	15-30%
Stand Initiation (SI)			
moist upland	268	4%	20-30%
dry upland	283	3%	15-30%
cold upland	431	3%	20-45%

OFMS

Many age classes and vegetation layers compose this structural stage containing large and old trees. Snags and decayed fallen trees may also be present, leaving a discontinuous overstory canopy. Old forest multi strata (OFMS) forest structure is within HRV for all PVGs. Moist Upland Forest is at 19% of the area (HRV 15-20%), Dry Upland Forest is at 14% of the area (HRV 1-15%) and Cold upland forest is at 17% of the area (HRV 10-25%). In general, for all plant vegetation groups within the project area, the amount of late and old multi-strata structure across the landscape is within HRV. Directional climate change is expected to bring more frequent and intense disturbances in the future to these forests, rendering their current condition at elevatedrisk for mortality from natural disturbances.

OFSS

Old forest single strata (OFSS) structure is deficient across the landscape. This structure type is below HRV for all PVG's; moist upland forest covers 1% of the area (HRV 10-20%), dry upland forest covers less than 1% of the area (HRV 40-65%), cold upland forest covers less than 1% of the area (HRV 5-20%). . OFSS forest structure is dependent on frequent low intensity fire disturbance. Since fire has not entered most of the project area in the last 100 years, there has been no mechanism to create or maintain this structure. Past harvest has also contributed to this loss of structure with past overstory harvests removing most of the late and old individuals from the stand.

UR, SE and SI

In the absence of disturbances, successional pathways from stand initiation to old forest would continue. Tree growth would slow in areas of high stocking and forest structure would continue to be outside of HRV favoring multi-storied conditions.

Understory reinitiation forest structural stage is overrepresented across all PVGs; moist upland forest covers 45% of the area (HRV 10-20%), dry upland forest covers 50% of the area (HRV 0-5%), cold upland forest covers 57% of the area (HRV 15-25%). Lack of fire disturbance has allowed forest stands to develop closed canopies, transforming vertical forest structure from one high canopy layer to multiple canopy layers in the understory . This arrangement creates ladder fuels that increase the probability for ground fire to transition into crown fire (Powell 2019). As such, these stands are considered at high risk of fire related mortality.

Stem exclusion is overrepresented across dry upland forest (33%, HRV 10-20%) and moist (32%, HRV 20-30%), and within HRV for cold (23%, HRV 15-30%). Many of these stands originated from previous harvest activities, regenerated naturally, and have grown without intervention. These stands currently experience intertree competition decreasing the overall growth and vigor of trees, and inherently increases their susceptibility to disturbance agents. Past management has left less desirable species (namely lodgepole pine and grand fir) dominating the composition of the stand.

Stand initiation (SI) is below HRV across all PVGs. SI is created and maintained by disturbance agents such as insects, disease and severe wildfire (Powell 2019). Regeneration harvest may also create this structure type, however minimal regeneration harvest has occurred in the project areas since the mid 1990's (see specialist report). Climate change is expected to increase the area effected by severe fire and extensive outbreaks of insects and diseases (Halofsky & Peterson 2017). These disturbances may create large areas of SI conditions very quickly, as was realized in the firestorm that swept across western Oregon in September 2020 (Urness 2020).

Insect and Disease Susceptibility

Table 18. Range of variation information for insect and disease susceptibility, expressed as percentages by agent and potential vegetation group.

Plant Vegetation Group	Insect and Disease Agents	Susceptibility Rating- % of Forest Area					
		Low		moderate		High	
		Existing	RV Range	Existing	RV Range	Existing	RV Range
Cold Upland forest (UF)	Defoliators	28%	40-95 ↓	24%	15-25	48%	5-10 ↑
	Douglas-fir Beetle		45-95 ↓		10-25		5-10 ↑
	Fir Engraver		35-75 ↓		20-45		5-10 ↑
	Bark Beetles in P Pine		55-95 ↓		5-30		0-5 ↑
	Mistletoes		50-100 ↓		40-80 ↓		30-70
	Root Disease		30-65↓		20-45		10-15 ↑
Moist Upland forest (UF)	Defoliators	48%	5-20 ↓	22%	20-30 ↑	30%	35-80 ↓
	Douglas-fir Beetle		30-60 ↓		20-40 ↑		10-30↑
	Fir Engraver		30-70 ↓		10-20 ↑		20-40
	Bark Beetles in P Pine		30-65 ↓		15-30 ↑		15-35
	Mistletoes		85-100 ↓		35-85		50-90 ↓
	Root Disease		5-25		20-40 ↑		35-65
Dry Upland forest (UF)	Defoliators	30%	40-85 ↓	34%	15-30 ↑	36%	5-15 ↑
	Douglas-fir Beetle		35-75 ↓		15-30 ↑		10-25↑
	Fir Engraver		45-95 ↓		10-25 ↑		5-10 ↑
	Bark Beetles in P Pine		35-75 ↓		15-35		10-20 ↑
	Mistletoes		85-100 ↓		15-65		20-35 ↑
	Root Disease		35-75 ↓		20-35		5-20 ↑

↓ less than RV; ↑ greater than RV

High, Moderate and Low Susceptibility Ratings

Current composition, structure, and stand density across all upland forest reflects excessive amount of dense, multi-layered canopy stands, with a high proportion of host tree speciesfacing greater competition for soil moisture and nutrients. This increases upland forest insect or disease susceptibility. To provide a process for evaluating insect and disease susceptibility, range of variation information was developed for insect and disease agents, and three classes of susceptibility (high, moderate, low)stratified by potential vegetation group (Powell 2019). There is an excessive amount (above HRV) of the project area, throughout all upland forest types, considered highly susceptible or moderately susceptible to defoliators, beetles, mistletoe and root disease. In turn, there is a deficiency across all PVG's for stands that exhibit high resilience and resistant characteristics (low susceptibility rating) to these disturbance agents.

Characteristic levels of insect and disease activity consistent with the range of variability would contribute to diverse landscape conditions and provide important wildlife habitat components. The no action alternative would leave 72 % of cold upland forest, 52% of moist upland forest and 70% of dry upland forest within the project area at an elevated risk to disturbance agents. These conditions indicate that a large percentage of the project area is at risk to high levels of mortality.

Alternative 2

Summary: Alternative 2 proposes to implement activities across approximately 12,785 acres in the Sheep Creek Project Area to meet the purpose and need. Silviculture treatments would provide a diversity of forest structures more consistent with desired conditions, and more resilient to anticipated future environmental conditions. Forest thinning prescriptions would follow a practical, science-based approach intended to restore characteristic functionality, resistance and resilience to disturbance consistent with conditions developed over the long term under natural processes (Powell 2019).

Thinning and mechanical fuel treatments would encourage the development of large tree structural characteristics, understory plant diversity, forage productivity, and resilience to disturbances such as wildfire. Thinning younger trees across areas that are recovering from a stand replacement disturbance may encourage the development of spatial heterogeneity and increase the proportion of early seral tree species. Silvicultural treatments would retain and protect large trees of early seral species and trees with old growth physical characteristics consistent with historical reference conditions. All action alternatives would aim to foster the re-introduction of planned and unplanned fire where ecologically beneficial.

In places where legacies of historic forest patterns are absent (e.g., young, post-fire or regenerated harvest forest areas), information from neighboring similar habitats is used to recreate historical forest patterns by developing spatial heterogeneity and increasing the proportion of early seral species. .

Regeneration of openings resulting from the thinning and regeneration treatments (HPO, HIM and HSH treatments) would generally rely on natural regeneration of conifer species. If monitoring indicates lack of desired regeneration, inter-planting may occur (including white pine blister rust resistant stock) to ensure tdesired post treatment stocking and species mix is attained. Prescribed burning would reduce fuel loads, increase understory productivity and diversity, allow fire to perform its natural ecological role, and reduce uncharacteristic disturbance from wildfire, insects, and disease. To restore insect and disease-related disturbance regimes in the project area, and move toward desired conditions, forest densities and species composition must be strategically restored in appropriate locations. Tools available to reduce uncharacteristic insect and disease disturbance include: thinning toward more natural forest structures, and the legally, ecologically, and socially appropriate use of planned and unplanned fire.

Tree Class Density

Treated areas are estimated to remain within their post treatment density classes for a period of 15-20 years or longer depending on site potential and climate.

Overall, alternative 2 would move or maintain all density classes within or closer to the HRV for each PVG. Alternative 2 adopts the approach to create more area in lower stand density classes than historically expected to address:

Article I. Current estimations of stand density commonly exceed the lower limit of the self-thinning zone resulting in elevated moisture stress induced by competition.
Article II. Existing vegetation has suffered additional moisture stress induced by protracted drought in recent years.
Article III. Competition and drought induced moisture stress have predisposed grand fir and lodgepole pine to elevated risk of mortality caused by fir engraver, *Scolytus ventralis*, and mountain pine beetle, *Dendroctonus ponderosae*, respectively.

Article IV. Greater duration of water deficit and greater extremes in both temperature and precipitation during the period of water deficit are expected in the coming decades. Consequently, water supply capacity of these sites is expected to diminish further.

Article V. Reducing current moisture demand to a level consistent with the water supply capacity of the site will help to mitigate competition induced moisture stress, moisture stress caused by infrequent periods of drought and predicted climatic conditions for the coming decades.

Article VI. Thinning trees to the lower limit of full site occupancy (Long,1985) and maintaining stand density below the zone of imminent competition mortality (Long 1985) will improve vigor of the leave trees and promote resilience and resistance to mortality agents and defoliators.

Article VII. Johnson (2016) shows that more productive forest stands (generally moist sites) experience greater relative change than dry forest with moisture availability and lack of disturbance (fire). Having more area in low or moderate stand density class is expected to benefit the landscape resiliency especially in the face of changing climate.

Table 19. Historical, current, and alternative conditions of stand density class in Sheep and Chicken Creek watersheds (HUC 12) for Dry, Cold and Moist Upland forest as expressed as percentages by potential vegetation group.

Stand Density Class (Expressed as basal area, in ft2/acre at 10" QMD)	Potential Vegetation Group Range of Variation (Percentage)			Current Conditions Range of Variation (Percentage)						Alt 2						Alt 3					
				Dry UF		Moist UF		Cold UF		Dry UF		Moist UF		Cold UF		Dry UF		Moist UF		Cold UF	
	Dry	Moist	Cold	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%
Low (dry: <55; moist: <100; cold: <80)	40-85	20-40	15-35	2475	30	2961	48	3985	28	3792	46	3810	62	5224	37	3289	40	3179	52	4286	30
Moderate (dry:55-85; moist:100-150; cold: 80-120)	15-30	25-60	20-40	2768	34	1343	22	3356	24	2792	34	998	16	4319	30	2815	34	1430	23	3988	28
High (dry:>85; moist: >150; cold: >120)	1-15	15-30	25-60	2971	36	1851	30	6851	48	1630	20	1347	22	4649	33	2110	26	1546	25	5918	42

Cold Upland Forest

High Density: Alternative 2 would reduce 2,202 acres of high density Cold Upland Forest into moderate or low-density classes, resulting in 33% (4,649 acres) of cold forest remaining in high density classesconsistent with the HRV of 25-60%. Existing vegetation in this density class has suffered additional moisture stress induced by protracted drought in recent years, predisposing host species such as lodgepole pine to elevated risk of mortality caused by mountain pine beetle, *Dendroctonus ponderosae*.

Moderate Density: Treatment will maintain area within the moderate stand density class or reduce down into the low density class, resulting in 30% of cold forest (3,988 acres) remaining moderate density consistent with HRV (20-40%).

Low Density: Low density cold forest area is maintained or expected to increase via treatment that reduces high and moderate stand densities into the low-density class. Currently, 28% of the total area (3,985 acres) is within low density class and alternative 2 will increase this area to 37% (5224), HRV 15-35%). Having slightly more area in lower density class will help address more frequent and intense disturbances expected with climate change (Halofsky and Peterson 2017).

Moist Upland Forest

High Density: Alternative 2 would reduce 504 acres of high density Moist Upland Forest into moderate or low density classes, resulting in 22% or 1,347 acres of high density consistent with HRV (15-30%).

Moderate Density: Treatment will maintain area within the moderate stand density class or reduce down into the low density class, resulting in 16% (988 acres) slightly below HRV (20-40%).

Low Density: Alternative 2 increases low density moist forest from 48% of the total area (2,961 acres) to 62% of the area (3,810 acres). Johnson (2016) explains that moister and more productive forest stands have experienced greater relative change compared to dry upland forest, due to moisture availability and lack of disturbance (fire). Furthermore, directional climate change will likely impose moisture constraints historically experienced by drier sites on cold and moist upland forest. These principals support creation and maintenance of larger areas within low to moderate stand density class to build resiliency to future disturbances.

Dry Upland Forest

High Density: Alternative 2 would reduce 1,341 acres within high density class to the moderate or low density classes. This results in 20% (1,630 acres) of dry forest in high density classes for Alternative 2 well over HRV (1-15%). This area is at the highest risk to disturbance agents and high intensity fire. Follow up treatment such as additional harvest entries or prescribe fire will be necessary to help reduce this area to the desired level.

Moderate Density: Currently there is 2768 acres or 34% of the area within the moderate stand density class. Alternative 2 treatments would result in 34 % (2,792 acres) and exceed HRV (15-30%). Without treatment this area would grow into the high density class in the next 10-20 years,

expanding the overly abundant amount of area in high density class above HRV.

Low Density: Alternative 2 reduces acres within the high and moderate stand density classes to the low density class, resulting in 46% (3,792 acres) of low density stands within the project area. Both alternatives would increase acres of low stand density class within HRV (40-85%). These stands are more resilient to disturbance agents because intertree competition is not occurring within the stand, promoting individual tree vigor, and increasing a trees ability to defend itself against disturbance agents.

Composition

In general, alternative 2 would maintain disease free existing early seral species where they exist in each upland forest type and create condition conducive to early seral species establishment where they are currently lacking. Alternative 2 adopts the approach to create more area with early seral species than what was historically expected to help restore resilience. Favoring species employing a fire resister adaptation to frequent low to moderate fire intensity will further reduce risk to mortality agents under the climate conditions expected in the coming decades. Restoring species composition towards HRV can at times require removing larger, younger (less than 150 years old) shade-tolerant species to favor shade-intolerant species. Post-harvest prescribed burning of these stands would play an important role in maintaining appropriate species compositions.

Table 20. Historical, current, and alternative conditions of cover types in Sheep and Chicken Creek watersheds (HUC 12) for Dry, Cold and Moist Upland forest as expressed as percentages by potential vegetation group.

			No Action		Alternative 2		Alternative 3	
PVG	**Cover Type**	**HRV %**	**Pre-Implementation**		**Post**		**Post**	
			Acres	**%**	**Acres**	**%**	**Acres**	**%**
Moist PVG	Grand Fir, Subalpine Fir and Engelmann Spruce	(15-30%,1-10%) **16-40%**	4,672	75	2,065	33	3,572	57
	Lodgepole Pine	25-45%	1,308	21	864	14	1056	17
	Western Larch, Ponderosa Pine, Douglas-Fir	(10-30%, 5-15%, 15-30%) **30%-75%**	237	4	3,287	53	1,589	26
Dry PVG	Grand Fir, Subalpine Fir and Engelmann Spruce	(1-10%, 0%) **1-10%**	6,818	83	4028	49	4508	55
	Lodgepole Pine	0%	36	<1	0	0	0	0

	Western Larch, Ponderosa Pine, Douglas-Fir	(1-10%, 50-80%, 5-20%) **56%-100%**	1360	17	4187	51	3707	45
Cold PVG	Grand Fir, Subalpine Fir and Engelmann Spruce	(5-15% 15-35%) **20-50%**	7,599	54	5825	33	6053	43
	Lodgepole Pine	25-45%	6,593	46	3665	26	5108	36
	Western Larch, Ponderosa Pine, Douglas-Fir	(5-15%, 5-15%, 0-5%) **10-35%**	<1	<1	5825	41	3031	21

Cold Upland Forest

Alternative 2 would treat 1,774 acres of late seral dominant stands and 2,928 acres of lodgepole dominant stands to promote deficient early seral species within cold upland forests. Treatments would result in 33% (5,825 acres) of the area in late seral species cover type (within HRV 20-50%), and 26% (3,665 acres) of the area in lodgepole pine cover type (within HRV 25-45%), and 41% (5,825 acres) of the area in early seral species (over HRV 10-35%). Climate change is expected to diminish the water supply capacity of this upland forest type along with Moist upland forest; favoring early seral species will make these forest types less susceptible to uncharacteristic wildfire and lower the risk from uncharacteristic insect and disease infestations and epidemics (Powell 2014; Johnston 2017).

Moist Upland Forest

Alternative 2 converts 2,607 acres of late seral cover type and 444 acres of lodgepole pine cover type into early seral cover type; reducing late seral species cover to 33% (2,065 acres) of moist upland forest (within HRV 16-40%). Lodgepole pine cover types would be reduced to 14% (864 acres) of moist forest (below HRV 25-45%). This would result in 53% (3,287 acres) of the area with early seral cover (within HRV 30-75%). Lodgepole pine is a short-lived species (Powell, 2014) and is less resilient to disturbances such as fire or drought than ponderosa pine or western larch. These early seral species, are long lived and can regenerate and persist in patches (Schaedel et al. 2017, Johnson 2017). Moving stands below HRV in lodgepole cover type to increase early seral HRV would help build stand and landscape resilience. Post-harvest prescribed burning of these stands would play an important role in early seral maintenance.

Dry Upland Forest

Alternative 2 would convert 2,790 acres from late seral species cover type and 36 acres of the lodgepole cover types to establish and maintain the early seral species within the PVG. Treatments would reduce late seral cover to 49% (4,028 acres) which is still over HRV 1-10%, and 0% of the area in lodgepole pine cover type (within HRV 0%). Early seral cover type would increase to 51 % (4,187 acres) of dry forest in the project area (under HRV 56-100%). Management area restrictions, wildlife protection and terrain limits the amount of dry upland forest that can be restored

into the desired condition containing early seral species.

Forest Structure

Table 21. Historical, current, and alternative conditions of forest structures in Sheep and Chicken Creek watersheds (HUC 12) for Dry, Cold and Moist Upland forest as expressed as percentages by potential vegetation group.

Present and historical conditions of forest vegetation types in Sheep and Chicken Creek watersheds (HUC 12)							
	HRV	Current Conditions		Alt 2		Alt 3	
PVG	Historical Range %	Existing Acres	% of PVG	Existing Acres	% of PVG	Existing Acres	% of PVG
Old Forest Multi Stratum (OFMS)							
moist upland	15-20%	1191	19%	1046	17	1191	19
dry upland	1-15%	1119	14%	830	10	1119	14
cold upland	10-25%	2422	17%	2222	16	2422	17
Old Forest Single Stratum (OFSS)							
moist upland	10-20%	0	0%	145	2	0	0
dry upland	40-65%	0	0%	289	4	0	0
cold upland	5-20%	1	<1%	200	1	1	0
Understory Reinitiation (UR)							
moist upland	15-25%	2755	45%	3547	58	3065	49
dry upland	0-5%	4085	50%	4901	60	4974	61
cold upland	10-25%	8106	57%	9710	68	9164	65
Stem Exclusion (SE)							

moist upland	20-30%	1,941	32%	1031	17	1602	26
dry upland	10-20%	2727	33%	1833	22	1833	22
cold upland	15-30%	3233	23%	1464	10	2226	16
Stand Initiation (SI)							
moist upland	20-30%	268	4%	386	6	297	5
dry upland	15-30%	283	3%	361	4	288	4
cold upland	20-45%	431	3%	597	4	380	3

Old Forest Multi-Strata

. Old forest multi-strata structures are will within HRV under all alternatives. Action alternatives will reduce the amount of OFMS due to treatment of OFMS to restore highly deficient levels of old forest single-strata (OFSS). Alternative 2 reduces 634 acres of OFMS stands for direct conversion to OFSS stands in upland forest across the planning area.

Article VIII. Cold: OFMS would be reduced by 1% (200 acres) for a total of 16% cold OFMS (within HRV 10-25%)

Article IX. Moist: OFMS would be reduced by 2% (145 acres) for a total of 17% moist OFMS (within HRV 15-20%)

Article X. Dry: OFMS would be reduced by 4% (289 acres) for a total of 10% dry OFMS (within HRV 1-15%).

Maintaining functioning OFMS stands across all upland forest types is important for providing quality habitat for a variety of wildlife species (Franklin et al. 2013a) and is why alternative 2 does not restore more OFMS into OFSS.

Old Forest Single-Strata

OFSS is severely deficient or nonexistent across the landscape and is concerning because this structure type is the most resilient to fire disturbance regimes typical for ponderosa pine dominated stands; which climate change is predicted to also impose similar regimes for dry and mixed conifer stands (Johnson 2017, Halofsky & Peterson 2017) The most direct method to restore OFSS is to convert OFMS stands to OFSS by removing the suppressed, intermediate, and some co-dominant trees. This maintains late and old structure in the overstory and removes potential ladder fuels that threatens moving fire from the ground level into the canopy. Additionally, thinning stands currently in the understory re-initiation (UR) or stem exclusion (SE) forest structure stage reduces competition and accelerates diameter growth of residual trees accelerating development into late and old structure (Cochran & Seidel 1999; Cochran & Dahms 1998; Powell 2014). A selected number of stands currently in the UR structure stage will likely grow (acquire the minimum number of trees > 21” diameter at breast height to meet interim Region 6 old growth definition) into late

and old structure in the next 10-20 years after treatments with OFSS objective (HTH-OFSS, HIM-OFSS).

Alternative 2 treats 893 acres of upland forest stands in the UR structure stage- 459 acres occurring in dry, 156 acres occurring in moist and 277 acres occurring in cold. After treatment, prescribed fire will be key in maintaining the OFSS structure. It is estimated that over the next 10- 20 years Alternative 2 would develop or restore 1526 acres of OFSS structural conditions. Dry Upland Forest would contain 748 acres or 9% its total area (HRV 40-65%), Moist Upland Forest would contain 301 acres or 5% of its total area (HRV 10-20%), and Cold Upland Forest would contain 477 acres or 3% of its total area (HRV 5-20%) in the OFSS condition.

The projected outcomes of alternative 2 illustrates the time necessary to develop late and old structure within the project area. Although treatment included in alternative 2 is a necessary step towards achieving our desired condition, post-harvest prescribed burning and additional treatment entries of these stands is critical in maintaining and developing more area into OFSS over time.

Understory Reinitiation and Stem Exclusion

Understory re-initiation forest structure stage across all PVGs is over represented (above HRV) across all PVGs. Stem exclusion is overrepresented across Dry and Moist Upland Forest, and within HRV for Cold Upland Forest. This is largely a consequence of the past timber harvest, fire suppression and grazing. Alternative 2 will largely focus on developing UR and SE stands towards late and old structure. Commercial and noncommercial treatment in stands that are in the UR structure stage lack a large diameter tree component, require periodic (roughly every 20 years) prescribe fire, and additional treatment entries to maintain development into OFSS.

Stands in SE structure stage that are proposed for treatment, would convert to URdue to anticipated establishment of an understory age class with reduced stand density. Openings, resulting from treatments, will develoop an understory cohort over the next 10-20 years. For this reason, the proposed stands in the SE structural stage will shift into UR. Alternative 2 treats 9696 acres in the UR or SE forest structural stage, 1465 acres commercially and 8231 acres noncommercially, across all PVGs.

Stand Initiation

Stand initiation (SI) forest structure is below HRV across all PVGs, because of the lack of any regeneration timber harvest, none ocurring since the mid 1990’s and fire suppression. This has limited the creation of early seral stand conditions. Disturbance agents such as insects, disease and severe wildfire are key contributors for creating and maintaining SI (Powell 2019) . Considering climate change is expected to increase the area effected by severe fire and extensive outbreaks of insects and diseases in the coming decades (Halofsky & Peterson 2017), these disturbances may create large areas of SI conditions very quickly. As wasrealized in the firestorm that swept across western Oregon in September 2020 (Urness 2020). Knowing that the consequences from past management has altered current forest conditions within the project area towards a non-resilient state against high intensity/ mortality disturbances. This presents a foreseeable risk that a disturbance could swifty enter the project area and drastically move a large amount of the upland forest, transitioning it into the stand initiation structural type (Halofsky & Peterson 2017). This project considers how directional climate change is projecting more frequent and intense disturbances, and so is limiting the creation of stand

initiation structures to areas where disease presence is impacting stand development and early seral species are present(Johnson 2017).

Utilizing this approach, Alternative 2 HPO, HBT ENHANCE and HSH treatments would create a total of 361 acres in the SI structural stage with 78 acres in Dry, 118 acres in Moist and 166 acres in Cold Upland Forest. This alternative does not substantially move any PVG towards HRV in terms of area within the SI forest structure. These treatments focus on opportunities to enhance regeneration of early seral species and address areas of root disease.

Insect and Disease Susceptibility

Table 22. Historical, current, and alternative conditions of forest susceptibility rating in Sheep and Chicken Creek watersheds (HUC 12) for Dry, Cold and Moist Upland forest as expressed as percentages by potential vegetation group.

Plant Vegetation Group	Agent	Susceptibility Rating- % of Forest Area											
		Low				Moderate				High			
		RV Range	Existing	Alt. 2	Alt. 3	RV Range	Existing	Alt. 2	Alt. 3	RV Range	Existing	Alt. 2	Alt. 3
Cold Upland forest (UF)	Defoliators	40-95	28%	37%	30%	15-25	24%	30%	28%	5-10	48%	33%	42%
	Douglas-fir Beetle	45-95				10-25				5-10			
	Fir Engraver	35-75				20-45				5-10			
	Bark Beetles in P Pine	55-95				5-30				0-5			
	Mistletoes	50-100				40-80				30-70			
	Root Disease	30-65				20-45				10-15			
Moist Upland forest (UF)	Defoliators	5-20	48%	62%	52%	20-30	22%	16%	23%	35-80	30%	22%	25%
	Douglas-fir Beetle	30-60				20-40				10-30			
	Fir Engraver	30-70				10-20				20-40			
	Bark Beetles in P Pine	30-65				15-30				15-35			
	Mistletoes	85-100				35-85				50-90			
	Root Disease	5-25				20-40				35-65			
Dry Upland	Defoliators	40-85	30%	46%	40%	15-30	34%	34%	34%	5-15	36%	52%	26%
	Douglas-fir Beetle	35-75				15-30				10-25			

forest (UF)	Fir Engraver	45-95				10-25				5-10			
	Bark Beetles in P Pine	35-75				15-35				10-20			
	Mistletoes	85-100				15-65				20-35			
	Root Disease	35-75				20-35				5-20			

High, Moderate and Low Susceptibility Ratings

Alternative 2 aims to reduce the amount of upland forest at an elevated risk to disturbance agents. This acceptable risk is represented in the historical range of variation. Once coniferous species respond physiologically to thinning (typically by 3 to 5 years after thinning, when crowns and roots have expanded into growing space liberated by the thinning), their improved vigor promotes increased production of defensive chemicals and resins enhancing beetle resistance. Alternative 2 would reduce susceptibility risk by 9% for cold upland forest, 14 % for moist upland forest, and by 16% in dry upland forest from high or moderate susceptible rating to low susceptibility rating. With completion of alternative 2, the amount of area of cold upland forest would still be below recommended levels of low susceptibility (37%), while the amount of area of moist (62%) and dry forest (46%) would move closer to recommended levels.

Alternative 3

Summary: The proposed vegetation treatments in Alternative 3 would have similar effects to alternative 2. The deferral of 4,465 treatment acres in cold and moist upland forest treatments as well as late and old forest (OFMS) would reduce the resilience and resistance to mortality agents, defoliators, and wildfire.

Tree Class Density

Alternative 3 leaves more a forest area then alternative 2 in its current condition which has low resiliency and is not at, nor likely to reach the landscape desired conditions.

Cold Upland Forest

High density Class: Alternative 3 would move 993 acres of high-density cold forest into moderate or low-density classes. This would result in 42% (5,918 acres) of the area remaining in the high-density class and is within HRV (25-60). In this density class, this forest type is at risk to high levels of mortality within the stand due to the amount of competition occurring. Furthermore, high density classes are not conducive to regenerating early seral species.

Moderate density Class: Alternative 3 would maintain stands in the moderate density class or reduce density in the high-density class, resulting in 3,988 acres or 28% of the project area and is within HRV (20-40%). This is less area than alternative 2 (30%) because thinning intensities from alternative 2 are greater than alternative 3 resulting in treatment units moving into the low-density class instead of the moderate density class.

Low Density Class: Alternative 3 would increase the area within the low density class to 30% (4,286 acres), 7 % less area then alternative two and within HRV (15-35%). Although the amount of area in low density class is within HRV, having more area may be appropriate for the expected conditions and disturbances associated with climate change such as reduced available soil moisture and more frequent fire.

Moist Upland Forest

High Density: Alternative 3 defers treatment in 301 acres of high density moist forest, resulting in 25% (1,546 acres) and is within HRV (15-30%). Having more forest area in the high stand density class presents an increased risk to disturbance agents, especially considering climate change predicted effects of reducing available soil moisture on these sites.

Moderate Density: Alternative 3 results in 23% (1,430 acres) and is below HRV (25-60%). Alternative 2 maintains less area (16%) in the moderate density class as proposed treatment

reduces more area from the high-density class into the moderate density class.

Low Density: Alternative 3 would result in 51% (3,179 acres) of moist forest in the low-density class and is above HRV (20-40%). Alternative 2 would reduce more acres (631) from both high and moderate stand density classes into the low density class compared to Alternative 3. Stands with low density may be appropriate given directional climate change will likely imposemoisture restriction in these forest types (Johnson 2017).

Dry Upland Forest

High Density: Alternative 3 would reduce density in 861 acres of upland forest in the high density class, resulting 2110 acres or 26% of the area, compared to alternative 2 with 20% (1630 acres). Both alternatives result in a reduction from the current condition (36%) but would remain over HRV (1-15%). Alternative 3 has more area in this class because late and old dry forest are not treated in this alternative. Climate change is expected to decrease the amount of water availability on these sites which will increase the intensity of competition across the stand and contribute to their vulnerability to disturbance agents and wildfire.

Moderate Density: Alternative 3 treatment results in 34% (2,815 acres) in the moderate stand density class, which is similar to Alternative 2 (34%, 2,792). Both Alternatives would exceed HRV (15-30%). Without treatment this area would likely grow into the high density class in the next 20 years, expanding the overly abundant amount of area in high density class above HRV.

Low Density: Alternative 3 would result in 40% of the project area (3,289 acres) in low density stands 6% less than alternative 2. Both alternatives would increase acres within the low stand density class to conditions within HRV (40-85%). Moisture currently is limited across these sites and is expected to intensify with directional climate change (Powell 2014). Stands not experiencing intertree competition have the best chance of maintaining vigor and decreasing the risk to mortality agents.

Composition

Cold upland forest

Alternative 3 would treat 1,546 acres of late seral species cover and 1,485 acres of lodgepole pine cover to promote early seral species. Late seral species cover types would be reduced to 43% (6,053 acres) and is within HRV (20-50%); lodgepole pine cover types would cover 5,108 acres or 36% and within HRV (25-45%); and early seral cover would increase to 21% (3,031 acres) and is within HRV (10-35%).

Moist Upland Forest

Alternative 3 would convert 1,100 acres of late seral species cover and 252 acres of lodgepole pine cover into early seral cover. Late seral species cover would be reduced to 26% (1,589 acres) and is within HRV (16-40%); lodgepole pine cover would be reduced to 17% (1,056 acres and is below HRV (25-45%); early seral cover would increase to 57% (3,572 acres) in moist forest and within HRV 30-75%). Replacing lodgepole dominant stands with early seral species improves resiliency to moisture limiting conditions (Johnson, 2017) that are likely to increase under a changing climate.

Dry Upland Forest

Alternative 3 treats close to the same proportion of Dry Upland Forest as Alternative 2 with exception to dry upland forest in late and old structure. Alternative 3 would convert 480 acres of

late seral species cover and 36 acres of lodgepole pine cover into early seral cover. Late seral species cover would be reduced to 55% (4508 acres) and is within HRV 16-40%; lodgepole pine cover would be removed as it is not resilient on these sites; early seral cover would increase to 45% of dry upland forest (3,707 acres) and is below HRV 56-100%. Past management has created conditions limiting the establishment or retention of early seral species. Future mechanical treatments and prescribed fire will be necessary to create and maintain dry upland forest area conducive to supporting early seral species.

Forest Structure

Old Forest Multi Strata

Alternative 3 would not reduce OFMS in any PVG.

Old Forest Single Strata

Alternative 3 treats 539 acres of upland forest described as stands in the UR structure stage that will develop into OFSS after treatment in the next 10-20 years. Modelling suggests 10-20 years after implementing Alternative 3, dry upland forest would occupy 326 acres or 4% well below desired HRV (40-65%), Moist Upland Forest would contain 116 acres or 2% HRV (10-20%), and Cold Upland Forest would contain 97 acres or 1% HRV (5-20%). Clearly, this forest structure type is limited across the landscape and will require additional mechanical, hand, and prescribe fire treatments to reach desired conditions.

Understory Reinitiation and Stem Exclusion

Alternative 3 treats 8,302 acres, 769 acres commercially and 7,533 acres noncommercially within these structure types. Treatment increases the acres in UR, and decrease the number of acres in SE, resulting with UR overrepresented in each upland forest compared to HRV: cold forest is over HRV (10-25%) at 9164 acres or 65%, dry forest is over HRV (0-5%) with 4974 acres or 61% and moist forest is over HRV (15-25%) with 3065 acres or 49%. With the exception of the 539 acres that will develop into OFSS in the next 10-20 years, the amount of UR would increase across the area because intermediate treatments, such as improvement harvest will maintain conditions in the UR structural stage. Time along with post treatments such as periodic prescribed fire will help develop these stands into late and old structure.

Implementing Alternative 3 will accelerate development into late and old structure and create openings throughout stands in the SE structural stage creating patches of UR. The number of acres in SE across the upland forest is reduced; cold forest is within HRV (15-30%) with 16 % area or 2226 acres, moist forest is with HRV (20-30%) with 26% area or 1602 acres and dry forest is above HRV (10-20%) with 22% area or 1833 acres. Openings in these stands are expected to regenerate and create a new canopy layer converting into UR.

Stand Initiation

Alternative 3 eliminates HSH treatment and limits HPO treatments to only areas within strategic fuel break objectives. A total of 84 acres of SI are created in Alternative 3, 28 acres in Moist ,51 acres in cold 5 acres in dry forest. As with alternative 2, Alt. 3 does not substantially move any upland forest area towards SI and will remain deficient compared to HRV. These treatments enhance regeneration of early seral species where they are present and address root disease. All upland forest types will lack area within the SI structure with 5% (297 acres) of moist (HRV 20-30%), 288 acres or 4% in dry (HRV 15-30%) and 380 acres or 3% in cold (HRV: 20-45%).

Insect and Disease Susceptibility

High, Moderate and Low Susceptibility Ratings

Alternative 3 will slightly reduce susceptibility risk across upland forest from high or moderate to low with a it aims to reduce 2% risk reduction to cold forest area, 4 % risk reduction for moist forest area, and 10% risk reduction to dry forest area. Alternative 3 would result in the amount of area of cold and dry forest at or below recommended HRV susceptibility risk. The amount of moist forest is mostly within the expected susceptible risk. Having more area in the low susceptibility risk rating than what was historically expected may be appropriate with expected changes in water availability associated with climate change.

Fire and Fuels

Table 23. Fire and fuels indicators and measures

Key Issue: Potential Fire Behavior	
Indicator	**Measure**
Canopy Characteristics	Basal Area Canopy Base Height Crowning Index Torching Index
Fire Behavior Characteristics	Size of fire one hour after ignition (Acres) Fire Rate of Spread Fire flame Length Fire Type
Fire Regime Condition Class	Acres moving toward historic ranges
Fuel Profiles in Defensible Spaces	Acres treated along primary control lines (PCLs), Defensible fuels profile zones (DFPZs) Potential operational delineation (PODs)
Surface Fuels	Levels Moisture (1 and 10 hour fuels) Temperatures
Other Issues	
Large Diameter Trees	Relative measure of large tree benefit from treatment
Air Quality	Smoke Emissions from Prescribed Burning

Alternative 1

This alternative represents existing conditions within the project area and serves as the baseline for analysis of the two action alternatives.

Summary: This alternative does not meet the purpose and need of this project. Fire behavior would not be modified through creation of strategic fuel breaks to support Potential Operational Delineation (PODs)[1] with Primary Control Lines (PCLs)[2] and Defensible Fuels Profile Zones

[1] PODs are areas with boundaries defined by potential control lines (PCL).

[2] PCLs are roads, ridgetops, natural or manmade openings which are not readily ignitable). In PODs can be used to guide choices of where to construct or hold fire line as well as where to conduct burnout operations.

(DFPZs)[3]. Most stands adjacent to private property would readily transmit wildfire from public to private lands in their current condition. Lack of DFPZs would increase firefighter risk and increase the potential for an uncharacteristically large and severe wildfire. Lack of pre-suppression planning and proactive treatments to break up the continuity of fuels compartmentalization (PODs) across the project area would limit wildfire and prescribed fire management options.

The deferral of proposed treatments increases the departure of fire adapted ecosystems from their range of historic conditions. Fire intolerant tree species would continue to increase and be overrepresented in dry forest types promoting surface, ladder and crown fuel conditions allowing fire to easily move vertically from the forest floor into the canopy. These changes in the composition, structure and surface fuels would continue to increase the potential for an uncharacteristic crown fire.

Direct and Indirect Effects

Potential Fire Behavior
Forest stands within the project area were combined into three modeling groups based on Potential Vegetation Group (PVG), surface fuel loadings, crown fuel characteristics, and potential fire behavior. Fuels specialists compiled surface and crown fuel data in representative stands for each of the modeling groups. This data was then extrapolated to all the stands within each of the modeling groups and input into fire behavior models.

- ***Modeling Group 1 Stand Characteristics***: lower elevation/south facing slopes with a mix of Ponderosa Pine and Douglas-fir dominate in the overstory and lodgepole and grand fir dominating in the regeneration layer.

- ***Modeling Group 2 Stand Characteristics****:* mixed conifer stands with an overstory comprised of grand fir, Douglas fir and western larch. Grand fir dominates the regeneration layer.

- ***Modeling Group 3 Stand Characteristics****:* Subalpine fir and lodgepole dominated stands in the higher elevations and cold drainages of the project area. Lodgepole dominates in the understory.

Table 24. Potential Fire Behavior for Alternative 1.

Fire Behavior Characteristics		Modeling Groups		
		1	2	3
Canopy Characteristics	Basal Area	96	172	159
	Canopy Base Heights	1	6	5
	Crowning Index	39	26	40
	Torching Index	0	0	0
Resultant Fire	Rate of Spread (ch/hr)	43	56	40
	Fire Flame Length (ft)	44	60	38

[3] Defensive Fuels Profile Zones (DFPZs) are the treated areas adjacent PCLs. DFPZs disrupt fire progression and or enhance suppression opportunities.

Behavior	Fire size 1 hour after ignition (acres)	76	125	63
	Fire Type	Passive Crown	Passive Crown	Passive Crown

Reference Fire Behavior Appendix for Detailed Information

Without treatment, fire brands from torching trees have a higher probability of crossing fire lines due to low canopy base heights and high surface fuel loads adjacent to control lines.

Fire Regimes and Condition Class

Tables 24-26 describe the elements that make up the fire regime condition class (FRCC)[4], and inform the strategies for returning vegetation to expected pre-European settlement conditions.

Table 25. Fire Regime Groups and Descriptions

Fire Regime Groups and Descriptions				
Fire Regime Group	Vegetation Types	Frequency (Fire Return Interval)	Representative Potential Natural Vegetation Group (PNGV)	Severity
1	All ponderosa pine types; Dry-Douglas fir/ pine grass; and grand fir/pine grass.	0 – 35 years	(PPDF1) Ponderosa pine Douglas-fir Inland Northwest	Low severity
2	True grasslands	0 – 35 yrs.	(MGRA1) Mountain Grassland	Stand replacing, high severity
3	Mixed Conifer	35 – 200+ yrs.	(GFDF) Grand fir – Douglas fir	Mixed severity
4	Lodge pole pine, western larch, spruce	35 – 200+ yrs	(SPFI5) Interior West Lower Subalpine Forest	Stand replacing, high severity
5	Wet meadows, discontinuous grass scabs on ridge tops	Greater than 200 years	(RIPA) Riparian	Mixed severity

This information helps managers determine how stands have changed from historic conditions, which they measure by the FRCC.

Table 26. Fire Regime Condition Classes

Condition Class	Description
1	Represents ecosystems that are still within the historical range.
2	Represents ecosystems which been moderately altered from the historical range
3	Represents ecosystems with have been substantially altered from the historical range.

[4] FRCC is a measure of the degree of departure from the natural fire regime.

The FRCC departure can change one or more of the following ecological components: vegetation (species composition, structural stages, stand age, canopy cover and mosaic pattern across the landscape); fuel composition; fire frequency, severity, and pattern.

Table 27. Fire Regimes Across the Sheep Creek Project Area

Condition Class	Fire Regime				% of project area
	1	**2**	**3**	**4**	
1	3082	82	7752	1304	**41**
2	1772	0	11557	324	**46**
3	2982	175	182	189	**12**
% project area	26	1	66	6	

The departure from historic conditions would continue to grow. This departure elevates the risk of high intensity and high severity wildfire damaging soil, vegetation, and watershed. The stand's resilience to future disturbance remains low.

Fuel Profiles in Defensible Spaces

PODs are conceptual boundaries defined by PCL's relevant to fire control operations (e.g. roads, ridgetops, natural or manmade openings which are not readily ignitable).

DFPZs are the treated areas adjacent to PCLs.

Lack of pre-suppression fuels reduction treatments, designed to create DFPZs, limit suppression opportunities. Without the development of PODs surrounded by PCLs fire managers would have limited ability to fully analyze the ecological and environmental tradeoffs of fire line locations prior to an actual fire. As a result, there would be:

- Increased potential for wildfire transmission from public to private lands.
- Reduced suppression options due to lack of functional DFPZs.
- Reduced ability to predictably manage wildfire without DFPZs and PCLs.
- Costs of wildfire suppression continues to increase due to limited pre-suppression planning.
- Reduced fire fighter safety and lack of safe access for suppression resources due to heavy fuel loading adjacent to road systems.

Surface and Crown Fuels

Multi-layered stand structures, tree densities, and live vegetation would continue to grow while surface fuels continue to accumulate in the absence of mechanical treatment or fire. High tree densities would also increase the susceptibility of the stands to insects and disease, resulting in increased surface fuel loading. Crown fire potential would remain high due to the low canopy base heights, high crown fuel loadings and abundant ladder fuels.

Large Diameter Trees

Risk to large diameter trees would continue to increase due to:

- Increased mortality created by high levels of surface fuels that burn at high intensity and damage cambium and shallow roots.
- Increased mortality from crown fire created from dense understory regeneration and ladder fuels underneath or adjacent to large trees.
- Decreased development of large fire tolerant tree species due to competition from overabundant fire intolerant species.
- Continued low crown base heights of the existing large trees allowing for increased risk of mortality from torching.

Air Quality

Alternative 1 would have no direct effects to smoke emissions. Biomass would continue to accumulate, increasing potential for the release of large amounts of emission during wildfire. Wildfires tend to occur at the driest time of the year, fuels are more completely consumed and typically produce three to five times more emissions than early or late season prescribed fires.

Alternative 2

Summary: Alternative 2 addresses the purpose and need by reducing potential fire behavior in strategic locations and maximizing fire management options. PODs with PCLs and DFPZs would be created using a combination of thinning, pruning, mechanical surface fuel reduction treatments and use of fire. The DFPZs constructed adjacent to roads and the associated road maintenance would improve firefighter response times and provide safer egress from a fire. DFPZs would also decrease potential wildfire transfer to private property or the WUI.

The proposed treatments would also meet the purpose and need by moving fire adapted ecosystems in the drier portions of the project area towards their range of historic conditions. Treatments would be designed to increase the percentage of fire tolerant tree species such as ponderosa pine, western larch and Douglas fir. Fire would be reintroduced into the project area, surface fuel loadings would decrease, and the gap in vegetation profiles between historical conditions and current conditions would decrease.

Direct and Indirect Effects

Potential Fire Behavior

The proposed treatments reduce surface, ladder and crown fuels thus reducing potential for uncharacteristic fire behavior.

Table 28. Potential Fire Behavior with Implementation of Alternative 2

Fire Behavior Characteristics	Modeling Groups		
	1	2	3

Canopy Characteristics	Basal Area	60	88	72
	Canopy Base Heights	20	14	6
	Crowning Index	75	51	75
	Torching Index	213	326	124
Resultant Fire Behavior	Rate of Spread (ch/hr)	5	3	3
	Fire Flame Length (ft)	2.4	1.5	1.5
	Fire size 1 hour after ignition (acres)	1	.3	.3
	Fire Type	Surface	Surface	Surface

Reference Fire Behavior Appendix for Detailed Information. Table 24 provides the numerical comparison for Alternative 1.

The effectiveness of the completed treatments would diminish over time. Most of the completed treatments would require some form of maintenance within 15 - 30 years to keep stands within the desired condition. Fire (planned and unplanned) would eventually be the primary maintenance tool for many of the treated stands along with additional mechanical treatments in the future.

Fire Regime Condition Class

Approximately 6,521 acres of treatment are proposed to maintain or improve condition class. Restoring FRCC would provide the following consequences:

- Reduced wildfire intensity decreases the risk of damaging impacts to soil, vegetation, watersheds, and visuals.
- Reduced tree densities and increased percentage of fire tolerant trees species to the HRV increases forest resilience to fire, drought, and disease
- Wildfire use for ecosystem benefits would become a viable option for fire managers as future policy allows.

Fuel Profiles in Defensible Spaces

Approximately 11,887 acres of the project area would have fuels reduction treatments with the following consequences:

- The creation of DFPZs adjacent to PCLs in strategic locations would proactively support suppression operations, increasing the probability of successful containment.
- Creation of functional DFPZs adjacent to the National Forest System (NFS) and private land interface decreases risks to private property.
- Reduction of surface and ladder fuels increases prescribed burning opportunities by reducing risk of escape.
- Road maintenance would improve wildfire initial attack response times and increase firefighter safety by improving access routes.
- Reduced probability that fire brands from torching trees would cross fire lines constructed in DFPZs.

Surface Fuels

Levels: The proposed thinning would create a short-term increase (5-10 tons per acre) in fine fuel loadings (3 inch minus size classes) immediately following activities. Fresh slash ("green" slash with high moisture content) from fuels reduction activities would not substantially increase fire hazard. The slash could cure rapidly and present a short-term (several months) elevated fire hazard in the late summer before fall rains/snows arrive.

Slash requires a curing period for effective consumption during a prescribed burn. Winter snowpack compresses slash (reducing the potential for crown fire), and after a period of drying in the late spring/early summer the fuels are generally ready for prescribed burning. If the fuels reduction treatment takes place within the year following harvest, there is a short term (3 month) period of elevated potential for high intensity wildfire. This risk would be immediately reduced following the completion of prescribed burning. Should the slash reduction be delayed high intensity fire risk remains during the summer months for a two-year period. After two years the fine fuels would no longer be a fire hazard.

Moisture: The proposed thinning treatments are not likely to substantially reduce the shading/sheltering of surface fuels or substantially decrease the small diameter surface fuels moisture levels. Surface fuel moisture differences between thinned and unthinned stands were small and only applicable to large diameter woody fuels in the early season when fuel moisture values are typically high and fire danger is low (Estes, Knapp, Skinner and Uzoh, International Journal of Wildland Fire, 2012, 21, pg 428-435). Faiella and Bailey (2007) found no substantial difference in fuel moisture of 1 hour and 10 hour fuels between unthinned and thinned stands. Any effect from thinning on fuel moisture levels is likely to be greater following precipitation events when fuel moisture levels are high, possibly due to how thinning influences interception of the rain or snow by the canopy. The decreased canopy closure from thinning means that less precipitation is intercepted by the canopy in thinned stands, allowing more rain and snow to reach the forest floor. The long hot and dry summers which occur in eastern Oregon have a much larger effect on fuel moisture than the canopy cover. Fuel moisture differences resulting from the proposed treatments would therefore not be expected to substantially influence fire behavior during times of the highest fire danger.

Wind Speed and Temperatures: Thinning may slightly increase surface wind speeds and the added sunlight may cause local increases to surface fuel temperatures, both of which can potentially influence fire behavior in terms of fire rates of spread. However, any enhancing effect on wind speeds and surface fuels temperatures from thinning would be offset by the reduction in ladder and crown fuels if the surface fuels/slash is adequately treated (Weatherspoon 1996; Agee and Skinner 2005).

Large Diameter Trees

Treatments would protect and enhance the growth of the remaining large fire-resistant trees. Thinning treatments would be designed to leave the largest/healthiest trees on site to provide shading of surface fuels and partial sheltering surface wind speeds (Albini and Baughman, 1979). Large diameter trees would see the following effects from treatment:

- Reduced tree mortality from fewer surface fuels that when burned, can damage tree cambium and shallow roots
- Decreased mortality from crown fire from reduced ladder fuels underneath or adjacent to large trees
- Increased development of large fire tolerant tree species due to reduced competition from fire intolerant species

Air Quality

Smoke Emissions from the proposed prescribed fire treatments in this alternative could create short-term smoke impacts to the public. This would be transient and may last for more than 72

hours per burn event. Prescribed burns would be planned so that factors such as wind direction and air mass stability would help limit the effects of smoke (e.g. smell, eye irritation) on residents, campers, or the general public. In the evenings, the residual smoke would tend to follow the local wind patterns, and flow down slope/down canyon into Vey meadow and into the Grande Ronde River corridor. Experience from past burns in the area has shown that the effects of this smoke can be minimized by controlling length and time of ignition and burning under favorable mixing conditions for smoke dispersion. Residents in the Starkey area would be contacted, and appropriate safety signs and other methods would be used to warn motorists. Fire managers would select areas to burn that optimize natural smoke dispersion and minimize local exposure to adverse smoke impacts. Emission data in the following table was derived from BlueSky Playground.

Table 29. Alternative 2 projected prescribed fire CO2 emissions

Projected Emissions in tons from Prescribed Fire Treatments in Alt 2					
Emission	**Activity Fuels**	**Natural Fuels**	**Grapple Pile**	**Hand Pile**	**Total**
Acres Burned	3385	9521	3946	3829	**20681**
PM10	755	1428	830		
PM2.5	652	1238	712		
CO2	86262	147290	176264		
Green House Gasses (GHG's)	102780	179,661	187708		

Overall, proposed treatments in Alternative 2 would decrease the amount of pollutants generated during a prescribed burn or wildfire. Smaller, less intense fires would produce less smoke and associated greenhouse gas emissions than large scale high severity fires.

Alternative 3

Summary: The proposed fuels treatments in Alternative 3 reduce surface and crown fuels which reduces the probability of a crown fire in treated areas. Deferral of 4,430 acres of treatments would leave areas adjacent PCLs with moderate to high crown fire potential. The deferred acres would not be prepared for use during a large wildfire and would reduce management and suppression options.

Direct and Indirect Effects

Fire Behavior Characteristics

Many of the treatments in Alternative 3 are identical to those in Alternative 2. Treated stands would have the same fire behavior and effects modeled under Alternative 2 (refer to table 28). Stands deferred from treatment under this alternative would have the same fire behavior and effects modeled under Alternative 1 (refer to table 24). The deferral of treatments in critical locations would reduce the effectiveness of strategic fuels breaks. Additionally, the 395 acres of deferred treatment in OFMS leaves areas within the proposed the fuels breaks with a high potential for crown fire.

Fire Regime Condition Class

Approximately 4,885 acres identified for treatment would either restore or maintain the historic condition class. Treated areas would have the same effects as Alternative 2. Untreated areas would have a higher risk for the following:

- Wildfire intensity and severity continue increase in stands that were deferred from treatment. The risk of damaging impacts to soil, vegetation and visuals would be unmitigated.
- Decreased forest resistance to fire, drought, and disease from high tree densities.

Fuel Profiles in Defensible Spaces

There are 7,457 acres of fuels reduction treatments planned in this alternative. Effects differ from Alternative 2 in the following ways:

- The strategic fuels break located on west side of the project area adjacent to the 5160-030 road would only be partially completed. The deferral of treatments (41, 42, 43, 47, 48, 49, 88, 95, 100, 102, 103, 108, 123, 223, 335 and 350) would diminish the effectiveness DFPZs by reducing the opportunities for suppression resources to anchor into preexisting fuels treatments.
- Deferral of treatment units (9, 64, 61, 65, 68, 70, 72, 77, 90, 92, 96, 99, 101, 106, 107, 125, 218, 242, 243, 244, 338 and 367) decreases the width of the fuels break adjacent to Forest Service roads 5182 and 5184. Lack of treatment in these stands increases the probability that fire brands from torching trees would be carried across control lines.
- Lack of a fully completed DFPZs alters and/or delays fire suppression response actions. This delay may lead to increased fire size and suppression cost, and places firefighters at greater risk due to increased exposure.
- Deferral of treatment units (4, 5, 11, 24-29, 31,114, 115, 206, 207, and 361) place the adjacent private property at risk for wildfire transmission from public lands. The lack of a fully implemented DFPZ along private boundary decreases fire suppression opportunities on public land and increases the potential for the loss of resources on private lands.

Surface Fuels Levels, Moisture, and Temperatures

The proposed treatment activities for Alternative 3 would reduce surface fuels characteristics to the desired levels, identical to alternative 2. There is a 4,430 acre decrease in the number of acres of surface fuel reduction treatments under alternative 3. The deferral of these treatment areas would leave areas with high surface and crown fuel loading. These untreated areas have the potential to produce uncharacteristic fire behavior.

Large Diameter Trees

Treatments in this alternative would protect and enhance the growth of the remaining large fire-resistant trees. Thinning treatments would be designed to leave the largest/healthiest trees on site to provide shading of surface fuels and sheltering of surface wind speeds. There are 94 acres of OFMS treatments designed to move stands into OFSS condition in this Alterative. The 395 acres of OFMS deferred from treatment under this alternative would have abundant ladder fuels and a heavy surface fuel loading placing remaining larger diameter trees and old forest stands at risk to an uncharacteristically severe fire.

Air Quality

Emissions generated from prescribed fire under this alternative could create noticeable smoke impacts to local communities and forest visitors, but air quality would remain within the requirements of the Clean Air Act. Prescribed fire managers would need to carefully select areas to be burned that optimize natural smoke dispersion and minimize local exposure to adverse smoke impacts. The following table displays the estimated emission from prescribed fire treatments in Alternative 3.

Table 30. Projected emissions from Alt 3 Prescribed Fire Treatments in tons

Emission	Activity Fuels	Natural Fuels	Grapple Pile	Hand Pile	Total
Acres Burned	1322	9521	3398	2866	17,107
PM10	292	1428	717		
PM2.5	252	1238	614		
CO2	33309	147290	152141		
Green House Gasses (GHG's)	39687	179,661	162019		

Cumulative Effects

Fire Behavior Potential

The proposed treatments within this assessment along with ongoing and proposed treatments on private and adjacent public land would reduce the potential for a large, high intensity wildfire in the Upper Grand Ronde watershed. Suppression resources would have a higher probability of successfully containing a wildfire on public lands. Wildfires would burn with reduce fire intensity at a decreased size and would require less resources for containment allowing resources to be utilized in higher priority areas during times of increased need.

Air Quality

Smoke emissions during the spring and fall months primarily result from prescribed fire activities. Federal land managers in northeast Oregon coordinate and manage the cumulative effects of prescribed burning on public land. Private landowners are required to follow the advice of the Department's smoke management forecaster when burning.

The smoke producing activities proposed in this project combined with all the other smoke generating activities throughout northeast Oregon would generate smoke that may have the potential to affect air quality in the Grande Ronde and Baker valleys. Coordination with ODF Smoke Management prior to burning would be required to ensure air quality objectives under the Clean Air Act are met.

Wildfire is a primary source of unintentional carbon emissions from forests in western United States (Stephens 2005). Other emission concerns include agricultural burning and home heating in local communities. Both wildfires and agricultural burning typically occur mid- to late-summer and are not expected to impact air quality at the time prescribed fire activities are planned. However, home heating with fuel wood and industrial slash pile burning occur in the fall and winter months and would produce additional emissions concurrent with prescribed fire.

Additional Disclosures

Climate Change and Fire

Climate change is expected to alter vegetation structure and composition, terrestrial ecosystem processes, and the delivery of ecosystem services in the Blue Mountains. Climate influences the spatial distribution of major vegetation biomes, abundance of species and communities within biomes, biotic interactions, and geographic ranges of individual species. Climate also influences disturbance processes that shape vegetation structure and composition, which are often the catalysts for vegetation change. However, there is considerable uncertainty in what the actual

effects on vegetation owing to climate change could be (JE Halofsky, DL Peterson, PNW-GTR-939, 2017).

Increased temperatures with climate change would likely lead to increased wildfire area burned (Littell et al. 2010, McKenzie et al. 2004, Westerling et al. 2006). With increasing fire in forested ecosystems, managing vegetation to reduce fire severity and decrease fire patch size could help to protect fire refugia and maintain old trees (Peterson et al. 2011). For example, incorporating openings in silvicultural prescriptions decreases forest density and fuel continuity, which may reduce wildfire severity and protect old trees (Churchill et al. 2013, Stine et al. 2014) (table 6.8a). Management practices that help fire to play a more natural role in ecosystems, such as density management, prescribed fire, and wildland fire use, may also increase ecosystem resilience to wildfire under a changing climate (Peterson et al. 2011, Stephens et al. 2010, Stine et al. 2014).

Ecological disturbance (e.g., fire, insect, and disease outbreaks), which is expected to increase in a warmer climate, would be extremely important in affecting species distribution, tree age, and forest structure, facilitating transitions to new combinations of species and vegetation patterns. Mountain pine beetle may be particularly important in lodgepole and ponderosa pine forests, and western spruce budworm and Douglas-fir tussock moth may also increase periodically. Annual area burned by wildfire is expected to increase substantially, and fire seasons would likely lengthen. In dry forest types where fire has not occurred for several decades, crown fires may result in high tree mortality. In addition, the interaction of multiple disturbances and stressors would create or exacerbate stress complexes. For example, an extended warm and dry period may increase bark beetle activity, which would increase short-term fine fuels. Considerable uncertainty exists about how climate change would affect species distribution, forest productivity, and ecological disturbance in the Blue Mountains. Simulation models provide science-based projections of how a warmer climate could modify the growth environment of species and broad patterns of ecological disturbance, supplemented by studies of the paleoecology of the region. However, because the future climate may differ considerably from what has been observed in the past, it is difficult to project vegetative response accurately for specific locations and time periods.

Greenhouse Gas Emissions

Climate change is a global issue that results from global Greenhouse Gas (GHG) emissions. From a quantitative perspective, there are no dominating sources and fewer sources that would even be close to dominating total GHG emissions. The global climate change issue is the result of numerous and varied sources, each of what might seem to make a relatively small addition to global atmospheric GHG concentrations. The Council on Environmental Quality recommends that environmental documents reflect this global context and be realistic in focusing on ensuring that useful information is provided to decision makers for actions that the agency finds are a significant source of GHGs.

While it is well documented that human activities have added greenhouse gases to the atmosphere, mainly through the burning of fossil fuels and clearing of forests, the activities proposed in this project were designed with adaptation strategies (actions that help ecosystems accommodate changes adaptively) and mitigation strategies (actions that enable ecosystems to reduce anthropogenic influences on global climate, Milar, 2007).

All action alternatives manage the forest ecosystem so that it is better able to accommodate climate change and to respond adaptively as environmental changes accrue. The action

alternatives encourage gradual adaption to a warmer and drier environment by favoring disease and fire resistant trees, reducing stand density, and lowering fuel loadings. This would reduce the potential for catastrophic conversion due to forecasted climate change driven disturbance factors.

Native Plants

Table 31. Native Plant indicators and measures

Indicator	Measure
Documented Sensitive Plant Species	Acres of treatments with sensitive plant populations
Sensitive Plant Habitat Types	Acres of treatments in sensitive habitats

Alternative 1 – No Action

Direct, Indirect, & Cumulative Effects

Impacts to Documented Sensitive Plant Species

There would be no direct effects for the no action alternative for umbrella false morel, Richardson's needlegrass, scalloped moonwort, mountain moonwort, northern twayblade, and whitebark pine in the project area.

Current population viability, trends, habitat conditions and threats to these sensitive species would persist. Under this alternative there would be indirect and enduring negative effects to whitebark pine, Richardson's needlegrass, and moonwort species. For whitebark pine (*Pinus albicaulis*), the absence of the whitebark pine enhancement treatments could decrease habitat because of increased shade and competition from other more fast-growing conifers. Richardson's needlegrass (*Achnatherum richardsonii)*, which appears to favor partial sunlight, would likely continue to be shaded out without thinning treatments aimed at reducing lodgepole pine densities. Moonwort species (*Botrychium spp*.) may experience indirect negative effects because they are often dependent upon frequent disturbance in their habitat. A lack of substantial disturbance, and increased shade from conifers, could reduce the overall potential moonwort habitat in the area in the long-term. Umbrella false morel and northern twayblade are not expected to have any indirect negative effects from this alternative.

Because no management would occur, there would be no effects to add to ongoing or future actions that would contribute cumulative effects for any of the sensitive plant species known from the project area.

In conclusion, Richardson's needlegrass, scalloped moonwort, mountain moonwort, and whitebark pine will potentially have effects from the no action alternative that **may impact individuals or habitat, but will not likely contribute to a trend toward federal listing or cause a loss of viability**. Umbrella false morel and northern twayblade will have **No Impact** from this alternative.

Continued Trends to Suitable Sensitive Plant Habitat Types

Under this alternative there is expected to be no direct or indirect effects to undetected populations of the 18 sensitive species not known from the project area. Any potential impacts to undetected populations are unlikely as these plants have a low likelihood to occur in the analysis

area and would be small; therefore, the cumulative impacts would not increase significantly. **No Impact** is expected from this alternative. However, current trends, and potential threats to sensitive plant habitats, are expected to continue. The anticipated trends to the seven sensitive plant suitable habitat types are summarized below.

Cold and/or Moist Upland Forest

Under the no action alternative, cold and moist upland forests would continue to trend toward landscape reduction of tree diversity, thereby potentially providing less habitat for sensitive plants. Under the no action alternative, forests with less ecological heterogeneity are also more vulnerable to large, high severity fire and insect outbreaks (Stine et al. 2014).

Dry Upland Forest

Under the no action alternative, dry upland forests would see continued fuel loading, potentially resulting in forests less resilient to disturbance (Powell et al. 2007), and therefore potentially able to provide less habitat for sensitive plants. The sensitive species that have the potential to occupy this habitat type are most likely adapted to fire regimes characterized by light, non-stand-replacing fires and might experience damage from large high intensity fires.

Warm Riparian Forest/Shrublands

Under the no action alternative, the quantity and quality of warm riparian forest and shrublands in the project area would either decrease or remain at current levels.

Bunchgrass Meadows, Dry Shrublands, and Lithosols

Under the no action alternative, bunchgrass meadows, dry shrublands, and lithosols are likely to continue to experience encroachment of lodgepole pine and of ponderosa pine (in areas of deeper soil), resulting in decreases of understory native bunchgrasses, and decreased forb composition.

Cliffs and Rock Outcrops

Under the no action alternative, cliffs and rock outcrops would likely see little change over time.

Springs and Seeps & Moist and Wet Meadows

Under the no action alternative, springs and seeps would see little change over time. Wet meadows are likely to continue to experience conifer encroachment. Additionally, restoration work including fencing around wet meadows and planting native broadleaf vegetation would not occur.

Aquatic Habitats, Intermittent and Perennial Streams

Under the no action alternative, aquatic habitats would likely continue to have a lack of shade producing and diversity-enhancing riparian vegetation.

Alternatives 2 and 3

Discussions of the action alternatives are combined because the effects to sensitive plants and their habitats would be similar.

Design Features and Mitigation Measures Common Across Action Alternatives

For a list of design features and mitigation measures that the La Grande Interdisciplinary Team developed to help reach the following determinations see Sheep Creek Vegetation Management Project Management Requirements, Constraints and Mitigation Measures on p. 27-28 of the EA.

Direct and Indirect Effects

Impacts to Documented Sensitive Plant Species

Umbrella false morel (Pseudorhizina californica), scalloped and mountain moonworts (Botrychium crenulatum and B. montanum) and northern twayblade (Listera borealis)

To protect these species, known population locations will be excluded from treatments by implementing a no-disturbance buffer around each site of a size adequate to provide protection from implementation impacts. Known occurrences will be depicted as Areas-to-Protect (ATPs) on implementation maps. Based on the Indicators and Measures that were identified for this analysis, 0% of the known populations of umbrella false morel, scalloped and mountain moonworts, and northern twayblade would be negatively affected by ground disturbance, prescribed fire, changes in light availability, or changes in water availability. However, it is unlikely, but possible that there are undiscovered populations of these species in the project area that could be inadvertently impacted by project activities. Thus, the effect for both action alternatives (2 and 3) for these species is **may impact individuals or habitat, but will not likely contribute to a trend toward federal listing or cause a loss of viability.**

Treatments proposed under both alternatives have the potential to promote habitat conditions suitable for colonization by moonwort (*Botrychium* spp.) spores and the development of new populations where there currently are none. Thus, moonwort species, which require early seral habitats to establish, have the potential to benefit from the implementation of treatments under the action alternatives.

Richardson's needlegrass (Achnatherum richardsonii)

Several large populations of Richardson's needlegrass were discovered in dry upland forests within the project area during 2020 field surveys. This resulted in the development of a series of mitigations to reduce potential impacts from the action alternatives. Both alternatives include 153 acres of Areas-to-Protect (ATPs) from a total of 16 units. ATPs were selected based on the following criteria: (1) highest abundance of Richardson's needlegrass and (2) geographic areas that would provide good seed sources for reestablishing populations outside of ATPs where treatments are proposed to still occur.

Overlapping design criteria from other resource areas, seed collection for reseeding areas with the greatest amount of soil disturbance, and adaptive management (trying prescribed burning in both spring and fall to see which has a more favorable response) will also reduce potential impacts to Richardson's needlegrass. Additionally, monitoring will be incorporated as part of this project because this species is considered very rare in Oregon and little is known about its ecology. The information obtained from monitoring will be used in the adaptive management strategy and to help inform future management decisions.

Table 7 compares the alternatives using the Indicators and Measures identified for this analysis. Following the table, the measures (i.e. ground disturbance, prescribed fire, available light, and available water) are discussed.

Table 32. Resource indicators & measures for assessing effects on Richardson's needlegrass

Analysis Question/Issue	Indicator	Alternative 2	Alternative 3

What are the effects of the proposed activity on the viability of Richardson's needlegrass?	Changes to population resilience from proposed activities	9% of known populations across the Forest with effects from ground disturbance 19% of known populations across the Forest with effects from prescribed fire 10-20% of known populations across the Forest with effects from changes in light availability 0% of known populations across the Forest with effects from changes in water availability	8% of known populations across the Forest with effects from ground disturbance 19% of known populations across the Forest with effects from prescribed fire 10-20% of known populations across the Forest with effects from changes in light availability 0% of known populations across the Forest with effects from changes in water availability

The proposed ground-disturbing treatments have the potential to affect approximately 9% for alternative 2 and 8% for alternative 3 of the Richardson's needlegrass known area of occurrence. For this analysis, population resilience is assumed to be affected when > 20% of a sensitive plant's known area of occurrence would be negatively influenced by project activities. Although there will be individual plants that will be impacted, there will not be a substantial change in population resilience from ground disturbing treatments. Additionally, project design criteria will further reduce impacts to this species by requiring reseeding areas where there has been heavy soil disturbance with a native seed mix. This seed mix will include a component of Richardson's needlegrass seed collected pre-implementation from within the project area.

Prescribed fire has the potential to affect approximately 19% of the Richardson's needlegrass known area of occurrence for either action alternative. Richardson's needlegrass that occurs within proposed fire units are expected to maintain viable populations due to timing of prescribed fires, the species' adaptations to low-intensity fire, and habitat conditions and project design criteria that prevent the intensity of fire necessary to damage populations. Therefore, although some individual plants might be incinerated, there will not be a substantial change in population resilience from prescribed fire.

Project activities would alter light availability for approximately 10-20% of the Richardson's needlegrass known area of occurrence for both action alternatives. This species was observed in highest abundance in areas where there was approximately 20-40% shade cover in mixed conifer forest of predominantly lodgepole pine. Areas where shade cover increased Richardson's needlegrass was most often observed where there were open pockets of sunlight furthest from the surrounding trees. Therefore, the changes in light availability are expected to have a positive impact on population resilience.

Richardson's needlegrass was observed in the project area in dry upland forests. Neither action alternative is expected to substantially change the hydrology in this habitat type. Therefore, project activities will not have a substantial change in population resilience for Richardson's needlegrass as a result of changes in the hydrologic conditions.

Thus, these actions **may impact individuals or habitat, but will not likely contribute to a trend toward federal listing or cause a loss of viability to populations of Richardson's needlegrass**. In the long term, the proposed actions are expected to benefit this species as the treatments will reduce fuel loading, promote landscape diversity, maintain and encourage a more natural disturbance cycle, and provide for more available light to the understory.

Whitebark pine (Pinus albicaulis)

Populations of whitebark pine seedlings and saplings, ranging in height from less than a foot to 15-feet tall, were discovered in subalpine habitat during 2020 field surveys. There were no mature, cone producing whitebark pine located. These findings resulted in the development of the proposed action to include whitebark pine mitigations and restoration activities. These actions include whitebark pine protection areas, hand-thinning of competing conifers, and developing and implementing a plan to plant rust resistant seedlings in priority management units. The whitebark pine protection areas will be identified prior to implementation of any treatments. Within these areas, hand-thinning of competing conifers to help enhance existing whitebark pine individuals will occur but no mechanical equipment will be allowed. Mitigation measures also include that < 20% of whitebark pine's known area of occurrence within the project area will be negatively influenced by project activities.

Table 8 compares the alternatives using the Indicators and Measures that were identified for this analysis. Following the table, the measures (i.e. ground disturbance, prescribed fire, available light, and available water) are discussed separately.

Table 33. Resource indicators & measures for assessing effects on whitebark pine

Analysis Question/Issue	Indicator	Action Alternatives (2 & 3)
What are the effects of the proposed activity on the viability of whitebark pine?	Changes to population resilience from proposed activities*	< 20% of known area of occurrence within the project area effects from ground disturbance < 20% of known area of occurrence within the project area effects from prescribed fire 50-70% of known area of occurrence within the project area with effects from changes in light availability 0% of known area of occurrence within the project area with effects from changes in water availability

With mitigation measures in place, the proposed ground-disturbing treatments would affect less than 20% of whitebark pine's known area of occurrence within the project area for either action alternative. Where the prescription is hand thinning, there will be very limited effects of ground disturbance to whitebark pine because implementation will be designed to protect this species. Individual whitebark pine seedlings, in mechanical treatment units (but outside of the whitebark pine regeneration protection areas) may be impacted. However, there will not be a substantial change in population resilience from the ground disturbing treatments because of the mitigation measures put in place. Additionally, the hand-thinning of competing conifers should enhance the ability of whitebark pine to reach maturity in the project area.

Prescribed fire will affect less than 20% of whitebark pine's known area of occurrence within the project area for either action alternative. Therefore, although individual whitebark pine seedlings might be top killed, there will not be a substantial change in population resilience from prescribed fire. Additionally, whitebark pine that occurs within proposed fire units are expected to maintain viable populations due to design criteria preventing direct ignition in whitebark pine regeneration protection areas and due to the low intensity of the prescribed fire proposed.

Project activities are expected to increase light availability for approximately 50-70% of whitebark pine's known area of occurrence within the project area for either action alternative. Whitebark pine is a shade intolerant species and is at risk of being successionally replaced by subalpine fir or other shade-tolerant species in the absence of disturbances or treatments. Therefore, the changes in light availability from proposed treatments are expected to have a positive impact on whitebark pine population resilience.

Whitebark pine was observed in the project area in cold upland forests, the hydrology is not expected to change substantially in this habitat type. Therefore, project activities will not have a measurable change in population resilience of whitebark pine as a result of changes in the hydrologic conditions.

In conclusion, with mitigations, both the short and long term effects of the proposed actions should have a **Beneficial Impact** on whitebark pine as the treatments will promote the vigor of whitebark pine regeneration by reducing competition from other more fast growing conifer species and by maintaining and encouraging a more natural disturbance cycle.

Impacts to Sensitive Plant Suitable Habitat Types

Table 9 uses the Indicators and Measures to compare the proposed action alternatives for effects to suitable sensitive plant habitat (using changes in acres of suitable habitat as a proxy for the effects to potentially undocumented sensitive plants within).

Following the table, the measures (i.e. changes in ground disturbance, prescribed fire, available light, and available water) are discussed specific to each of the seven suitable sensitive plant habitat types.

Table 34. Resource indicators & measures for assessing effects from changes in acres of suitable habitat

Indicator	Measures		Suitable sensitive plant habitat types*						
	Alterative 2	Alternative 3	Cold & Moist UF	Dry UF	Warm Riparian Forest/ Shrub	Bunchgrass, Dry Shrub & Lithosol	Cliff & Rock	Spring & wet meadow	Aquatic & Stream
Change in acres of suitable habitat, across the project area	11,680 acres with changes from ground disturbance	7,455 acres with changes from ground disturbance	X	X	X				X
	9,521 acres with changes from prescribed fire	9,521 acres with changes from prescribed fire	X	X	X				
	Up to 11,680 acres with changes in available light	Up to 9,521 acres with changes in available light	X	X	X	X		X	X
	1,154 acres with measurable changes	911 acres with measurable changes			X			X	X

	in available water**	in available water**							

* An (X) indicates that actions are proposed to occur within that habitat type and are included within the total acreages presented on the table for each alternative.

** Calculated as the total number of acres of RHCA-Wetland and RHCA Thinning treatments.

Cold and/or Moist Upland Forest

Actions proposed to take place in cold and moist upland forests include various road actions, commercial harvest, noncommercial thinning, post-harvest treatments, and prescribed fire. Even though alternatives 2 and 3 differ in the total acres of moist upland forest treatments, the alternatives are discussed together because the overall effects to the sensitive plants that may occupy this habitat type would be similar.

The actions proposed may have limited negative direct effects from ground disturbance and prescribed fire on the sensitive plants that can occupy this habitat type. This is due to acute disturbances to undocumented plants, disturbances to suitable habitat from heavy machinery, and possible incineration from prescribed fire.

Proposed actions may also have limited negative indirect effects on any undocumented shade tolerant species due to altering the amount of light reaching the understory. However, actions may have a beneficial effect for other species of sensitive plants that require less canopy cover. Additional indirect effects would likely be beneficial, as the treatments would reduce fuel loading, help to restore heterogeneity to these forests, and promote a healthy herbaceous understory. Additionally, various road actions (e.g. road maintenance, road decommissioning, road reconstruction, and culvert replacement) in this habitat type would repair hydrological processes adjacent to the road. Restoration of these processes could create more habitat suitable for sensitive plants that thrive in moist forests.

Based on this assessment, sensitive plants that can occupy cold and/or moist upland forest will potentially have effects from project activities in the action alternatives that **may impact individuals or habitat, but will not likely contribute to a trend toward federal listing or cause a loss of viability.**

Dry Upland Forest

Actions planned for dry upland forests in alternatives 2 and 3 include the same actions as those discussed for cold and moist upland forests (i.e. various road actions, commercial harvest, noncommercial thinning, post-harvest treatments, and prescribed fire). These actions may have limited negative direct effects on sensitive plants that can occur in this habitat type. This is due to (1) ground disturbances, potentially resulting in physical damage to undocumented plants and disturbances to suitable habitat from machinery or tree felling and (2) prescribed fire, potentially resulting in top-kill of individuals of undocumented sensitive plants.

A reduction in shade due to logging and thinning may indirectly impact shade tolerant sensitive plants. However, treatments are expected to benefit other sensitive plant species that may inhabit these areas. Treatments would create more heterogeneity across dry forests, which have become oversimplified because of past management. Other indirect effects would likely be beneficial because the treatments would reduce fuel loading and potentially prevent severe fires that could destroy sensitive plant habitat. The hydrologic conditions are not expected to change significantly in this habitat type.

Thus, sensitive plants that can occupy dry upland forest will potentially have effects from project activities in the action alternatives that **may impact individuals or habitat, but will not likely contribute to a trend toward federal listing or cause a loss of viability**.

Warm Riparian Forest/Shrublands

The treatments proposed for both action alternatives in warm riparian forests and shrublands (i.e. RHCA-Riparian Thinning) would involve variable thinning around deficient cottonwood, aspen, willow, and early seral tree and shrub species. These treatments would occur by hand unless material could be removed with total suspension and the equipment does not have to leave existing roadbeds. These treatment practices would greatly reduce the amount of ground disturbance in this habitat type. There is a small possibility that felled trees would physically fall on undocumented sensitive plants during implementation, but the treatments would produce indirect, long-term benefits. Fuels treatments would likely have no effect on riparian forests and shrublands because design criteria would prohibit direct ignition in this habitat type. Additionally, because of the water requirements of riparian shrub species, it is unlikely that prescribed fire would carry through this habitat except under extreme drought conditions.

The addition of woody material to the meadow and riparian systems could indirectly prevent some ungulate access, potentially resulting in lower risk from herbivory and trampling. Additionally, adding wood to the channels within meadows would attenuate the flow of water, reducing erosion and downcutting through the system, potentially raising the water table and re-connecting the hydrology. Both factors could indirectly contribute to the increase in quality and quantity of sensitive plant habitat in warm riparian forests and shrublands.

Thus, sensitive plants that can occupy warm riparian forests and shrublands will potentially have effects from project activities in the action alternatives that **may impact individuals or habitat, but will not likely contribute to a trend toward federal listing or cause a loss of viability**.

Bunchgrass Meadows, Dry Shrublands, and Lithosol

Project design criteria to protect potential sensitive plant habitats would avoid ground disturbing activities (e.g. piling slash, decking, motorized travel, parking, staging operations, and temporary road creation) on previously undisturbed non-forested terrain. This would protect specialized habitats within bunchgrass meadows, dry shrublands, and lithosols that provide habitat for diverse plant species. Additionally, design criteria to protect shallow soils and meadows would prevent heavy equipment use or allow it to be permitted only over dry or frozen ground. Prescribed fire activities have the potential to directly harm undocumented sensitive plants within this habitat type if heat is transferred below the soil surface. This has the potential to damage roots and kill plants. However, season of burn, burn intensity, and design criteria would limit potential negative effects.

Changes in available light and water will be limited to the edges of open areas that are adjacent to treatment units. The changes are expected to have a negligible indirect effect to sensitive plants occupying this habitat type. Many invasive plants compete with sensitive species and can reduce their abundance and distribution. Invasive plants can also indirectly affect sensitive plants by degrading their habitat by changing fire or hydrologic processes. Invasive species are very common in this habitat type in the project area. The potential for additional spread of invasive species is higher in treatment areas. This project includes prevention measures to minimize the risk of introduction and spread of invasive plants during project implementation (described in the Sheep Creek Invasive Plants Report). These measures are expected to mitigate risks and maintain or decrease existing noxious weed infestations in this habitat type in the project area.

Thus, sensitive plants that can occupy bunchgrass meadows, dry shrublands, and lithosols will potentially have effects from project activities in the action alternatives that **may impact individuals or habitat, but will not likely contribute to a trend toward federal listing or cause a loss of viability.**

Cliffs and Rock Outcrops

Very few human activities have potential for direct or indirect impacts to this habitat type. Additionally, design criteria would protect these areas from ground disturbing activities. Prescribed fire generally does not burn in this habitat type due to the low fuel levels. Therefore, the implementation of alternatives 2 and 3 should have no direct or indirect effects to cliffs and rock outcrops or to any sensitive plant species that may occur there.

Based on this assessment, proposed activities from the action alternatives will have **No Impact** on sensitive plants that can occupy cliffs and rock outcrops.

Springs and Seeps & Moist and Wet Meadows

To protect soil and water resources, most activities would be greatly restricted in identified groundwater dependent and wetland habitats. These are biodiversity hotspots and can support many sensitive species present in the Wallowa Whitman National Forest. Both action alternatives include RHCA-Wetland enhancement treatments. Wetland enhancement includes hand thinning small encroaching conifers, fencing around wet meadows, and planting native broadleaf vegetation.

Many project design criteria would limit the use of heavy equipment and minimize ground disturbance in these communities. Design criteria would also prevent prescribed fire ignition within floodplains, RHCAs, and seeps, springs, and wet meadows. This would protect sensitive plants that may occur in this habitat type. In the long term, the treatments near and within this habitat type should benefit sensitive plants by reducing conifer encroachment (which have altered the available light and moisture to the ground in these habitats) and by improving hydrological processes.

Thus, sensitive plants occupying springs/seeps, and moist/wet meadows will potentially have direct effects from project activities in the action alternatives that **may impact individuals or habitat, but will not likely contribute to a trend toward federal listing or cause a loss of viability**. However, indirect and long-term effects will likely benefit these species.

Aquatic Habitats, Intermittent and Perennial Streams

Actions proposed in aquatic habitats and streams include RHCA- HTH Riparian Thinning under both action alternatives. RHCA thinning treatments would involve hand thinning and removal or felling of conifers within this habitat type. Design criteria prohibit certain activities (including the use of mechanical equipment) in these habitats. This should limit the direct effects from ground disturbance to any undocumented sensitive species. To protect sensitive plants from deleterious thermal effects of fire, direct ignition would not occur within RHCAs; but low intensity prescribed fire would be allowed to back into these areas. With these restrictions in place, fire would likely have limited effects on sensitive plants in this habitat type. The long-term impacts would change the hydrology and shade levels in these ecosystems. This could help restore and maintain suitable habitat for supporting sensitive plants.

Thus, sensitive plants occupying aquatic habitats and streams will potentially have effects from project activities in the proposed action alternatives that **may impact individuals or habitat, but**

will not likely contribute to a trend toward federal listing or cause a loss of viability.

Cumulative Effects

A list of past, present and reasonably foreseeable future activities within the project area, and on immediately adjacent public and private lands are described in Sheep Creek Vegetation Management Appendix D Cumulative Effects Analysis Process and Project Area Activities. This list serves as a guide for analyzing the cumulative effects of implementing the Sheep Creek Vegetation Management Project.

Road Maintenance – there is ongoing road maintenance in and near the project area. This may result in some increase in localized disturbances to sensitive plants and in potential increases to invasive plant abundance. This could continue to contribute to small scale adverse impacts to sensitive plants in the project area.

Grazing – there are active grazing allotments within the project area (Sheep Ranch and Chicken Hill Allotments). It is possible that activities proposed under this project (e.g. harvest and prescribed burning) could promote suppressed vegetation and promote the growth, abundance, and vigor of sensitive plants making them more available and desirable to livestock. Conclusive information on the growth habits and effects of management actions is largely unknown for the sensitive plants known/suspected in the project area. It is not expected that this project will result in cumulative effects from potential changes in grazing patterns due to the design criteria in place. But, if observations/monitoring indicate an adverse impact, timing of grazing to reduce impacts can be incorporated into annual operating instructions.

Recreational Use – the project area currently has high levels of recreational use, and recreation is expected to increase. Areas with high concentrations of recreational use are vulnerable to disturbances including inadvertent trampling of sensitive plants in the project area.

Other Fuels Management—adjacent to the project area other vegetation management projects have occurred and have the potential to continue to occur on private lands. These have the potential to impact sensitive plants.

Overall, the cumulative impact of management activities upon sensitive plant population viability are expected to be low. Sensitive plant surveys have been conducted and potential impacts to the known Richardson's needlegrass, scalloped and mountain moonwort, northern twayblade, and whitebark pine, have been addressed through mitigation measures and project design features. Any potential impacts to undetected populations of the 18 sensitive species not known from the project area are unlikely as these plants have a low likelihood to occur in the analysis area and would be small; therefore, cumulative impacts are unlikely.

Regulatory Consistency

The Sheep Creek Vegetation Management Project has been reviewed and was determined to comply with the regulatory framework applicable to botanical resources. The laws, regulations, policies and Wallowa Whitman National Forest Land and Resource Management Plan (LRMP) requirements/guidance applicable to this project and this resource are listed below in Table 10.

Table 35. Regulatory framework applicable to botanical resources in the Sheep Creek Project

Forest Plan Standards
Threatened and Endangered and Sensitive Species (p. 4-30 thru 4-31)

(1) Review all actions and programs, authorized, funded, or carried out by the Forest Service, to determine their potential effects on threatened, endangered, and sensitive species. Conduct these reviews, including biological evaluations, per direction in FSM 2670 and appropriate Region 6 manual supplements.
(2) Protect and manage habitat for the perpetuation and recovery of plants which are listed as threatened, endangered, or sensitive. To assure that management activities do not jeopardize the continued existence of sensitive species or result in adverse modification of their essential habitat.
Forest Service Manual – FSM 2670.32
(1) Review programs and activities as part of the National Environmental Policy Act of 1969 process through a biological evaluation, to determine their potential effect on sensitive species.
(2) Avoid or minimize impacts to species whose viability has been identified as a concern.
(3) Analyze, if impacts cannot be avoided, the significance of potential adverse effects on the population or its habitat within the area of concern and on the species as a whole.
Forest Service Manual – FSM 2672.41
Ensure that Forest Service actions do not contribute to loss of viability of any native or desired non-native plant or contribute to trends toward Federal listing of any species.
Endangered Species Act of 1973
Federal agencies are to ensure that any action authorized, funded, or carried out by the agency is not likely to jeopardize the continued existence of any endangered, threatened or proposed species, or result in the destruction or adverse modification of designated critical habitat.

Wildlife Management Indicator Species (MIS)

Effects on species will be determined by assessing how the No Action Alternative and action alternatives affect the structure and function of vegetation relative to current and historical distributions. Some wildlife habitats require a detailed analysis and discussion to determine potential effects on a particular species. Other habitats may either not be impacted or are impacted at levels unlikely to influence the species or their occurrence. The level of analysis depends on the existing habitat conditions, the magnitude and intensity of the proposed actions, and the risk to the resources.

Table 36. Wildlife indicators and measures

Key Issue: Connectivity	
Indicator	**Measure**
Stand level connectivity	Acres of reduced connectivity
Other Issues	
Management Indicator Species	Acres of habitat impacted
Sensitive Species	Acres of habitat impacted

The LRMP identifies five wildlife species, or groups of species, as MIS (Table 37) (US Forest Service 1990). These species serve as indicators of the effects of management activities by representing habitat for a broad range of other wildlife species. We assume that habitat requirements of MIS represent those of a larger suite of species using the same type of habitat. All MIS are present in the project area.

Table 37. MIS and their primary habitats.

Species	Habitat

American marten (*Martes americana*)	Old-growth and mature forest
Northern Goshawk (*Accipiter gentilis*)	Old-growth and mature forest
Pileated Woodpecker (*Dryocopus pileatus*)	Old-growth and mature forest
Primary cavity excavators[1]	Snags and logs
Rocky Mountain elk (*Cervus canadensis nelson*)	Cover and forage

[1] Northern Flicker; black-backed, downy, hairy, Lewis', three-toed, and white-headed woodpeckers; red-naped and Williamson's sapsuckers; black-capped, chestnut-backed, and mountain chickadees; and pygmy, red-breasted, and white-breasted nuthatches

1) Rocky Mountain Elk (*Cervus canadensis nelson*)

Rocky Mountain elk are an indicator of habitat diversity, interspersion of cover and forage area, and security habitat provided by areas of low human disturbance. Elk management on the Wallowa-Whitman National Forest is a cooperative effort between the Forest Service and the Oregon Department of Fish and Wildlife (ODFW). The Forest Service manages habitat while ODFW manages populations by setting seasons, harvest limits, and goals for individual Wildlife Management Units (WMU). The Sheep Creek project lies within the Starkey WMU.

Methods

We use a habitat effectiveness index (HEI; Thomas et al. 1988) assessing the quality of elk habitat at the project area level. This model considers the density of open roads, the availability of cover habitat, the distribution, and juxtaposition of cover and forage, and forage quantity and quality. Forage data is unavailable for this project area and is omitted from the total HEI value. This report also employs the use of distance band analysis (DBA) to determine the effects of roads and motorized disturbance on elk security habitat (Rowland et al. 2005). The impacts of OHV's on closed roads and cross-country travel are not considered in an HEI analysis, although they likely cause reduction in habitat effectiveness. Additionally, a discussion of the best available science accompanies the results.

Alternative 1

Summary: There will be no immediate direct or indirect adverse effects to elk cover and forage from Alternative 1 because no timber harvest, fuels treatments, or transportation activities will occur. The no action alternative would maintain current conditions for elk habitat in the short-term (0-20 years). How elk habitat changes in the mid to long-term (beyond 20 years) would depend largely on the occurrence and scale of disturbances (wildfire, insect, or disease), stressors (drought, global climate change), and changes in management of travel and hunting. These events cannot be predicted with a reasonable level of certainty, but risks associated with forgoing management actions can be described.

Cover-Forage

There are 2,340 acres (8%) of satisfactory cover, 12,671 acres (43%) of marginal cover and 14,667 acres (49%) of forage habitat within the project area (Table 40). A study conducted by Wisdom and Rowland (2020) found that elk use is highest at 35% canopy cover, roughly 40% of the Sheep Creek Project Area. Recent research demonstrates forest stands in the Southern Blue Mountains, regardless of potential vegetation group (PVG) or moisture regime, are 273-316% more dense and contain 60-176% higher basal area currently than in the late 1800s (Johnston et al. 2018).

Data (see forest health report for project specific data) supports that this no action scenario could result in a higher risk of tree mortality due to increased competitive stress, insect outbreaks, fuel

loading, and associated increases in fire severity and crown fire spread (Hessburg and Agee 2003, Spies et al. 2006, Keane et al. 2018). Landscapes reflective of HRV result in mixed severity fires, creating a patchy mosaic of cover types beneficial to elk. Large scale, severe-intensity fire (a result of no action) would degrade elk habitat through a loss of habitat in the near-term, and a reduction in edge habitat between cover and forage areas in the long-term.

Security

Approximately 8.3% of habitat is moderate to high security and 91.8% of habitat is low security (Table 38).

Table 38. Distance of habitat from open roads within the subwatersheds that comprise Sheep Creek Project unit.

Distance Bands by Subwatershed		
Sheep Creek:	Existing Condition	
Distance (miles)	Acres	% of Total Area
0.5 mi (low security)	17654	93.0
1 mi (moderate security)	1300	6.9
1.5 mi (high security)	23	0.1
Chicken Creek:	Existing Condition	
Distance (miles)	Acres	% of Total Area
0.5 mi (low security)	9829	89.6
1 mi (moderate security)	1146	10.4
1.5 mi (high security)	0	0.0
Combined (Entire Project Area):	Existing Condition	
Distance (miles)	Acres	% of Total Area
0.5 mi (low security)	27484	91.8
1 mi (moderate security)	2446	8.2
1.5 mi (high security)	23	0.1

Moderate and high security habitat are preferred for elk management. No difference in road management between Proposed Alternatives 2 and 3 resulted in identical distance band analysis results.

Habitat Effectiveness Index Results

The HEI values for Alternative 1 are 0.60 (road density analysis; Table 3) and 0.51 (distance band analysis; Table 39).

Table 39. Habitat-effectiveness index calculations for existing elk habitat within the Sheep Creek analysis area.

Habitat Effectiveness Variable	Habitat Effectiveness Value (Optimal = 1.0)	Comments
HE Cover	0.58	Amount of satisfactory cover relative to marginal cover
HE Size and Spacing	0.65	Mosaic of cover and forage, 50.6:49.4
HE r value using road density	0.47	Open road density 2.13 mi/mi sq LRMP MA-1 $\leq$ 2.5 mi/mi sq

HE r value using distance bands	0.36	Concentric bands around open roads
Total HEI using road density[1]	0.60	LRMP MA-1 ≥ 0.5 HEI
Total HEI using distance band analysis*	0.51	LRMP MA-1 ≥ 0.5 HEI
Percent of area ≥ 0.5 mi from open motorized route	0.08	Security habitat

[1] HEI calculations do not include a forage variable because current, reliable forage data are not available

Alternatives 2 and 3

Summary: Both action alternatives are consistent with LRMP standards and guidelines pertaining to elk. Treatments proposed under action alternatives are expected to maintain or slightly improve elk habitat effectiveness, as indicated by HEI values, mostly due to an increase in forage and security availability. Secure habitat is minimal within this study area, with potential for large amounts of secure habitat in the adjacent North Fork John Day Wilderness and seasonally in the Trail Creek area. Proposed road closures across all alternatives will increase security habitat within the project area and will have a small, but positive effect on distribution and escapement.

Cover-Forage

Existing conditions demonstrate a surplus of cover with limited forage. All action alternatives meet or exceed LRMP standards for stands with cover >40%. Cook (et al. 2005) found dense cover did not benefit elk and improving the quality and quantity of forage habitat should be a management priority. This is accomplished by creating stands with <40% cover and setting them back to an early seral stage (Cook et al. 2016).

Action alternatives would affect elk habitat with 11,598 acres treated in Alternative 2 compared to 7,368 acres treated in Alternate 3. Alternative 3 eliminates prescriptions that remove the highest basal area, commercial treatments in RHCAs, and commercial harvest in corridors of connectivity, all implemented in Alternative 2. Both will reduce satisfactory and marginal cover, and in turn improve the arrangement of forage and cover. Commercial harvest would generally increase available elk forage by reducing canopy cover. Overall changes in cover are similar regardless of alternative (Table 40).

Post-treatment tree densities are expected to be variable, consisting of dense patches interspersed with open areas., Commercial thinning activities will overall convert marginal cover to forage. The amounts of forage, marginal, and satisfactory cover remaining under each alternative does not reflect the finer scale mosaic of cover types resulting from thinning prescriptions.

Table 40. Elk habitat present in Sheep Creek project area and projections under proposed alternatives.

	Existing Condition		Alternative 2		Alternative 3	
Habitat	Acres	% of Total	Acres	% of Total	Acres	% of Total
Forage (< 40% canopy cover)	14,667	49.4	16,177	54.5	15,450	52.1
Marginal Cover (40-70% canopy cover)	12,67	42.7	11,486	38.7	12,21	41.2

	1				8	
Satisfactory Cover (> 70% canopy cover)	2,340	7.9	2,019	6.8	2,009	6.8

Security

The HEI model developed by Thomas et al. 1998 relies on open road density as an indicator of relative effects from roads on elk habitat. More recent research in northeastern Oregon found that road density is a poor indicator of habitat effectiveness (Rowland et al. 2000). In contrast to Thomas et al., this study described a strong linear increase in elk use as the distance from roads increased. Therefore, a method using a distance banding approach, as described by Rowland et al. (2005) is utilized here as an alternate indicator of road effects on elk habitat in the Sheep Creek project area (Table 41). Road closures are consistent across Alternatives 2 and 3 and will have a positive, though small, effect on elk security with only 3.3 miles of roads closing. A minimal amount of security habitat exists in the Sheep Creek project area; 8.3% existing and a proposed 9.3% in both Alternatives 2 and 3.

Table 41. Distance of habitat from open roads within the subwatersheds that comprise the Sheep Creek Project unit.

Distance Bands by Subwatershed				
Sheep Creek:	Existing Condition		Alternatives 2 and 3	
Distance (miles)	Acres	% of Total Area	Acres	% of Total Area
0.5 mi (low security)	17654	93.0	17647	93.0
1 mi (moderate security)	1300	6.9	1307	6.9
1.5 mi (high security)	23	0.1	23	0.1
Chicken Creek:	Existing Condition		Alternatives 2 and 3	
Distance (miles)	Acres	% of Total Area	Acres	% of Total Area
0.5 mi (low security)	9829	89.6	9517	86.7
1 mi (moderate security)	1146	10.4	1457	13.3
1.5 mi (high security)	0	0.0	0	0.0
Combined (Entire Project Area):	Existing Condition		Alternatives 2 and 3	
Distance (miles)	Acres	% of Total Area	Acres	% of Total Area
0.5 mi (low security)	27484	91.8	27165	90.7
1 mi (moderate security)	2446	8.2	2765	9.2
1.5 mi (high security)	23	0.1	23	0.1

[1] Moderate and high security habitat are preferred for elk management. No difference in road management between Proposed Alternatives 2 and 3 resulted in identical distance band analysis results.

Habitat Effectiveness Index Results

Results from the HEI analysis are nearly identical to the Existing Condition (Table 42). Total HEI was 0.6 for all scenarios. HEI results for Alternatives 2 and 3 are identical due to no difference in road closures and similar size and spacing of units despite differences in areas treated. Although Alternative 3 has fewer acres treated for thinning, proportionally more stands will be transitioned to Forage (canopy <40%) than in Alternative 2. With 3.3 miles of road closure in both alternatives, we observed very small gains in secure habitat with almost no effect on Total HEI.

Table 42. Habitat-effectiveness index calculations for elk habitat under Alternatives 2 and 3 within the Sheep Creek analysis area1.

Habitat Effectiveness Variable	Habitat Effectiveness Value (Optimal = 1.0)	Comments
HE Cover	0.57	Amount of satisfactory cover relative to marginal cover
HE Size and Spacing	0.67	Mosaic of cover and forage, 54.6:45.4 Alt 2, 52.1:47.9 Alt 3
HE r value using road density	0.47	Open road density 2.06 mi/mi sq LRMP MA-1 $\leq$ 2.5 mi/mi sq
HE r value using distance bands	0.36	Concentric bands around open roads
Total HEI using road density[1]	0.60	LRMP MA-1 $\geq$ 0.5 HEI
Total HEI using distance band analysis*	0.52	LRMP MA-1 $\geq$ 0.5 HEI
Percent of area $\geq$ 0.5 mi from open motorized route	0.09	Security habitat

[1] HEI calculations do not include a forage variable because current, reliable forage data are not available

Cumulative Effects

Effects of past human activities and naturally occurring events on Wallowa-Whitman lands have been incorporated into the existing conditions for elk habitat in the project area. Direct and indirect effects of each alternative and foreseeable consequences are discussed in the preceding section. Alternatives 2 and 3 are combined in this discussion due to similarities in HEI results. Other management activities that may occur within the Sheep Creek project area include: the Wallowa-Whitman Invasive Species Management Plan and the Blue Mountains Forest Plan Revision.

Ongoing activities including firewood cutting, grazing, prescribed fire, noxious weed control, road maintenance, and both motorized and non-motorized recreation will have no measurable impact on cumulative effects for elk. There is currently a Travel Management Area (TMA) that closes roads seasonally (Oct 25- Nov 15) in the Trail Creek area, adjacent to the Sheep Creek Project area, which benefits elk with an increase in secure habitat during hunting season. Under both action alternatives this closure is extended to encompass archery elk season increasing the timing of travel restrictions and associated security habitat.

2) Old Growth Habitat: American Marten, Northern Goshawk, and Pileated Woodpecker

The American marten, Northern Goshawk, and Pileated Woodpecker are MIS of old growth habitat (U.S. Forest Service 1990). Impacts within the Sheep Creek project area are determined by analyzing effects to their habitat at several spatial scales starting with the project level then framing that within the context of the watershed and the Wallowa-Whitman National Forest. These scales take into account the species' relationship with the landscape as well as being practical for management purposes. MIS population viability assessments have been conducted for American marten, Pileated Woodpecker, and Northern Goshawk at the Blue Mountains and Wallowa-Whitman. These assessments are incorporated by reference within the existing condition and effects analysis for each species. For more in-depth information on the methodology behind these assessments, please refer to the full-length assessments in the project record and the associated peer-reviewed literature scales (Penninger and Keown 2011a, Penninger and Keown 2011b, Penninger and Keown 2011c).

3) American Marten (*Martes americana*)

Alternative 1

Upper Grande Ronde Watershed

The Sheep Creek project area lies within the Upper Grande Ronde watershed, composed of the Sheep Creek and Chicken Creek subwatersheds. This watershed contains 3,698 existing acres of marten source habitat (habitat that can support a stable or increasing population of marten) out of 70,857 (5%) potential acres of marten habitat.

Bayesian Belief Network (BBN) models were used to conduct a viability assessment for various wildlife species of interest at the Blue Mountains and WWNF scales (Wales et al. 2011, Penninger and Keown 2011a,). This analysis used vegetation data to determine the existing amount of source habitat, the departure from historic conditions, and the quality of the source habitat. BBN models were used to derive a watershed index (WI) score for each watershed by evaluating the departure from historic condition and several parameters of habitat quality. A watershed with a high viability index score would provide habitat of the quality, quantity, and distribution to support a self-sustaining and well distributed marten population. Watershed index scores >2 indicate a relatively high level of habitat quality and quantity, scores between 1 and 2 are moderate, and scores <1 are low. The WI scores were then weighted by the amount of source habitat currently existing in each watershed to derive a weighted watershed index (WWI). Watersheds with the highest WWI scores are considered to provide the greatest contribution to species viability.

This watershed shows the impacts of past management activities which resulted in reduction of marten habitat. The current watershed index is 0.74 with the historic watershed index at 2.78, indicating a high historic level of habitat quality and a current low level of habitat quality and quantity. This watershed currently does not provide ≥ 40% of the median amount of source habitat that occurred historically (Penninger and Keowen 2011a). The weighted index of this watershed is 1,111 indicating this watershed does not have the capability of supporting self-sustaining and well-distributed marten populations.

Table 43. Historical and current marten habitat identified by Wales (2011)

	Historical Habitat	Current Habitat (acres)	Percentage of

	(acres)		Historical Habitat
Regional Scale (Blue Mountains)	277,715	257,942	93%
Wallowa-Whitman NF scale	144,347	129,943	90%

Sheep Creek Project Area

Primary source habitat for marten is defined as habitat within moist and cold upland forests in the LOS stage with ≥ 60% canopy closure and ≥ 20" dbh as the tree size. According to a GIS query, the Sheep Creek project area contains 2,712 acres of source habitat, which comprises 9% of the project area. Remote sensing cameras were utilized in the summer of 2017 and 2018 in areas identified as marten habitat. Marten were detected on the southern boundaries of the project area, in the same areas that collared marten were detected in a 1995 research study (Bull et al. 2005b). Source habitat conditions are primarily distributed on north facing slopes along the Sheep and Chicken creek main tributaries with areas of important connectivity to the Upper North Fork John Day River along the southern boundary of the project area. Modeled source habitat, remote cameras and past research were all accounted for in our analysis.

Pacific marten habitat was designed into the Sheep Creek project area to maximize the retention of high canopy cover habitat on north facing slopes and within identified areas of important connectivity. In specific areas, proposed silviculture treatments were dropped or modified to retain higher canopy cover, and fuels treatments along National Forest System Road 5184 will retain greater ground heterogeneity in spots to maintain travel areas between watersheds.

There will be no direct adverse effects to marten from Alternative 1 because no timber harvest, fuels treatments, or transportation activities will occur. Existing marten source and secondary habitat would remain unchanged. The project area would continue to increase in risk to uncharacteristic insect outbreaks and fire that has the potential to degrade connectivity for marten between watersheds, in light of the already reduced habitat conditions.

Alternatives 2 and 3

Summary: Because this project impacts less than 0.006% of source habitat across the Forest, the overall direct, indirect and cumulative effects will result in a small negative effect to marten habitat. The decrease in habitat quality due to the Sheep Creek Vegetation Management Project will be insignificant at the scale of the Wallowa-Whitman. The Upper Grande Ronde watershed will remain below the threshold of 40% of the historical amount and this project will not change the watersheds contribution to species viability on the Wallowa-Whitman. No existing large trees (a vital component of marten source habitat) will be removed as part of this project. Marten connectivity between watersheds has been emphasized within this project and fuels treatments are intended to create resilient landscapes in the face of disturbances (insects, fire, disease) and environmental stressors (global climate change, human impact). Allowing natural processes to shape future structure stage in the long term, while being mindful of connectivity concerns over the short term will ensure marten can continue to thrive.

Sheep Creek Project Area

In general, commercial treatments have the potential to affect marten habitat suitability by reducing stand canopy closures and understory tree densities and simplifying the structural complexity. This could expose marten to higher predation risk, reduce foraging opportunities and potential denning habitat. Habitat after a commercial treatment would not be expected to function as source habitat and potentially not as foraging habitat in the medium term (0-50 years) before

canopy cover increases and heterogeneous structure returns. Commercial treatments proposed under alternative 2 and 3 would treat 388 acres and 33 acres (14% and 1.2% of existing) source habitat found within the project area.

Application of fuel treatments outside of stands proposed for timber harvest has the potential to reduce understory and down wood densities, but is unlikely to substantially reduce stand canopy closures. Moriarty (2014) compared marten movement within open, simple stands resulting from fuels treatments and untreated complex stands. She found that marten selected home ranges with a disproportionate amount of complex stands and avoided openings. Simple stands were marginally avoided compared to complex stands. Marten movement within simple stands vs. complex stands suggests that marten use simple stands for travel and for intermittent foraging but not for denning. Therefore, fuels treatments are expected to degrade, but not remove, marten habitat. Alternatives 2, and 3 propose fuels treatments on 436 and 268 acres (16% and 9% respectively.

Table 44. Proposed Silvicultural and Fuels Treatments in Marten Source Habitat within Sheep Creek Project Area

	Alternative 2		Alternative 3	
	Commercial Harvest	Prescribed Fire Only	Commercial Harvest	Prescribed Fire Only
Acres of Treatment within Source Habitat	388 acres	436 acres	33 acres	268 acres
Percent of Existing Source Habitat	14%	16%	1%	9%

Upper Grande Ronde Watershed

Treatment under Alternative 2 would reduce complexity within approximately 21% of the source habitat available within the watershed and Alternative 3 would reduce complexity within about 8% of source habitat available in the watershed.

Post-treatment availability of source habitats would continue to be below the threshold of 40% of the historical amount in the Upper Grande Ronde watershed under all action alternatives. Post-treatment amounts of source habitat as a percentage of potential habitat would continue to be below the historic median of 16% described by Penninger and Keown (2011a). However, most of the proposed commercial treatment within *potential* marten habitat is intended to encourage large tree structure in the long term. No existing large trees (a vital component of marten source habitat) will be removed as part of this project. Marten connectivity has been emphasized within this project and fuels treatments are intended to create conditions where fire can return to the landscape. Allowing natural processes to shape future forest structures in the long term, while being mindful of connectivity concerns over the short term will ensure marten can continue to use the area.

Marten Habitat at the Wallowa-Whitman Scale

Estimated habitat impacts at the project area and watershed scales (described above) are based on source habitat parameters modeled according to Penninger and Keown (i.e. 50% canopy closure and 15” dbh criteria). Existing marten source habitat on the Wallowa-Whitman as modeled by Wales (2011) totals 129,943 acres. As a result of proposed activities under the Sheep Creek project, source habitats would be impacted at a maximum of 824 acres under Alternatives 2.

Because source and secondary habitats at the Forest level were modeled according to more conservative thresholds described by Wales (i.e. 60% canopy closure and 20 inch dbh criteria), it is reasonable to assume that the source habitat impacts would actually be less than the estimate based on the 50% canopy closure and 15" dbh criteria. Therefore, reduction of habitat quantity and quality at the Forest level would equate to less than 0.006% of existing source habitat across alternatives.

Cluster analysis used to describe existing distribution of source habitats across the Wallowa-Whitman indicates that these habitats are well distributed across the Forest (Penninger and Keown 2011a). Post-treatment levels of source habitat under all Sheep Creek action alternatives are expected to result in no change in the number of watersheds in Cluster W3 containing >40% source habitat that contribute to marten habitat distribution.

Landscape Permeability

Treatments proposed under each action alternative may decrease existing habitat permeability due to reduced canopy closure, decreased structural complexity, and increased disturbance on specified and temporary roads. However, areas of connectivity between the subwatersheds of the Upper Grande Ronde and the Upper North Fork John Day River were identified and designed into the project. Commercial and fuels treatments in these areas will maintain the stand at the upper third of the site potential and higher levels of downed woody material to promote continued landscape permeability function.

Cumulative Effects

Effects of past activities including road construction, fire suppression, prescribed fire, and timber management on Wallowa-Whitman lands have been incorporated into the existing conditions for amounts and locations of marten habitats in the analysis areas and into the viability analysis.

Ongoing and future livestock grazing is expected to have no effect on marten habitat because cattle tend to avoid areas with high amounts of down wood. On Forest Service lands within and outside the project area, firewood cutting will continue to reduce available snags and logs, but the effect is typically limited to areas adjacent to open roads.

Wales et al. (2011) estimated that approximately 144,300 acres of source habitat existed on the Wallowa-Whitman historically. At the time of the analysis, approximately 129,900 acres (90% of estimated historical conditions) of source habitat occurred on the Wallowa-Whitman. Since the viability assessment was run 17 Vegetation/Fuels Restoration projects have been analyzed across the Wallowa-Whitman. Some have been implemented and some are still undergoing the NEPA process, and anticipate being implemented in the foreseeable future. These combined projects, including the Sheep Creek Vegetation Management project, anticipate commercially impacting 3,123 acres of marten source habitat and non-commercially impacting 5,478 acres of marten source habitat. Taking these 8,601 acres of impacted source habitat into account, this results in approximately 122,521 acres (84% of estimated historical conditions) of source habitat existing on the Wallowa-Whitman. Cumulatively, vegetation management activities on the Wallowa-Whitman are not expected to change the viability outcome found by Wales et al. and marten source habitat will remain well distributed and highly abundant with some gaps where suitable environments are absent or only present in low abundance (viability outcome B).

4) Northern Goshawk (*Accipiter gentilis*)

Alternative 1

Upper Grande Ronde Watershed

The Sheep Creek project area lies within the Upper Grande Ronde watershed. This watershed contains 12,870 existing acres of goshawk source habitat (habitat that can support a stable or increasing population of goshawk) out of 105,916 (12%) potential acres of goshawk habitat. The current watershed index (see explanation of watershed indices in III. "American Marten") is 2.30 with the historic watershed index at 2.94, indicating a shift from high historic levels of habitat quality to a current moderate level of habitat quality and quantity. This watershed currently provides ≥ 40% of the median amount of source habitat that occurred historically and is above the threshold necessary to support goshawk population viability (Penninger and Keowen 2011b). The weighted index of this watershed is 29,259, indicating that this watershed provides habitat of the quality, quantity, and distribution to support a self-sustaining and well-distributed goshawk population.

Sheep Creek Project Area

Northern Goshawk source habitat was assessed for the Sheep Creek analysis area using four variables; potential vegetation group, canopy closure, number of canopy layers and tree size, as defined in the Northern Goshawk Management Indicator Species Assessment (Penninger and Keown 2011). Potential vegetation groups include dry ponderosa pine, dry Douglas-fir, dry grand fir, cool moist and cold dry. Canopy closure is generally greater than 40% in the dry vegetation types and greater than 60% in the cool and cold types. Canopy layers included both single and multi-story and tree size is defined as 15" dbh or greater. A GIS query found 2,387 acres of primary Northern Goshawk habitat in the project area about 8% of the project area. Audio callback transects were conducted June-August 2017-2018 along transects in identified goshawk source habitat and high intensity surveys were done around historic nest sites. Two active goshawk nests were located within the project area.

There will be no direct adverse effects to old-growth associated MIS from the No Action Alternative because no timber harvest, fuels treatments, or transportation activities will occur. Existing source habitat would remain unchanged. However, the no-action alternative maintains unsustainable conditions in late-seral stage montane forests where there have been large transitions from shade-intolerant to shade-tolerant tree species, described as a management issue for Group 6 habitats by Wisdom et al. (2000).

Alternatives 2 and 3

Summary: Because this project impacts less than 1% of source habitat across the Forest, the overall direct, indirect and cumulative effects will result in a minimal negative effect to goshawk habitat. The loss of habitat will be insignificant at the scale of the Wallowa-Whitman. Post-treatment availability of source habitats would continue to exceed the threshold of 40% of the historical amount in the Upper Grande Ronde watershed under all action alternatives, thereby continuing to contribute to habitat distribution and species viability on the Wallowa-Whitman.

For the identified nests withing the project area (in accordance with the East Side Screens), 30 acre no touch buffers were established around each nest and a 400 acre post-fledging area (PFA) was established. Fuels treatments will occur within 50% of one PFA outside the timing restrictions of March 1st- August 31st. If any other nests are discovered during implementation, the same buffers and restrictions will apply.

Sheep Creek Project Area

Both timber harvest and fuels treatments within and outside timber harvest units would occur in Northern Goshawk source habitat under all action alternatives. Intermediate harvest treatments are expected to increase average stand diameter due to removal of trees primarily in smaller size classes, but across all size classes less than 21 inches DBH for Alternatives 2 and 3. Due to the possibility of snag removal during harvest and potential consumption of down logs during post-treatment underburning, treatments that retain sufficient canopy closures are expected to degrade, but not remove, source habitat. Although some habitat elements may be reduced where habitat is degraded, sustainability of habitats is expected to increase as stand density reductions lower the risk of disturbance such as stand-replacement fire, especially in Dry Forest types. Table 10 shows acres and percent of source habitat proposed for treatment under each alternative.

Treatments proposed under Alternative 2 would impact the greatest amount of goshawk source habitat. Harvest activities would occur within 479 acres in Alternative 2 and 190 acres in Alternative 3. These harvest activities could alter 7-12% goshawk source habitat within the Sheep Creek project area for approximately 20-30 years until canopy closure recovers and snags and logs are recruited. Although the treated acres may no longer meet the definition of source habitat, they would still be available for goshawk foraging, roosting, and travel between other habitat patches. Fuel management activities (pre-commercial thinning, hand piling and prescribed fire) would occur within 302 acres in Alternative 2 and 190 acres in Alternative 3. Fuel management could reduce structural complexity in the understory in up to 12% of goshawk source habitat in the project area, but it will still meet the requirements for source habitat.

Table 45. Summary of Proposed Treatments in Goshawk Source Habitat in the Sheep Creek Project Area

Existing Source Habitat	Treatment Type by Alternative in Acres (% of Source Habitat)			
	Alternative 2		Alternative 3	
	Commercial	Non-commercial	Commercial	Non-commercial
2,387 acres	177 acres (7%)	302 acres (12%)	0 acres (0%)	190 acres (8%)

In addition to impacts to available habitats, each action alternative poses potential for direct impact to nesting individuals. Both timber harvest and prescribed fire could cause individual harm or mortality if operations destroy a nest tree occupied by young of the year. If goshawk nesting is discovered prior to, or during implementation, a no-activity nest area of at least 30 acres will be designated for active nests. Because goshawks were detected at locations during 2016 and 2017 surveys, and because the existing nest site was not confirmed with 100% certainty, additional goshawk surveys in these locations would occur prior to implementation of proposed silvicultural and fuels treatments.

Goshawk Habitat at the Watershed Level

Watershed indices reported by Wales (2011) and further assessed by Penninger and Keown (2011b) for the existing condition showed that the Upper Grande Ronde watershed currently contains a high amount of source habitat. Treatments proposed under Alternative 2 would reduce the amount of source habitat available in the watershed by approximately 1 percent and by 0 percent under Alternative 3. Post-treatment availability of source habitats would continue to exceed the threshold of 40% of the historical amount in the Upper Grande Ronde watershed under all action alternatives, thereby continuing to contribute to species viability at the watershed scale.

Goshawk Habitat at the Wallowa-Whitman Scale

Existing goshawk source habitat on the Wallowa-Whitman as modeled by Wales et al. 2011 totals 440,696 acres. As a result of projected habitat loss under the Sheep Creek project, source habitats at the Forest-level would decline by less than 1 percent under all action alternatives.

Cluster analysis used to describe existing distribution of source habitats across the Wallowa-Whitman indicates that these habitats are well distributed across the Forest. Post-treatment levels of source habitat under all Sheep Creek action alternatives result in no change in the number of watersheds in Cluster W3 containing >40% source habitat that contribute to goshawk habitat distribution.

Cumulative Effects

Cumulative effects for goshawk are analyzed for the Upper Grande Ronde watershed. Effects of past activities including road construction, fire suppression, prescribed fire, and timber management on Wallowa-Whitman lands are incorporated into the existing conditions for amounts and locations of marten habitats in the analysis areas. Although some commercial treatments may occur within goshawk suitable habitat, the scale of potential impacts is not substantial in comparison to source habitats currently estimated to exceed 27,000 acres.

Ongoing and future livestock grazing is expected to have a minimal effect on suitable habitats. Additional grazing may occur in treated stands within the project area, but is not expected to alter suitable characteristics. On Forest Service lands within and outside the project area, firewood cutting will continue to reduce available snags and logs, but the effect is typically limited to areas adjacent to open roads. Timber harvest on private inholdings is expected to continue at some level, with anticipated reductions of trees larger than 10” dbh. Lands to the south of the project area will continue to consist of open grassland habitats in private ownership.

Wales et al. (2011) estimated that approximately 466,679 acres of source habitat existed on the Wallowa-Whitman historically. At the time of the analysis, approximately 440,696 acres (94% of estimated historical conditions) of source habitat occurred on the Wallowa-Whitman. Since the viability assessment was run 17 Vegetation/Fuels Restoration projects have been analyzed across the Wallowa-Whitman. Some have been implemented and some are still undergoing the NEPA process but are anticipated being implemented in the foreseeable future. These combined projects, including the Sheep Creek Vegetation Management project, anticipate commercially impacting 7,222 acres of goshawk source habitat and non-commercially impacting 19,151 acres of goshawk source habitat. Taking these 26,373 acres of impacted source habitat into account there is approximately 440,306 acres (94% of estimated historical conditions) of source habitat existing on the Wallowa-Whitman. Cumulatively, vegetation management activities on the Wallowa-Whitman are not expected to change the viability outcome found by Wales et al. and goshawk source habitat will remain well distributed and highly abundant (viability outcome A).

5) Pileated Woodpecker (*Dryocopus pileatus*)

Alternative 1

Upper Grande Ronde Watershed

The Sheep Creek project area lies within the Upper Grande Ronde watershed. This watershed contains 5,776 existing acres of pileated source habitat (habitat that can support a stable or increasing population of Pileated Woodpeckers) out of 103,621 (6%) potential acres of Pileated Woodpecker habitat. The current watershed index (see explanation of watershed indices in III.

"American Marten") is 0.79 with the historic watershed index at 2.63, indicating a high historic level of habitat quality and a current low level of habitat quality and quantity. This watershed currently provides ≥ 40% of the median amount of historic source habitat and is above the threshold necessary to support Pileated Woodpecker population viability (Penninger and Keowen 2011c). The weighted index of this watershed is 17,033, which, when compared to other watershed indices, indicates this watershed provides habitat of the quality, quantity, and distribution to support a self-sustaining and well-distributed Pileated Woodpecker population.

Sheep Creek Project Area

Although Pileated Woodpeckers will use many habitat types, successful reproduction is typically tied to Old Forest Multi Structure (OFMS) source habitat. Pileated Woodpecker source habitat was assessed for the Sheep Creek analysis area using four variables; potential vegetation group, canopy closure, number of canopy layers and tree size, as defined by Penninger and Keown (2011c). Potential vegetation groups include dry Douglas fir, dry grand fir, cool moist and cold dry. Canopy closure is generally greater than 40% in the dry vegetation types and greater than 60% in the cool and cold types. Canopy layers included both single and multi-story and tree size is defined as 20" dbh or greater. Source habitat for Pileated Woodpeckers within the Sheep Creek analysis area is approximately 1,604 acres, (5%) of the project area. Surveys during the 2018 field season consistently found pileated sign in dry and moist OFMS stands.

LRMP standards and guidelines

The LRMP requires that a 300-acre pileated feeding area be established in proximity to any patch of MA15 ≥ 300 acres and that at least 2 snags > 10" dbh/acre be maintained within the feeding area. The Regional Forester's Eastside Forest Plan Amendment #2 (SCREENS) requires the maintenance of snags and GTR trees >21" dbh at 100% potential population levels; at least 2.25 snags/acre are needed after post-sale activities are completed to meet the 100% level. The SCREENS require a higher density of snags compared to the LRMP and, therefore, designation of a 300-acre pileated feeding area as identified in the LRMP is exceeded by SCREENS directions. Within the Sheep Creek Project area, there is one stand of trees designated MA15 that is >300 acres.

There will be no direct adverse effects to Pileated Woodpeckers from alternative 1 because no timber harvest, fuels treatments, or transportation activities will occur. Existing source habitat for Pileated Woodpeckers would remain unchanged. The no-action alternative maintains potentially unsustainable conditions in warm, dry LOS forests where there have been large transitions from shade-intolerant to shade-tolerant species. In the near-term, these denser forests with greater structural complexity may be highly attractive to Pileated Woodpeckers. However, large uncharacteristic wildfires could render this habitat unsuitable.

Alternatives 2 and 3

Summary: Because this project impacts less than 0.3% of suitable habitat across the Forest, the overall direct, indirect and cumulative effects will result in a small negative effect to pileated habitat. The reduction of habitat would be immeasurable at the Wallowa-Whitman scale. Post-treatment availability of source habitats would continue to exceed the threshold of 40% of the historical amount in the Upper Grande Ronde watershed under all action alternatives, thereby continuing to contribute to habitat distribution and species viability on the Wallowa-Whitman.

Direct and Indirect Effects

Both timber harvest and prescribed fire treatments within and outside timber harvest units would occur in Pileated Woodpecker source habitat under all action alternatives. Thinning harvest

treatments are expected to increase average stand diameter due to removal of trees primarily in smaller size classes, but across all size classes less than 21 inches DBH for Alternatives 2 and 3. Treatments that retain canopy closures that meet the definition of source habitat would remain as source habitat. However, due to the possibility of minor snag reductions for logging safety, and potential consumption of downed logs and snags during post-treatment prescribed fire units, treatments that retain sufficient canopy closures are expected to degrade, but still function as source habitat. Although some habitat elements could be reduced, sustainability of habitats is expected to increase as stand density reductions lower the risk of disturbance such as stand-replacement fire, especially in warm, dry forest types. Table 46 shows acres and percent of source habitat proposed for treatment under each alternative.

Table 46. Summary of Proposed Treatments in Pileated Source Habitat in the Sheep Creek Project Area

	Treatment Type by Alternative in Acres (% of Source Habitat)			
	Alternative 2		Alternative 3	
Existing Source Habitat	Commercial	Non-commercial	Commercial	Non-commercial
1,604 acres	177 acres (11%)	289 acres (18%)	3 acres (0.001%)	177 acres (11%)

Treatments proposed under Alternative 2 would affect the largest amount of pileated source habitat. Harvest activities may alter 11-18% of pileated source habitat within the Sheep Creek project area for approximately 20 years until canopy closure recovers and snags and logs begin to be recruited. Fuels activity could reduce structural complexity in the understory of pileated source habitat, but it will still meet the requirements for source habitat as long as down wood standards continue to be met.

Retention of all snags except for safety concerns minimizes the potential for direct impacts to nesting Pileated Woodpeckers. In the long-term, accelerated tree growth due to lower stocking densities is expected to develop large trees, and consequently large snags, at a faster rate than untreated areas. While long-term availability of total snag numbers may decrease, available snags will on average be larger in treatment units compared to untreated areas (See snag analysis).

Activities that increase overall human presence and project-related noise levels, including system road reconstruction as well as timber harvest, may temporarily displace Pileated Woodpeckers locally in the short-term (i.e. during implementation), but are not expected to impact distribution or productivity within the project area in the long-term.

Pileated Woodpecker Habitat at the Watershed Level

Watershed indices reported by Wales (2011) and further assessed by Penninger and Keown (2011c) for the existing condition showed that the Upper Grande Ronde watershed low amount of source habitat compared to historical conditions. Treatments proposed under Alternative 2 and 3 would reduce the amount of source habitat available in the watershed by 3% and 0.05%, respectively.

Post-treatment availability of source habitats would continue to exceed threshold of 40% of the historical amount in the Upper Grande Ronde watershed under all action alternatives, thereby continuing to contribute to species viability at the watershed scale.

Pileated Woodpecker Habitat at the Wallowa-Whitman Scale

Existing Pileated Woodpecker source habitat on the Wallowa-Whitman as modeled by Wales

(2011) totals 129,943 acres. As a result of projected habitat loss under the Sheep Creek project, source habitats would be affected by a maximum of 466 acres. This results in a reduction in source habitat of 0.3% at the Forest level.

Cluster analysis used to describe existing distribution of source habitats across the Wallowa-Whitman indicates that these habitats are well distributed across the Forest (Penninger and Keown 2011c). Post-treatment levels of source habitat under both Sheep Creek action alternatives result in no change in the number of watersheds in Cluster W3 containing >40% source habitat that contribute to Pileated Woodpecker habitat distribution.

Cumulative Effects

Effects of past activities including road construction, fire suppression, prescribed fire, and timber management on Wallowa-Whitman lands have been incorporated into the existing conditions for amounts and locations of source habitats in the analysis area.

Cumulative impacts of ongoing and foreseeable actions within the next 5 years from the present which overlap in time and space with the Sheep Creek project and create a potentially measurable effect were considered. Ongoing and future livestock grazing is expected to have no effect on suitable habitats. Additional grazing may occur in treated stands within the project area, but is not expected to alter source habitats. On Forest Service lands within and outside the project area, firewood cutting will continue to reduce available snags and logs, but the effect is primarily limited to areas adjacent to open roads. Limiting public motor vehicle use to designated roads, trails and areas has the potential to reduce the miles of open roads where firewood gathering can reduce snags and logs. Timber harvest on private inholdings is expected to continue at some level, with anticipated reductions of trees larger than 10” dbh. Lands to the south of the project area will continue to consist of open grassland habitats in private ownership.

Wales et al. (2011) estimated that approximately 359,608 acres of source habitat existed on the Wallowa-Whitman historically. At the time of the analysis, approximately 206,374 acres (57% of estimated historical conditions) of source habitat occurred on the Wallowa-Whitman. Since the viability assessment was run 17 Vegetation/Fuels Restoration projects have been analyzed across the Wallowa-Whitman. Some have been implemented and some are still undergoing the NEPA process, but are anticipated being implemented in the foreseeable future. These combined projects, including the Sheep Creek Vegetation Management project, anticipate commercially impacting 3,454 acres of pileated source habitat and non-commercially impacting 10,039 acres of pileated source habitat. Taking these 13,493 acres of impacted source habitat into account, this results in approximately 192,881 acres (53% of estimated historical conditions) of source habitat existing on the Wallowa-Whitman. Cumulatively, vegetation management activities on the Wallowa-Whitman are not expected to change the viability outcome found by Wales et al. and pileated source habitat will remain distributed frequently as patches and in low abundance (Viability outcome C).

6) Connectivity

The SCREENS provide direction for connectivity. Old growth stands are to be connected in a least two different directions by the shortest length, with a minimum 400 ft. wide corridor maintaining canopy cover in the upper one-third of the site potential. If this standard cannot be met, proposed treatments are dropped.

According to the SCREENS Forest Plan Amendment (U.S. Forest Service 1995), connectivity corridors do not necessarily meet the same description of “suitable” habitat for breeding for old

growth species, but allows free movement between suitable breeding habitats. Identifying these connective corridors ensures blocks of habitat maintain a high degree of connectivity between them, and do not become fragmented in the short-term. Connective corridors between patches of old growth structures have been identified on a map on file at La Grande Ranger District. These connective corridors are forest stands identified to provide connectivity between old-growth stands at a small scale.

Alternative 1

Distribution of Old Forest Multi-Strata (OFMS) stands and Old Growth (Management Area 15) areas, marten source habitat (due to its identified high canopy cover), slope, aspect and soil type were used to identify watershed level landscape scale corridors and permeability (different from the fine-scale connective corridors between old-growth stands). These areas of connectivity are primarily found in the southeast portion of the project area. These corridors contain the majority of the old growth and MA15 found within the Sheep Creek project area and occur on north and north-east facing slopes. These areas have the greatest potential productivity and ability to provide high levels of canopy cover and multi-level complexity. These areas were built into the project design to allow the landscape to continue to provide movement corridors for marten between sub-watersheds with high levels of marten source habitat.

This alternative would have no direct effect on connectivity between Late Old Structure (LOS) habitat patches. . In the absence of silvicultural treatments ,or large scale disturbances the connective corridors will continue to increase in canopy closure and structural complexity maintaining the current level of connectivity. This condition in cold and moist upland forests can enhance connectivity for species like American marten. Conversely, dry upland forests are inherently less structurally complex than cold and moist upland forests. In the absence of silvicultural treatments to reduce tree stocking, these stands would continue to allow the establishment of shade tolerant grand fir, increased canopy closure, and increased stress to competition for resources. In the long-term (30+ years) these drier stands would be subjected to increased risks from wildfire, insects and diseases with tree mortality in numbers and distribution that could negatively affect connectivity between patches of LOS habitat.

Alternatives 2 and 3

Summary: The incremental effects of prescribed burning, non-commercial thinning, and mechanical fuels reduction would be immeasurable relative to the quality and function of connective corridors.

Direct and Indirect Effects

Alternative 2 and Alternative 3 would reduce the quality of connectivity corridors on 154 acres and 84 acres respectively by reducing the canopy closure and structural complexity. Silvicultural prescriptions in connective corridor units would reduce competition between residual trees, increase tree growth rates, and increase trees' ability to defend against insects and diseases, while retaining levels of canopy closure and structural complexity to facilitate movement of wildlife between old-growth habitat patches. Fuel treatments will reduce the complexity of the stand but won't affect canopy cover in existing high canopy cover stands. Treatments in identified connective corridors will maintain stands in the upper third of their site potential for canopy closure.

Cumulative Effects

Alternative 2 would impact more acres than Alternative 3. It is unknown whether the level of treatments would compromise connectivity to a level that leads to isolation or fragmentation of wildlife habitat. However, the riparian habitat conservation area network, M15 areas, and the remaining forest matrix would combine to facilitate varying degrees of connectivity between distant LOS habitat patches.

7) Snag and Log Habitat: Primary Cavity Excavators (PCEs)

Alternative 1

The Eastside Mixed Conifer (EMC) wildlife habitat types (WHT) occur in the analysis area. Results of the DecAID distribution analysis are displayed in Figures 2-3. Reference condition derived from DecAID unharvested vegetation plots in the Blue Mountains (see analysis file, Mellen-McLean et al. 2017). Tolerance levels for woodpeckers are displayed in Table 47).

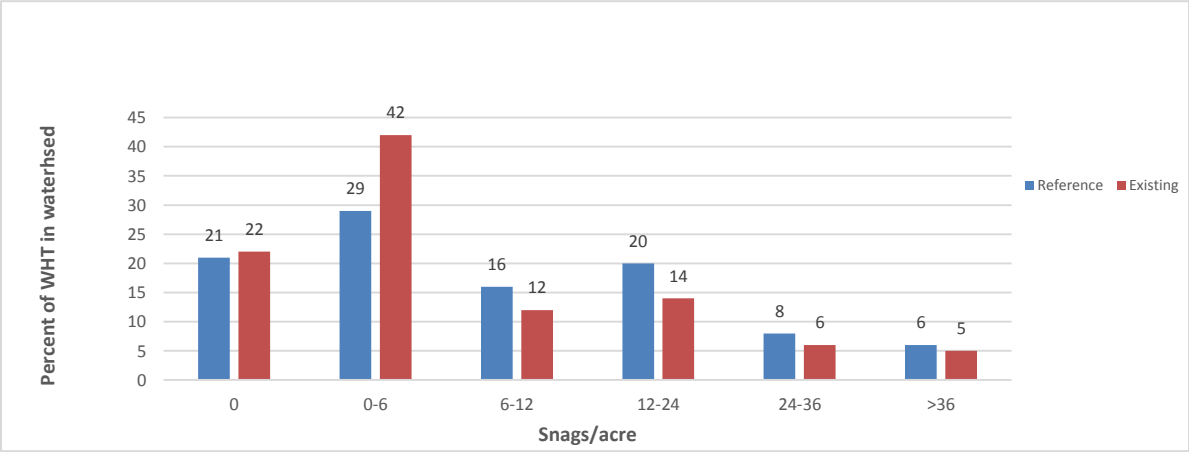

Figure 2. Density of snags with 10-20" dbh for reference and current conditions in the EMC WHT portion of the Upper Grande Ronde Watershed.

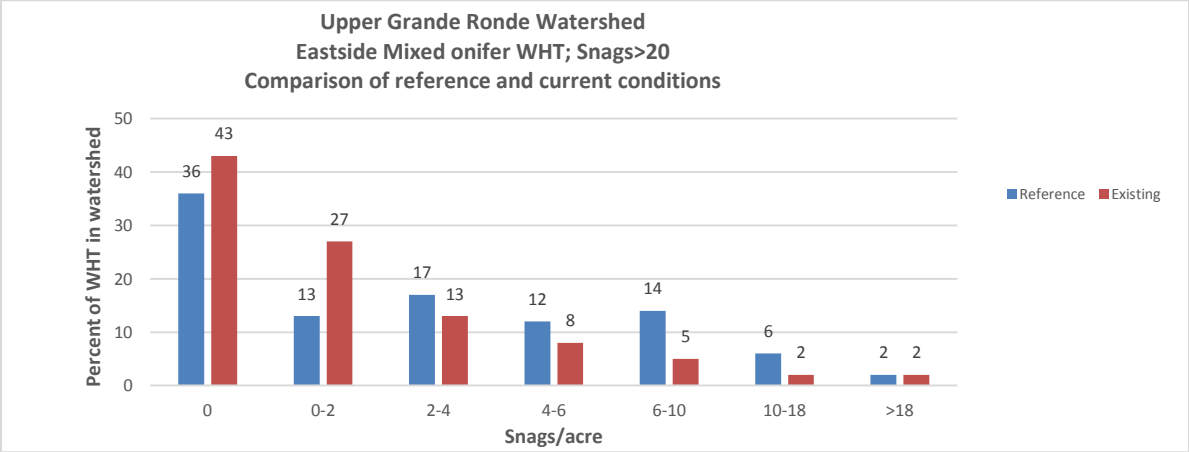

Figure 3. Density of snags with >20" dbh for reference and current conditions in the EMC WHT portion of the Upper Grande Ronde Watershed.

Table 47. Tolerance levels for woodpeckers occurring in the EMC Wildlife Habitat Type (From DecAID Tables EMC_S/L.sp-22 and EMC_PF.sp-22; Mellen-McLean et al. 2017)

Species	Snag density/acre for 30%, 50%, 80% tolerance levels	
	>10” dbh	>20” dbh
White headed woodpecker	0.3, 3.9, 11.9	0.5, 1.8, 3.8
Pygmy nuthatch	1.1, 5.6, 12.1	
Black-backed woodpecker	2.5, 13.6, 29.2	0.0, 1.4, 5.7
Williamson’s sapsucker	14.0, 28.4, 49.7	3.0, 8.4, 16.3
Pileated Woodpecker	14.9, 30.1, 49.3	3.3, 8.6, 16.6

In the Eastside Mixed Conifer Wildlife Habitat Type (WHT), the landscape is deficient in large snag (> 20” dbh) density classes above 2 per acre , as compared to reference conditions (Figure 2). Snag habitat for cavity-nesting birds is generally below reference conditions for densities of both large (>20”) and small (>10”) snags as more area is within the snag density class of 0 snags/acre than would be expected. In the higher density classes, especially the highest density classes, the area is currently below reference condition (Figure 1, 2). These snag density classes (in deficit) provide habitat above the 30% tolerance level for Pileated Woodpecker and Williamson’s sapsucker. Large snag habitat for those two species may be limiting in this WHT and the 2 woodpeckers may be limited to more productive sites in this WHT where snag densities are expected to be higher (Bull et al. 2007, Ohmann and Waddell 2002). The amount of the landscape in the highest density classes for snags from unharvested stands (DecAID data) may be somewhat inflated due to an excess of dense stands with smaller trees susceptible to mortality than likely occurred historically. In addition, the data used in the calculation of reference conditions are from the late 1990s when spruce budworms were active in the Blue Mountains which created high levels of tree mortality.

There are pockets of high snag density within the project area, particularly in the southwest in the area of the Boundary Fire of 1996. The Boundary fire caused a dramatic, short-term increase in snag numbers, mostly in lodgepole pine and grand fir habitat. Snag habitat occurring within the fire area is serving as intermittent habitat for most cavity excavator species (Saab et al. 2004). The process of tree mortality and snag recruitment are balanced by the processes of snag decay and fall (Everett et al. 1999). It is estimated that about 75% of all snags may fall within 20 years (Keen 1929, Dahms 1949, Parks et al. 1999, and Everett et al. 1999), though field observations show many snags still standing. The effect of the Boundary fire was an immediate increase in snag habitat followed by a slow reduction in available habitat.

This alternative retains the most snag habitat in the short-term and mid-term to the degree that snags would not be reduced for operational reasons or consumed during prescribed burning as in the action alternatives.

Stands containing larger structure trees would continue to provide snag and down wood habitat to meet habitat requirements of primary cavity nesters at least through the short-term (15-25 years). In the absence of stand replacement fires, down wood levels would continue to increase. Stands within the analysis area logged in the early 1990s would provide snag habitat in the long- term. Tree mortality in overstocked stands will increase fuel loadings, increasing the likelihood of stand replacement fires. This would benefit species like black-backed and hairy woodpeckers in the short term, but would reduce or eliminate habitat for pileated, white-headed, and downy woodpeckers less associated with fire.

Alternatives 2 and 3

Summary: Current availability of snags in the project area indicate deficiencies in large snag densities within the Eastside Mixed Conifer Habitat Types, though habitat remains for all species at the 50% tolerance level. All proposed activities are consistent with Forest Plan standards and guidelines pertaining to primary cavity excavators. Timber harvest and prescribed burning under all action alternatives have the potential to decrease snag densities, but that impact is expected to be minor within the project area and the landscape as a whole. Prescribed fire has the potential to increase snags through fire-related tree mortality. Current burn plans typically estimate up to 10% mortality providing future pulses of snag habitat in prescribed fire units.

Harvest treatments will result in lower levels of green tree recruitment, but recruitment levels meet Forest Plan standards and exceed recommendations (Bull et al. 1997, Harrod 1998). Stand density treatments in conifer stands are expected to enhance habitats for northern flicker, pygmy nuthatch, white-breasted nuthatch, and Williamson's sapsucker green tree habitats. Although treatments would improve habitats for these species within the project area, the effect to habitats Forest-wide would be minor considering that the project area encompasses only <1% of the Wallowa-Whitman acres. Proposed tree density reduction treatments would reduce risk to insect and wildfire disturbance on up to 11,598 acres within the project area, thereby reducing the potential for future pulses of habitat suitable for Lewis', hairy, and black backed woodpeckers. No alternative considered for the Sheep Creek project would affect population trends or viability for primary cavity excavator species at the Forest level. Direct and Indirect Effects

Non-commercial

Project activities will not remove any snags >12" except when they pose a danger to personnel. Non-commercial fuels treatments are not expected to negatively affect snag densities; though in the long-term pre-commercial thinning is expected to provide larger snags, similar to commercial thinning. Snags lost in prescribed burns are often replaced with new snags from trees killed during the fire. Proposed fuels activities (removing small trees, retaining large trees, prescribed burning) are expected to help create habitat for PCEs using open forests with large trees in the long-term and reduce habitat for those PCEs using dense forests.

Prescribed burning creates a period of reduced "soft snag" habitat that persists into the early mid-term. This can cause wildlife species depending on such structures, such as Pileated Woodpeckers, to move to other areas in search of suitable habitat, resulting in lower productivity and reduced local populations. Although burning would likely reduce the densities of snags and down logs, the burn plan is designed to protect large snags through unit preparation and lighting pattern. The function of snag and log habitat in the analysis area is not likely to be compromised by burning given the considerations built into the prescription. Prescribed fire can create new snags and logs to replace some of the small to medium diameter material that may burn.

Commercial

Four different types of commercial treatments proposed for the Sheep Creek project area are expected to affect future recruitment of snags. Models were run using the Forest Vegetation Simulator (FVS) looking at different treatments on different stands in the dry, moist and cold forest types to evaluate effects to snags comparing no treatment and treatment after 30 and 50 years.

All commercial treatments will reduce the density of snags on the landscape in the short and the long-term. Treatments are designed to improve the health of the stand, reducing competition, insect and disease mortality in turn reducing snag recruitment. After 30 years, a treated area has a range of 9-28 snags/acre as opposed to 16-76 snags/acre in an untreated area, and after 50 years a

range of 7-35 snags/acre is found in treated areas compared to 20-70 snags/acre in untreated areas. These ranges in the treated areas still meet the minimum thresholds for primary cavity excavators and still meet forest plan standards for ecologically appropriate numbers. With treatment, snag size tends to be larger than without treatment. The average dbh of snags in treatment areas after 30 years is 11.2" as opposed to 8.8" dbh. Fifty years after treatment, the average dbh in treated stands is 12" dbh compared to an average dbh of 10" in untreated stands. Treatments increase the growth rate of the remaining trees, thus increasing the amount of large trees in the mid to long-term, benefiting PCE's as large snags are limiting on the landscape in all wildlife habitat types except Ponderosa Pine/Douglas-Fir.

Each Alternative proposes differing amounts of commercial treatment and non-commercial treatments (Table 15). Alternative 2 proposes the highest amount of commercial treatments, 11% of the project area. This alternative would have the highest short-term negative effect on the overall density of snags in the project area but long-term would provide the greatest positive effect on large snag recruitment. Alternative 3 proposes the least amount of commercial treatments, 4% of the project area. This Alternative would have the least short-term negative effect on the overall density of snags in the project area, but would also have the lowest positive effect on large snag recruitment. All alternatives would maintain snag levels above forest plan standards and provide habitat for PCE's at least at the 50% tolerance level (i.e., an estimated 50% of the population of PCE's would utilize stands with the levels of maintained snags proposed in each alternative). .

Table 48. Comparison of proposed commercial and non-commercial treatments between Alternatives. Percentage is percent of project area.

Treatments	Measure	Alternative 1	Alternative 2	Alternative 3
Commercial	Acres % Project Area	0	3,367 11%	1,308 4%
Non-commercial	Acres % Project Area	0	8,231 27%	6,060 20%
Total Commercial/ Non-Commercial	Acres % Project Area	0	11,598 39%	7,368 24%
Prescribed Fire	Acres % Project Area	0	9, 521 32%	9,521 32%

Cumulative Effects

The list of past, present and foreseeable actions was reviewed to determine potential effects to dead and defective wood habitat. Effects of past activities including road construction, fire suppression, prescribed fire, and timber management on Wallowa-Whitman and BLM lands have been incorporated into the existing condition. Firewood cutting will continue to reduce available snags and logs, but the effect is primarily limited to areas adjacent to open roads. Roads temporarily open for harvest activities will temporarily increase firewood cutting activities and snag densities in those areas will go down, though it is illegal to take snags > 21 inch dbh. Precommercial thinning activities on adjacent private lands would not directly affect current snag levels but are expected to reduce future snag densities and increase average snag diameter while

still maintaining Forest Plan snag standards. Timber harvest on private inholdings is expected to continue at some level, with anticipated reductions of trees larger than 10” dbh and snag densities are expected to decline.

8) Neotropical Migratory Bird Species

Alternative 1

Bird Conservation Region (BCR)-10 includes the Northern Rocky Mountains and outlying ranges in both the United States and Canada, and the inter-montane Wyoming Basin and Fraser Basin. The Rockies are dominated by a variety of coniferous forest habitats. Drier areas are dominated by ponderosa pine, with Douglas-fir and lodgepole pine at higher elevations and Engelmann spruce and subalpine fir even higher. More mesic forests to the north and west are dominated by eastern larch, grand fir, western red cedar and western hemlock. In 2000, the Oregon-Washington Chapter of Partners in Flight published its Northern Rocky Mountains Bird Conservation Plan (Altman 2000). The plan provides conservation recommendations for the various species of landbirds occupying the Oregon and Washington portions of the Interior Columbia Basin. For the Sheep Creek project, dry forest, mesic forest, subalpine forest and montane shrubland habitat exist. Formal surveys have not been conducted specifically for any of these species within the Sheep Creek analysis area, although terrestrial birds were monitored in the Blue Mountains from 1994-2011 as part of the U.S. Forest Service Avian Monitoring Program, as well as multiple annual breeding bird survey route through the La Grande and Baker districts (Sauer et al. 2011). Table 16 details migratory species of concern that may occur within the Sheep Creek analysis area and key habitat needs.

Table 49. Migratory species of conservation concern identified within the Sheep Creek analysis area

Focal Species	Key Habitat Relationships	
	Vegetation Species	Habitat Structure
Dry Forest		
Flammulated Owl	Ponderosa pine, Douglas-fir	Old forest with grassy opening and dense thickets
Chipping Sparrow	Ponderosa pine	Short-statured herbaceous understory with scattered sapling pines
White-headed Woodpecker	Ponderosa pine	Large patches of late-successional forest with heterogeneous canopy cover
Moist Mixed Conifer Forest		
Townsend’s Warbler	Grand fir, Douglas-fir	High canopy cover and foliage volume
Olive-sided Flycatcher	Grand fir	Open conifer forests (<40% canopy cover), edge and openings with scattered trees
Orange-crowned Warbler	Riparian vegetation, fir	Patches of a dense understory shrub layer, low canopy lift, and younger, more open stands
Williamson’s Sapsucker	Grand fir, spruce, lodgepole pine	Large snags, coniferous trees, dead and downed wood
MacGillivray’s Warbler	Grand fir, riparian vegatation	Patches of a dense understory shrub layer

There will be no direct adverse effects from Alternative 1 because no timber harvest, fuels treatments, or transportation activities will occur. Existing habitat would remain unchanged. The project area would continue to increase in risk to uncharacteristic insect outbreaks and fire potentially to degrading connectivity between watersheds, in light of the already reduced habitat

conditions. Species that depend on dry forest, specifically old forest single-story habitat, would continue to experience suboptimal habitat. Though there would be no direct effects, habitat conditions that favor high-density forest stands may not be sustainable in the long-term.

Alternatives 2 and 3

Summary: All action alternatives have the potential to directly impact migratory bird species, due to potential nest tree removal during the nesting season. The level of impact is unknown, but potential is highest for Alternative 2. Project design criteria reduce the potential for direct impacts to nesting land birds.

The action alternatives have the potential to directly impact neotropical migratory bird species due to potential nest tree removal during the nesting season. Implementing project work outside of nesting season limits the potential for direct impacts to nesting land birds. All action alternatives would decrease available moist OFMS with >70% canopy cover with Alternative 2 removing the most, though levels are still within HRV for OFMS.

Alternative 2 improves dry forest habitats by restoring old forest single-story structure, thereby benefiting land birds associated with this habitat type. It would decrease available moist old forest multi-story with >70% canopy cover. The proposed action alternatives will not affect population viability for any migratory bird species due little change within HRV values.

Direct and Indirect Effects

Both timber harvest and prescribed fire would occur in potential migratory bird habitat under both action alternatives. Thinning harvest treatments are expected to increase average stand diameter due to removal of trees primarily in smaller size classes, but across all size classes less than 21 inches for Alternatives 2 and 3. Due to the possibility of minor snag reductions for logging safety, and potential consumption of downed logs and snags during post-treatment prescribed fire units, treatments retaining sufficient canopy closures are expected to degrade high-canopy closure habitat, but still function as habitat. Although some habitat elements could be reduced, sustainability of habitats is expected to increase as stand density reductions lower the risk of disturbance such as stand-replacement fire, especially in warm, dry forest types. Alternative 2 will treat more acres and riparian habitat, whereas alternative 3 will not treat moist or cold upland forests and will not treat riparian zones. Species-specific impacts are listed in Table 50.

Table 50. Impacts to habitat of migratory species of conservation concern within the Sheep Creek analysis area

Species	Impacts to Habitat		
	No Action	Alt 2	Alt 3
Flammulated Owl	Potential source habitat would continue to be unsuitable due to high densities of small diameter trees.	Conversion of 2,960 acres to OFSS are proposed under this alternative. Treatments are expected to encourage habitat, by reducing densities of small diameter trees, encouraging the growth of larger trees and snags and creating heterogeneous openings of grassland. Proposed treatments would increase OFSS stands but would still be well-below HRV.	Conversion of 1,229 acres to OFSS are proposed for treatment, meaning the under-represented OFSS that this species depends upon would continue to persist at levels well-below HRV.

Species	Impacts to Habitat		
	No Action	Alt 2	Alt 3
Chipping Sparrow	Potential source habitat would continue to be unsuitable due to high densities of fir spp., out-competing shade-intolerant pine saplings.	Conversion of 2,960 acres to OFSS are proposed under this alternative. Although ponderosa pine saplings would be negatively impacted in the short-term, creating a more open canopy will allow this shade-intolerant species increased seed germination and recruitment into the sapling stage.	Conversion of 1,229 acres to OFSS are proposed for treatment, meaning the under-represented OFSS that this species depends upon would continue to persist at levels well-below HRV.
White-headed Woodpecker	Potential source habitat would continue to be unsuitable due to high densities of fir spp., out-competing shade-intolerant pine saplings.	Conversion of 2,960 acres to OFSS are proposed under this alternative. Large snags in the softwood stage are essential to nesting and will not be affected by this alternative unless individual trees pose a safety concern. Mature ponderosa that produce prolific pinecones provide important winter forage and will benefit from this proposed alternative by elimination of encroaching tree species that compete for resources with ponderosa.	Conversion of 1,229 acres to OFSS are proposed for treatment, meaning the under-represented OFSS that this species depends upon would continue to persist at levels well-below HRV.
Townsend's Warbler	High density stands will continue to provide nesting and foraging habitat.	Commercial treatment proposed on 3,367 acres within moist late-successional forest will reduce existing >70 canopy cover, though all >21" dbh trees will remain. Habitat is expected to be unsuitable for Townsend's Warbler until stand develops high canopy closure again. OFMS acres remain within HRV with this treatment.	Commercial treatment proposed on 1,308 acres within will reduce existing >70 canopy cover, though all >21" dbh trees will remain. Habitat is expected to be unsuitable for Townsend's Warbler until stand develops high canopy closure again.
Olive-sided Flycatcher	Suitable habitat condition would continue to be absent until suppression mortality created gaps and edge habitat.	Variable density thinning would create more diverse stand conditions and accelerates growth of larger trees that may become snags. Forest gaps would increase understory growth, contributing to increased insect production over the next 20 years. Increased forest edge habitat would also enhance foraging opportunities. Gaps created by thinning may allow foraging until the canopy eventually closes again and these opportunities are lost. Under Alternative 2 HPO (gap opening) thinning is proposed in 276 acres of moist and cold mesic forest.	Variable density thinning would create more diverse stand conditions and accelerates growth of larger trees that may become snags. Forest gaps would increase understory growth, contributing to increased insect production over the next 20 years. Increased forest edge habitat would also enhance foraging opportunities. Gaps created by thinning may allow foraging until the canopy eventually closes again and these opportunities are lost. Under Alternative 3 HPO (gap opening) thinning is proposed in 72 acres of moist and cold conifer forest.
Orange-crowned Warbler	Existing conditions would continue to provide habitat for this species due to an excess of UR compared to HRV.	1,250 acres of commercial and 3,949 acres of non-commercial cold upland forest habitat is proposed for treatment. Tree removal would create openings where shrub component for foraging and nesting could persist until the canopy cover increases and closes in 10 to 20 years.	418 acres of commercial and 2,767 acres of potential habitat is proposed for treatment. Tree removal would create openings where shrub component for foraging and nesting could persist until the canopy cover increases and closes in 10 to 20 years.
Williamson's Sapsucker	Existing conditions would continue to provide suitable habitat for the Williamson's Sapsucker at the HRV, but important aspen habitat would continue to be encroached upon by conifer species.	The proposed action alternative would reduce dead and down materials, but will maintain a minimum of 7-15 tons/ac per project design criteria. 297 acres of riparian areas would be treated, addressing conifer encroachment issues. Large snags will be protected under this proposed alternative.	This alternative would have similar impacts of alternative 2, but would treat only 36 acres of riparian area.

Species	Impacts to Habitat		
	No Action	Alt 2	Alt 3
Willow Flycatcher	Conifer encroachment within riparian zones would continue, precluding necessary shrub component from developing.	Alternative 2 proposes 261 acres of commercial and 36 acres of non-commercial treatments within identified RHCAs. Treatments will reduce density of conifers within riparian zones and encourage riparian shrub growth. And additional 115 acres of treatment within lodgepole pine and fir stands will encourage shrub growth.	Alternative 3 proposes treatment of 36 acres within riparian zones. Conifer encroachment within riparian zones would continue, precluding necessary shrub component from developing. Treatment within lodgepole pine and fir stands encouraging shrub growth will not occur.
MacGillivray's Warbler	Existing conditions would continue to provide habitat for this species due to an excess of UR compared to HRV.	Alternative 2 proposes 261 acres of commercial and 36 acres of non-commercial treatments within identified RHCAs. Treatments will reduce density of conifers within riparian zones and encourage riparian shrub growth.	Conifer encroachment within riparian zones would continue, precluding necessary shrub component from developing. Only 36 acres of riparian zone treated.

Cumulative Effects

Effects of past activities including road construction, fire suppression, prescribed fire, and timber management on Wallowa-Whitman lands have been incorporated into the existing condition. Livestock grazing is expected to continue within the analysis area. Habitat improvements afforded by the action alternatives for chipping sparrow may also increase access of areas to livestock and brown-headed cowbirds. The potential for increase in nest parasitism is expected to be most pronounced in areas adjacent to existing cattle operations and agriculture on private lands along the southern boundary of the project area.

Timber harvest on adjacent private lands is expected to continue, with little availability of late and old forest structure and large snags anticipated. Therefore, habitat on National Forest lands will be increasingly important as habitat on private lands is reduced.

Wildlife Biological Evaluation

Only those Proposed, Endangered, Threatened, or Sensitive species or habitats known or suspected to occur in or immediately adjacent to the analysis area are addressed in this Biological Evaluation.

I. Columbia Spotted Frog (*Rana luteiventris)*

Alternative 1

A study conducted from 1997-2004 in northeastern Oregon found that the frog is widely distributed throughout northeastern Oregon where permanent ponds and rivers or creeks occur, and although populations are generally not large, numerous small ones occur, particularly when connected by flowing water (Bull 2005). Egg mass surveys are conducted annually along the Upper Grande Ronde and its tributaries, including Sheep Creek. Sheep Creek contains a number of historical breeding ponds and pit tag surveys along a section of Sheep Creek were conducted in 2018, to provide baseline surveys for a stream restoration project. Populations appear to be steady within the Upper Grande Ronde.

Under this alternative, the risk of uncharacteristic wildfire or disease/insect outbreaks would continue to increase naturally over time because there would be no changes to stand stocking levels (currently overstocked) or fuel loads from active management. Assuming no

uncharacteristic wildfire or disease/insect outbreaks conifer encroachment on meadows and over streams could lower water temperature on breeding ponds, reducing habitat for spotted frogs. Uncharacteristic wildfires could affect spotted frogs and their habitat by burning through riparian areas and removing existing trees, aspen, and other riparian vegetation that is currently shading streams, preventing erosion and sedimentation, and keeping banks stable.

Alternatives 2 and 3

Discussion of these alternative is combined because the effects would be similar. There would be no direct effects to spotted frogs from treatment activities because no treatments would take place within the stream or breeding pond sites. Alternatives 2 and 3 propose 36 acres of meadow restoration treatments intended to remove encroaching small diameter conifers from a meadow system. This will maintain the meadow as stream restoration projects works to restore the hydrologic function on the floodplain. Commercial and fuels treatments in the uplands would create forest conditions more resilient to future disturbances and allow for fire to return to the system and maintain healthy systems, with Alternative 2 proposing to treat more acres than Alternative 3.

Cumulative Effects

Determination

Proposed project activities under Alternatives 2 and 3 are expected to have a **Beneficial Impact (BI)** due to the meadow restoration treatment. Other reasonably foreseeable activities within spotted frog habitat areas include continued stream restoration activities aimed at reconnecting channels to floodplains to restore key floodplain processes. Restoration and reconnection of floodplains is anticipated to improve habitat availability for spotted frogs and other amphibians over time through maintenance and creation of slow/still water habitats.

II. Bald Eagle (*Haliaeetus leucocephalus*)

Alternative 1

Bald Eagles are known to occupy Vey Meadows (a large privately owned ranch that occurs within the northern part of the project area) during winter and spring. The project area contains several streams including, Sheep and Chicken, potentially utilized by bald eagles for occasional foraging.

There will be no direct adverse effects to bald eagles from the No Action Alternative because no timber harvest, fuel treatments, or transportation activities will occur.

Alternatives 2 and 3

Discussion of these alternatives is combined because effects would be similar. Potential impacts to bald eagles are similar under all action alternatives because no timber harvest or active lighting of prescribed fire will occur within 300 feet of perennial fish bearing streams under any alternative, and log hauling and smoke from fuels treatments will occur under all action alternatives. Potential foraging in the project area could occur at Sheep Creek, although the likelihood of occurrence is low based on the lack of reported sightings. Intermediate treatments within one mile of Sheep Creek may benefit future bald eagle nesting habitat by accelerating tree growth and reducing risk of stand disturbance due to insect-outbreak and wildfire. Smoke generated by fuels treatments may be of sufficient density to temporarily displace foraging eagles, but the impact would be of short duration. Increased human activity along portions of Sheep

Creek due to log hauling and transportation-related activities may displace foraging eagles if present in close proximity to activities. However, the impact would be localized and temporary. In addition, risk of disturbance to foraging bald eagles is low for all activities due to a lack of past occurrence in the project area. If bald eagle use of the project area changes, this new information would be assessed and mitigations developed to protect newly discovered nests or roost sites.

Cumulative Effects

The area considered for cumulative effects is the project area, as well as the area within one mile of the project area boundary. One mile is the distance described as a threshold for disturbance of nesting bald eagles (USDA Forest Service 2009) and would encompass shorter disturbance distance for foraging eagles. All of the activities in Appendix D of the EA have been considered for their cumulative effects on bald eagles and their habitat. Ongoing and foreseeable activities considered in this cumulative effects analysis include firewood cutting, travel of open roads, summer and winter recreation, livestock grazing, and prescribed fire activities outside the project area. No measurable cumulative impacts to bald eagles are expected from the proposed project due to lack of negative impacts to available perching habitat and restrictions imposed by the Migratory Bird Treaty and Bald and Golden Eagle Acts that would prevent activities that disturb eagles or their nests on both private and public land.

Determination

All action alternatives would have no effect on bald eagle nesting or winter foraging/roosting. Due to the low level of eagle foraging activity along Sheep Creek, increased smoke levels due to fuels treatments and increased human presence associated with project activities **may temporarily displace individuals, but will not likely contribute to a trend towards Federal listing or cause a loss of viability to the population or species (MIIH).**

III. Lewis's Woodpecker (*Melanerpes lewis*)

Alternative 1

No surveys have been specifically conducted for Lewis's woodpecker, however incidental sightings have been reported along the Grande Ronde River. No sightings have been recorded within the project area boundary. While its presence in the project area is unknown, the presence of ponderosa pine forest indicates potential habitat may exist. It may occur in the ponderosa pine and riparian habitat along Sheep and Chicken creek. The project area is almost completely lacking in Old Forest Single Story (OFSS) characteristic of old ponderosa pine forests. Large ponderosa pine, western larch and Douglas-fir snags are uncommon in the project area because of past timber management, road building and firewood cutting. A snag analysis showed that snags >21" dbh are deficient in most abundance classes across most of the project area (see Wildife Specialist Report). There are remnant cottonwood within riparian habitat, though many are currently being suppressed by lodegepole pine and grand fir.

Under this alternative, the risk of uncharacteristic wildfire or disease/insect outbreaks would continue to increase naturally over time . Sound live trees that are killed by fire often do not contain the rot and defects that exists in snags and logs that die more slowly from other causes and it can take several years before the sapwood of fire-killed trees begins to soften enough for excavation (Bull et al. 1997). The impact to habitat would depend on the size and severity of the disturbance. Riparian habitat would continue to be deficient in hardwoods.

Alternatives 2 and 3

Alternative 2 and 3 propose commercial and non-commercial treatment within existing OFMS to move those stands to a single story structural stage, as well as treatments within stands of understory reinitiation to encourage large tree growth and development of OFSS. Alternative 2 would directly treat more acres than Alternative 3 and neither alternative would remove any trees over 21" dbh. In the short term, disturbance from treatment activities might cause individual birds to shift spatially, but over the mid to long term these alternatives would increase potential habitat across the project area . The proposed treatments (removing small trees, retaining big trees, and underburning) would promote dry forest restoration and over the long term would move the project area toward open stands of single-story, mature ponderosa pine and Douglas-fir. Additionally, Alternatives 2 and 3 propose treatment within specific riparian habitat, removing competition around existing hardwoods and reducing stand density to promote larger tree growth. Alternative 3 proposes approximately 40 fewer acres or RHCA treatment.

Long-term reductions in potentially available burned habitat are expected in both action alternatives, but would be offset by a relatively steady availability of suitable green stands. In the long-term, maintenance burning would reduce shrub availability temporarily, but shrub growth and development that support insect prey populations is expected to occur between burning treatments.

Table 51. Treatment with Dry PVG stands and Riparian habitat

Treatment Type by Alternative, Acres, Sheep Creek Project Area				
	Alternative 2		Alternative 3	
	Comm.	Rx Fuel Only	Comm.	Rx Fuel
OFMS to OFSS	68 acres	160 acres	0 acres	142 acres
UR to OFSS	606 acres	532 acres	371 acres	462 acres
RHCA	13 acres	248 acres	0 acres	0 acres
Meadow	0 acres	36 acres	0 acres	0 acres

Cumulative effects

Past, ongoing, and future activities affecting Lewis's woodpecker habitat include grazing, fire suppression, prescribed fire, logging and woodcutting, and have been incorporated into the existing conditions. Lewis woodpeckers have relatively small home ranges (15 acres, Thomas 1979) and the cumulative effects are analyzed at the project level. Grazing has the potential to reduce shrub presence in suitable stands, but the predicted degree of impact is unknown.

Determination: Increased smoke levels from fuels treatments and increased human presence associated with project activities **may temporarily displace individuals, but will not likely contribute to a trend towards Federal listing or cause a loss of viability to the population or species (MIIH).** Effects from Alternative 2 and 3 are expected to have a **Beneficial Impact (BI)** on the species through habitat creation, with Alternative 2 having a greater impact than Alternative 3.

IV. White-Headed Woodpecker (*Picoides albolarvatus*)

Alternative 1

The white-headed woodpecker is an uncommon permanent resident in forests of the Ochoco, Blue, and Wallowa Mtns. Past, present, and ongoing habitat loss pose a threat to the continued existence of the species throughout its range (Wisdom et al. 2000). The amount of old-growth ponderosa pine left in Oregon is unknown, but it is probably less than 10% of what occurred in pre-European settlement (Marshall 1997). Among the most significant and greatest declining wildlife habitat in the Interior Columbia Basin is late and old-growth forest structure. Wisdom et al (2000) concludes that source habitat for most species declined strongly from historical to current periods across large geographic areas, that the steepest declines were for species dependent on low elevation, old forest habitats, and that the white-headed woodpecker has experienced the sharpest reduction of any species associated with late and old forest habitat. Much of the remaining late and old forest structure exists in isolated remnant stands. The loss has occurred mainly through a combination of timber harvest, road building, and wildfire. Motorized access into these areas increases the potential for disturbance and habitat fragmentation, and reduces habitat quality through the removal of snags and logs by firewood cutters (Wisdom et al 2000).

A Region 6 developed Habitat Suitability Index model (Latif et al. 2017) helps identify potential existing habitat within the forest. White-headed woodpecker surveys were conducted using this HIS to identify suitable habitat along the north and north-east portion of the project area where treatment is expected, paired with a control transect outside the project area boundary. Hairy woodpeckers and pileated woodpeckers were located but no white-headed woodpeckers were encountered. Baseline surveys allow for additional surveys after treatment to better understand the impacts of our treatments.

Under alternative 1, the risk of uncharacteristic wildfire or disease/insect outbreaks would continue to increase naturally over time . Conversely, wildfire would likely also produce snags, but newly created snags are usually hard and not easily excavated. Sound live trees killed by fire often do not contain the rot and defects existing in snags and logs that die more slowly from other causes. The impact to habitat would depend on the size and severity of the disturbance.

Alternatives 2 and 3

Alternatives 2 and 3 propose commercial and non-commercial treatment within existing OFMS structure stages to move those stands to a single story structure stage, and treatments within the understory reinitiation structure to encourage large tree growth and development of open single story structures. Alternative 2 would directly treat more acres than Alternative 3. No trees over 21” dbh would be removed under either alternative. In the short term, disturbance from treatment activities might cause individual birds to shift spatially, but these alternatives would increase the potential of the project area to provide habitat. The proposed treatments (removing small trees, retaining big trees, underburning) for these alternatives would help in dry forest restoration and over the long term would move the project area toward open stands of single-story, mature ponderosa pine and Douglas-fir. Treatments in potential white-headed woodepcker habitat would begin to restore dry old forest single strata (OFSS) by removing smaller trees to promote the desired development of large ones. Activities would reduce tree densities but increase the rate of development of the large trees needed by white-headed woodpeckers. Long-term reductions in potentially available burned habitat are expected, but would be offset by a relatively steady availability of suitable green stands. In the long-term, maintenance burning would reduce shrub

availability temporarily, but shrub growth and development supporting insect prey populations is expected to occur between burning treatments.

Table 52. Proposed Treatment in Dry PVG, OFMS and UR structure stages

Treatment Type by Alternative, Acres, Sheep Creek Project Area				
	Alternative 2		Alternative 3	
	Comm.	Rx Fuel Only	Comm.	Rx Fuel
OFMS to OFSS	68 acres	160 acres	0 acres	142 acres
UR to OFSS	606 acres	532 acres	371 acres	462 acres

Cumulative effects

Past activities that have affected white-headed woodpecker habitat include grazing, fire suppression, prescribed fire, logging and woodcutting and have been incorporated into the existing conditions. White-headed woodpecker home ranges are moderate in size, averaging about 257-524 acres in old-growth habitat (Dixon 1995) and the cumulative analysis was analyzed at the project scale. Ongoing and future activities that may affect white-headed woodpeckers is grazing. Livestock grazing has the potential to limit shrub densities which may reduce risk due to nest predation, but the degree of benefit is unknown. None of these effects are expected to be significant because they are not likely to impact habitat availability at this scale. The Sheep Creek project is not expected to contribute to negative cumulative effects to white-headed woodpeckers.

Determination

Effects from Alternative 2 and 3 are expected to have a **Beneficial Impact (BI)** on the species through habitat creation, with Alternative 2 having a greater impact than Alternative 3.

V. Canada Lynx (*Lynx canadensis*)

Alternative 1

The Blue Mountains represent the southern extent of lynx distribution, helping explain the rarity of this species on the periphery of its range both historically and presently. The presence of lynx in Oregon in the late 1800s and early 1900s is documented by 9 museum specimens collected from 1897 to 1927 (McKelvey et al. 2000). Records after that are rare. Only 4 recent specimens are known, one from Wallowa County in 1964, one from Benton County in 1974, and one from Harney County in 1993 (McKelvey et al. 2000). Based on limited verified records, lack of evidence of reproduction, and occurrences in atypical habitat that correspond with cyclic highs, lynx are thought to occur in Oregon as dispersers that have never maintained resident populations. They are considered an infrequent and casual visitor by the state of Oregon (Ruediger et al. 2000).

Lynx habitat in northeastern Oregon is categorized as a “peripheral area”, meaning there is no evidence of long-term presence or reproduction that might indicate colonization or sustained use by lynx, but that it may enable the successful dispersal of lynx between populations or subpopulations. The Forest is considered “unoccupied” habitat because there has not been a verified lynx observation since 1999. “Occupied” habitat is defined as requiring at least 2 verified

observations or records since 1999 on the Forest or evidence of lynx reproduction on the Forest.

The No Action alternative would have no direct, indirect, or cumulative effects on lynx or lynx habitat since no management activities are proposed.

Determination

There would be **No Effect (NE)** to the Canada lynx from any of the alternatives for this proposed project because this species is not considered present on the Forest (Wallowa-Whitman National Forest Lynx Strategy Letter April 19, 2007).

VI. Gray Wolf (*Canis lupus*)

Alternative 1

The WWNF occurs within the historic range of the gray wolf, but no breeding packs have been identified as using the project area (ODFW personal communication). Potential habitat and adequate prey occurs throughout the project area, and movement through the project area is likely.

There would be no direct, indirect, or cumulative impacts to wolves under the no-action alternative because no project activities would occur.

Alternatives 2 and 3

The primary threats to wolves are human disturbance, mortality from shooting and vehicle collisions (Wisdom et al. 2000). Primary concerns for the Forest Service are 1) disturbance to denning or rendezvous sites, and 2) providing adequate habitat for populations of prey species such as elk (USDA Forest Service 2009).

Neither of the action alternatives would affect wolves or their habitat because there is an abundance of prey and prey is not a limiting factor, and most FS management activities are compatible with breeding wolf populations with relatively minor considerations for disturbance at dens and rendezvous sites. No known den or rendezvous sites are located within the Sheep Creek project area. For all action alternatives, treatments are not expected to impact big game prey availability (see Rocky Mountain Elk discussion).

Cumulative Effects

Because the home range of a colonizing wolf population can average 301^2 miles (Bangs and Fritts 1993) with dispersal movements up to 522 miles (Boyd and Pletscher 1999), the Upper Grande Ronde watershed (756^2 miles) defines the cumulative effects analysis area. The only activity with potential cumulative impacts to wolves would be the implementation of a new Forest Plan and/or travel management plan. Management of motor vehicle use within the analysis area could have a positive effect on the distribution of elk, a primary prey resource for wolves. Reduced road densities distribute elk across seasonal ranges during the proper season and may reduce the likelihood of wolves coming into contact with livestock on private lands. Ongoing livestock grazing on WWNF lands in the watersheds presents the potential for wolf-livestock interaction on these lands. However, potential wolf-livestock interaction is not cumulative to activities proposed under this project, because project activities are not expected to affect wolves.

Determination

There would be **No Impact (NI)** to the gray wolf from any of the alternatives from this project due to a lack of effects resulting from management activities.

VII. California Wolverine (*Gulo gulo*)

Alternative 1

Adjacent wilderness areas including the Eagle Cap and North Fork John Day Wilderness are the nearest potential natal denning sites. There are no known den sites on the Forest (USDA Forest Service 2009). The Forest conducted extensive winter track surveys for wolverine and lynx from 1991 to 1994, and no wolverine tracks were found on what was formally-called the Pine RD, presently part of the Whitman RD (Wolverine and Lynx Winter Snow Track Reports, 1991-92, 1992-93, 1993-94). Surveys conducted on the WWNF during the winter of 2010/2011 detected 3 different wolverines, one of which was located in the southern Wallowa Mountains, across the Grande Ronde valley from the Sheep Creek project area. Nearly all of the project area is well-roaded, facilitating human disturbance through access by motorized vehicles. Existing suitable habitat is located primarily in roadless and wilderness areas.

There will be no direct impacts to wolverine from the No Action Alternative because no timber harvest, fuels treatments, or transportation activities will occur.

Alternatives 2 and 3

Discussion of these alternatives is combined because the effects would be similar. Due to higher temperatures and increased summer human traffic, it is unlikely that wolverines would occupy portions of the project area that lie at lower elevations, south of the northern boundary, but movement through the project area is possible. The lack of lingering snowpack within the project area also minimizes the potential for wolverine denning. Forays into the project area would be more likely during the winter when human presence decreases due to snow, and potential food sources such as large ungulates move to lower elevations. Timber harvest operations, if conducted during the winter, could impact local presence and pattern of wolverine via disturbance, but impacts would be temporary.

Cumulative Effects

Wolverines have large home ranges, estimated from studies in central Idaho to range from 26,000 to 128,000 acres (Banci 1994); corresponding to a cumulative effects area encompassing the project area and lands within a distance of 4.5 miles. Present and reasonably foreseeable future actions were analyzed for cumulative impacts to the species. Review of the FACTS database for the WWNF indicate that activities that may impact wolverine habitat within the Upper Grande Ronde watershed and outside the project area within the next 10 years consist of underburning, pre-commercial thinning, and commercial harvest. Because wolverines are known to avoid roaded areas, these activities within roaded areas are unlikely to impact the species.

Of the activities listed in Appendix D, ongoing access and human use within and proximate to the project area, may continue to preclude at least seasonal use by this species.

Determination

Past road construction has provided human access to portions of the project area that may have been utilized by wolverine historically. Activities proposed by the action alternatives would be undertaken primarily during the snow-free months when human presence is high and wolverine use unlikely. Winter timber harvest operations may impact presence and pattern of individual wolverine via disturbance. Project activities would not impact core habitats located in wilderness or roadless areas. Therefore, all action alternatives **may impact individuals or habitat, but will not likely contribute to a trend towards Federal listing or cause a loss of viability to the**

population or species (MIIH).

VIII. Fringed Myotis (*Myotis thysanodes*)

Alternative 1

There is no known records of fringed myotis in the project area. There are no known roost sites, or hibernacula or maternity colonies in the project area. While its occurrence in the project area is unknown, the presence of ponderosa pine forest and permanent water indicate potential habitat may exist.

Under this alternative, the risk of uncharacteristic wildfire or disease/insect outbreaks would continue to increase naturally over time. Assuming no uncharacteristic wildfires or disease/insect outbreaks, this alternative would limit habitat by perpetuating overstocked stand conditions. If uncharacteristic wildfire or disease/insect outbreaks occurred, the impact to habitat would depend on the size and severity of disturbance.

Alternatives 2 and 3

If fringed myotis occur in the project area, mechanical treatments and/or smoke from prescribed fire could result in the deaths of individual bats or cause them to shift spatially when foraging, but these treatments would also likely create habitat. Thinning stands typically benefits bats by increasing flight space in the stand and by promoting herbaceous growth for insect prey by increased sunlight reaching the forest floor (Taylor 2006). Fire can also improve foraging space and travel corridors by decreasing tree density and increased openings enhancing insect prey diversity and abundance by increasing plant growth. Roosting habitat would not be substantially affected as no snags > 9” dbh or trees > 21” dbh (these trees represent future large snags) would be cut unless identified as imminent danger trees.

Cumulative effects

Ongoing and reasonably foreseeable activities within or near the project area include firewood cutting, grazing, prescribed fire, noxious weed treatment, road maintenance, and recreation (snowmobile, OHV use, mountain biking, dispersed camping, hunting). Of these activities, the ones that have the potential to impact roost trees are firewood cutting and prescribed fire. Firewood cutting occurs primarily along roads and does not target snags or trees over 21 inches dbh so it should not have a measurable effect on roost site availability. Prescribed fire outside the project area could eliminate suitable roost sites in addition to the roost sites that would be eliminated from burning and harvest within the project area. However, prescribed fire is staggered across multiple years and the area will continue to provide a mosaic of burned and unburned habitat and thus provide an abundance of roost sites for this species.

Determination

Alternatives 2 and 3 **May Impact Individuals or Habitat (MIIH)** but would not likely contribute to a trend towards Federal listing or cause a loss of viability to the population or species.

IX. Fir Pinwheel (*Radiodiscus abietum*) and Shiny tightcoil (*Pristiloma wascoense, Pristiloma idahoense*)

Alternative 1

Recent surveys on the Wallowa-Whitman National Forest (2016-2019, Blevins et al.) found all three species distributed in low numbers across the forest. A simple analysis of variation found no statistical difference in slope, aspect, elevation and canopy cover variables for these three species and they were often found together on the same survey site. As such, it seems reasonable to combine them for an effects analysis. These species were more often found on ash soil types, within multi story structure stages in the moist potential vegetation group, with canopy cover higher than >70% (Personal communication, L. Navarrete). Surveys were conducted within the Sheep Creek project area and neither of these species were found, however detectability rates are low and the presence of moist Douglas-fir, grand fir and riparian habitat makes potential habitat likely. Using the variables identified as correlating with species presence, potential habitat was mapped out within the project area.

There would be no direct impacts to this species under the no-action alternative due to a lack of proposed management activities. The risk of uncharacteristic wildfire or disease/insect outbreaks would continue to increase naturally over time because there would be no changes to stand stocking levels or fuel loads from active management. If uncharacteristic wildfire or disease/insect outbreaks occurred, the impact to habitat would depend on the size and severity of disturbance

Alternatives 2 and 3

Proposed treatments that reduce canopy cover can result in increases in microclimate extremes, changes in forest vegetation and litter, soil compaction and population fragmentation. In addition, fuel treatments often result in reduction of coarse woody debris (Kappes 2005). No treatments are proposed within the stands identified as potential habitat based on correlated variables, however there are treatments in some stands with high canopy cover. No treatments in high canopy cover areas are expected to bring the stand level canopy cover below 40%. One exception is creation of some gap openings removing those acres from functioning as snail habitat. The majority of prescriptions will utilize variable retention thinning with less of an impact on gastropod communities than complete removal of trees. Maintaining patches of trees provides microhabitats and lowers the harvest related loss of organisms (Jordan and Black, 2012). Alternative 3 would reduce less acres of high canopy cover than Alternative 2

Prescribed burning can have a negative effect on terrestrial mollusks depending on the severity and often it can take up to 25 years for re-colonization. Intense fire events can even require a century for post-fire recolonization. There is no difference in proposed prescribed fire between alternatives, but Alternative 2 is expected to reduce wildlife hazard in the project more due to a higher number of acres treated.

Table 53. Proposed Treatments in >70% Canopy Cover Moist PVG Habitats

Treatment Type by Alternative, Acres, Sheep Creek Project Area			
Alternative 2		Alternative 3	
Comm.	Rx Fuel Only	Comm.	Rx Fuel
201 acres	383 acres	74 acres	141 acres

Cumulative Effects

Frest and Johannes (1995) describe logging of high canopy cover moderate-elevation Douglas fir forest, grazing, and severe forest fires as the highest threats to the fir pinwheel (Frest and Johannes 1995). Grazing will continue within the project area in traditional areas, with no additional areas proposed under this project and is therefore not an overlapping activity of the proposed action. Vegetation and fuel treatments are expected to reduce the risk of high severity fires in the future and there are no other proposed project activities expected to impact the fir pinwheel. Due to a lack of overlapping activities, no cumulative impacts are expected.

Determination

Given the habitat and distribution descriptions provided by Frest and Johannes, this species and its habitats potentially occur within the project area. Vegetation management treatments could affect habitats by reducing moisture retention in areas and directly causing mortality through prescribed fire. However, by utilizing variable tree thinning, retaining canopy cover in patches within each treatment area, and understanding that prescribed fire is extremely variable and will not affect all habitat in the area it is utilized, it is expected that this project **may impact individuals or habitat but will not likely cause a trend toward Federal listing or a loss of viability of the population or species for *radiodiscus abietum, pristiloma wascoense* and *pristiloma idahoense* (MIIH)**.

X. Western Bumblebee (*Bombus occidentalis*), Suckley Cuckoo Bumblebee (*Bombus suckleyi*)

Alternative 1

Historically B. occidentalis and B. suckleyi were found from the Pacific coast to the Colorado Rocky Mountains, but have seen severe population decline west of the Sierra-Cascade Crest. In Oregon, this species has been documented on Deschutes, Fremont-Winema, Malheur, Mt. Hood, Ochoco, Rogue River-Siskiyou, Siuslaw, Umatilla, Umpqua, Willamette, and Wallow-Whitman National Forests, and BLM land in the Burns, Lakeview and Medford Districts. Given the relatively recent range contraction for these species, it is unknown what the current "Documented" status is for many of these field units, as many of the documented sites are considered historic. Surveys conducted on the La Grande district 2014-2015 found B. occidentalis to be low in abundance, but present at about 50% of the surveyed sites. These same surveys only located B. suckleyi in two locations.

Surveys were conducted within the Sheep Creek project area. Neither species were encountered.

Under this alternative, the risk of uncharacteristic wildfire or disease/insect outbreaks would continue to increase naturally over time because there would be no changes to stand stocking levels or fuel loads from active management. Large stand replacing fires do have the potential to reduce available habitat in the short term for this species, though fire has been shown to be beneficial for pollinators (Panzer 2002). The impact to habitat would depend on the size and severity of the disturbance. Without active management, conifer encroachment into meadows would reduce the amount of habitat for bumblebees.

Alternatives 2 and 3

Discussion is combined because effects of alternatives would be similar. Thinning can increase gaps in the canopy facilitating positive understory plant diversity and cover, helping to increase food resources. Thinning over large areas should result in increased cover of understory plants

which provides larger food patches with increased connectivity. However, heavy machinery can disturb and compact the soil negatively effecting ground nesting bumblebees. Fire is positively correlated with plant diversity and pollinator visitation, with significant differences found in floral visitation rates between burned and unburned areas (Nuland et al.) However, prescribed fire can negatively affect immature bumblebees confined to the nest through direct mortality. Fire can also indirectly affect bumblebees by burning litter and coarse woody debris used as nest sites. Proper timing of prescribed fire is important to maximize its benefits. Fall burning occurs during the mobile stage of the bumblebee life cycle and is likely to have the least negative impact (Nyoka 201). Fuels treatments would reduce the risk of stand replacing fire and encourage the return of low severity fire that can enhance meadow habitat and forb species.

Cumulative effects

Past events that affected potential bumblebee habitat include grazing and fire suppression and have been incorporated into the existing conditions. Present and proposed activities within the project area with a potential to affect bumblebees are a continuation of the current level of livestock grazing and prescribed burning. There could be cumulative effects from these alternatives they would be limited spatially and temporally.

Determination

A benefit to the species is expected by reducing canopy cover, however due to the uncertainty over how mechanical treatments and prescribed fire might affect nesting and hibernation habitat the alternatives **May Impact Individuals or Habitat (MIIH)** but would not likely contribute to a trend towards Federal listing or cause a loss of viability to the population or species for Western bumblebee or Suckley cuckoo bumblebee.

Soils

Alternatives 1, 2, and 3 are summarized below. Resource indicators and measures used to assess the different alternatives are found in Table 54.

Table 54. Resource indicators and measures for assessing soil effects

Attribute	Indicator	Measure	Used to address: P/N, or key issue?	Source (LRMP S/G; law or policy, BMPs, etc.)?
Productivity	Detrimental Soil Conditions	Acres previously harvested areas proposed for treatment	No	LRMP, FSM, NFMA, Multi-Use Sustained Yield Act
		Acres of detrimental soil conditions		
	Droughty Soils	Acres of droughty soil types proposed for treatment		
	Sensitive Soils	Acres of sensitive soil types proposed for treatment		
Erosion	Erosion Potential	Tons/year of hillslope erosion modeled from WEPP		
		Acres of proposed treatment activities on soils with high erosion potential		
		Miles of temporary roads on soils with high erosion potential		
Slope Stability	Landslide	Acres of proposed treatment activities on		

	Potential	landslide prone areas		
		Miles of temporary roads on landslide prone areas		

Alternative 1

Table 55. Existing Resource Conditions

Resource Element	Resource Indicator	Measure	Existing Condition
Soil Productivity	Detrimental Soil Conditions	Acres of previously harvested areas	23,079
		Acres of detrimental soil conditions	1,488
	Droughty Soils	Acres of droughty soil types	5,797
	Sensitive Soils	Acres of sensitive soil types	22,650
Soil Erosion	Erosion Potential	Tons/year of hillslope erosion modeled from WEPP	0.33
		Acres of soils with high erosion potential	14,007
		Miles of temporary roads on high erosion potential soil	0
Slope Stability	Landslide Potential	Acres of landslide and landslide prone areas	1,518
		Miles of temporary roads on landslide and landslide prone areas	0

Soil Productivity

Alternative 1 (No Action) would not cause short-term effects on the soil resource over and above existing condition. No additional road building, timber harvest, prescribed burning, or fuel reduction would disrupt natural soil processes.

Physical Soil Characteristics

Alternative 1 would not cause soil compaction, rutting, puddling, or soil displacement. Undisturbed soils would remain so. Soil productivity in areas where past timber management compacted soils would slowly improve as plant roots, soil organisms, and freeze-thaw events loosen the soil. Most soil disturbances would recover after 70 years (Gonsior, 1983). Sites that are slightly compacted would recover in fewer than 70 years. Displaced, rutted, and puddled soils would have reduced productivity for a longer time than compacted soils.

Organic Matter

Standing dead trees would eventually fall over and contribute coarse woody debris and additional organic material would be recruited through natural mortality. Fine-woody debris would remain on site. Soil organisms would decompose the organic materials adding humus to the soil. Nutrients associated with this material would slowly become available for plant growth. As the tree canopies close and shade the soil surface, decomposition rates would slow, allowing organic matter and nutrients to accumulate on the soil surface. This process would continue until another major disturbance, such as fire or a windstorm, opens the tree canopy and speeds up the recycling process again.

Soil Biological Activity

Microorganism populations would fluctuate with the changes in microclimate and supply of organic matter on the soil surface. These changes would be in response to the changing vegetation as a result of natural events such as fire, wind throw, and other sources of natural vegetation mortality. Any changes would be buffered by the capability of the soil microbial communities to adapt to changing conditions on very short time scales (Schmidt et al., 2007).

Soil Erosion

Soil erosion would naturally decrease with Alternative 1 as vegetation returns to soils currently lacking plant or other effective ground cover. Wildfires could cause short-term increase in soil erosion. Soil erosion rates would fluctuate with natural changes in vegetation and associated ground cover.

Soil Stability

Alternative 1 would not change the risk of mass failures within the project area. Most slopes are considered stable. Mass failures are unlikely with no management actions.

Table 56. Slope stability within the project area

Slope Stability in Project	Acres
Stable Areas	28,223
Potential Landslide Areas	781
Mapped Landslide Areas	737

Alternatives 2 and 3

Project Design Features and Mitigation Measures are located on p. 21 of the EA.

Soil Productivity

Physical Soil Characteristics

Table 6 in the soils specialist report shows the expected new and total Detrimental Soil Conditions (DSCs) for proposed action alternatives in this project. The final DSCs were calculated by adding existing DSCs with anticipated project-induced DSCs. Alternative 2 has 63 units and Alternative 3 has 31 units expected to exceed the standard threshold of 20 percent DSCs due to existing high levels of DSC. Soil rehabilitation activities would occur after ground-based activities are completeincluding decompaction of landings and used or old skid trails to bring DSCs below 20% (Soil PDC 2). If decompacting is not feasible then equipment would only operate under winter harvest conditions to limit additional DSC (Soil PDC 2). If none of these actions are feasible, then that treatment area would be excluded from mechanical activities. All action alternatives will ensure soil productivity moves toward a net improvement in soil quality. Limiting ground-based operations to dry, snow covered, or frozen ground would provide additional soil protection. Grapple piling and burning generates minimal DSCs. Hand treatments would not be expected to result in any additional detrimental impacts. Direct and indirect effects to physical soil characteristics may be less in RHCAs, because PDCs were developed to reduce ground-disturbing impacts and by operating under suitable ground moisture conditions (Soil PDC 9) and limiting heavy equipment in RHCA's to existing disturbed roadbeds.

This project will implement pre and post monitoring of any units identified for tethered logging. Any units identified as having slope instability will be excluded from treatment. Project design criteria and mitigations have been developed, in part, based on observations from other forests in the region (see Soil PDC 8). Regional observations showed lower detrimental impacts than ground based commercial thinning. Out of caution, the DSCs for this project were calculated to reflect ground-based thinning impacts until future monitoring is completed in Blue Mountain forests.

In Alternatives 2 and 3, there are up to 4.5 miles of temporary roads proposed with approximately 4 miles of new temporary road construction. Upon completion of use, all temporary roads will be rehabbed and will follow mitigation measures listed in (Soil PDC 14).

Non-system roads within the project total approximately 30 miles (43 acres). This project will prioritize KV funds for rehabilitation of non-system historic or user-created road templates that still exist on the landscape within the project area.

Several studies discuss the effectiveness of subsoiling as a soil restoration activity. Seedling survival and growth can be improved by 39 percent after decompacting soils (Froehlich and McNabb, 1983). Subsoiling restores biological processes reduced by soil compaction (Dick et al., 1988). In general, tilling or scarifying a compacted soil improves productivity by reducing the resistance of soil to root penetration and providing improved soil drainage and aeration to enhance seedling establishment and tree growth (Bulmer, 1998). These conditions also improve the environment for soil microorganisms. Soil restoration is not the immediate result of ripping, planting, or any other activity. The goal of soil restoration is to create favorable conditions for impaired soils to begin the recovery process.

Organic Matter

All proposed units would leave live vegetation. Most of the living grass, forb, and shrub components would be retained in each of the proposed activity areas. Many live trees would remain on each of the sites. The material that remains in each of the activity areas would provide an active, microorganism-rich organic layer on the soil surface. Coarse woody debris (greater than three inches in diameter) would be retained at approximately 5 to 10 tons per acre on dry ponderosa pine sites and 7 to 15 tons per acre on mixed conifer sites (Adapted from DeBano, Neary, and Ffolliott, 1998) (Soil PDC 11).

Limiting hand pile size to less than 50 square feet could reduce surface organic horizon loss and limit soil heating. Pile burning when duff is moist or wet can reduce organic matter loss and soil heating (Soil PDC 15).

Under Alternative 2, there are 197 acres of low productivity soils not capable of producing or maintaining adequate fine organic matter if slash is removed. Under Alternative 3, there are 107 acres of low productivity soils not capable of producing or maintaining adequate fine organic matter if slash is removed. Special design criteria will mitigate potential loss of organics on these soils by ensuring fine slash is left on site (Soil PDC 16).

Soil Biological Activity

The amount of detrimental physical soil changes would be minimized and organic matter in various forms would remain on the proposed units, so the effects to soil microorganisms would be minor. Soil microorganisms are mobile. They can quickly re-colonize disturbed sites from adjacent undisturbed sites. A variety of organic matter would remain on all sites, including living

trees and other forest vegetation. In addition, the organic layer on the soil surface would be retained over at least 80 percent of the area, providing habitat and nutrients for soil microorganisms.

Droughty Soils

In Alternative 2, there are 2,049 acres of droughty soil types that will be treated. In Alternative 3, there are 1,322 acres of droughty soil types that will be treated. Treatment on droughty soils to reduce stand densities will help restore soil moisture and plant community ecological processes to adapt to climate change and build forest resiliency.

Sensitive Soils

There are 237 acres of shallow soils (<25cm), considered sensitive, within Alternative 2 activity areas. In Alternative 3, there are 171 acres of shallow soils (<25cm), considered sensitive. Project design criteria specifies shallow, clayey soils and meadows will be avoided unless over frozen ground/snow conditions. Shallow soils won't be used for skid trails, slash piles, or log landings unless no other location is practical and there is an existing prism, in which case ground-based equipment will remain within the existing prism as much as possible (Soil PDC 4 and 7). Shallow soils are often clay dominated, hold onto moisture, and are not appropriate for road use (Soil PDC 4). Operation on these soils will only occur during frozen ground/snow or dry conditions to mitigate compaction and rutting (Soil PDC 3 and 4).

Alternative 2 has 7,500 acres of thick ash cap soils. Alternative 3 has 4,491 acres of thick ash cap soils. These soils are characterized with low bulk density, high porosity, and high water-holding capacity. They tend to be non-cohesive and because of their relatively low strength, are highly susceptible to both vibratory and compressive compaction. Controlling compaction involves use of low impact equipment selection, use of designated skid trails, and limitation of operations to dry seasons or when the ground is frozen. Ground-based activities on ash soils will be mitigated by only operating when ground conditions are dry, frozen, or snow covered (Soil PDC 3).

Alternative 2 has 7,991 acres of soils with an excess of soil moisture either yearlong or on a seasonal basis. Alternative 3 has 4,904 acres of sensitive soils with an excess of soil moisture either yearlong or on a seasonal basis. These soils have an increased potential for compaction and deep rutting and require special design criteria. Spring and early summer harvest on these soils will be avoided, and if this is not possible, ground-based equipment will operate on a bed of slash maintained at >12 inches to mitigate compaction and rutting as much as possible (Soil PDC 5).

In Alternative 2, there are 120 acres of hydric soils, which are wetland soils formed under saturated conditions. In Alternative 3, there are 105 acres of hydric soils, which are wetland soils formed under saturated conditions. When identified during implementation, these soils would be buffered appropriately as wetlands to meet national and regional laws and regulations (see Aquatics Report).

Soil Erosion

The dominant surface erosion hazard when the forest floor has been disturbed with proposed ground-based activities is slight to moderate. Alternative 2 has 441 acres and Alternative 3 has 283 acres of soil types (>1 acre in size) with high erosion hazard. Alternative 2 has 2,000 acres and Alternative 3 has 1,081 acres of soil types (>1 acre in size) with very high erosion hazard.

Together, soils with high and very high erosion potential make up 34% of ground-based activities in Alternative 2 and 31% of ground-based activities in Alternative 3. To reduce surface erosion potential, disturbed areas within these units would be required to have a minimum of 60 to 90 percent effective ground cover following cessation of any soil-disturbing activities (R6 Soil Quality Standard) (Soil PDC 12). Any increase in overland flow from existing areas of compacted soil is likely to be buffered by existing forest floor and/or new accumulations of woody debris.

Alternative 2 and 3 treatments for each hillslope were modeled to determine potential erosion after both thinning and prescribed fire treatments. Alternatives 2 and 3 mean average annual soil loss is 0.33 tons per year (Table 57). By way of comparison, the average annual erosion on Oregon cropland in 2015 was 1.7 tons per acre per year. One ton of soil spread across an acre would be as thick as a dime.

Erosion potential is highest within the first year following ground-disturbance, wildfire, or prescribed fire. This project will be implemented across approximately 10 to 15 years. This makes it very likely that actual erosion rates across the project area will be less than modeled.

Table 57. Potential Soil Erosion modeled in WEPP for Alternative 2 and 3

Alternative	**Potential Erosion Rate** (lb/acre/yr)	**Potential Total Hillslope** Erosion (**tons**/yr)
No Action	0.07	0.3
Alt 2	0.07	0.3
Alt 3	0.07	0.3

Alternative 2 has 3.9 miles and Alternative 3 has 2.5 miles of temporary roads proposed on soils with high erosion hazard. These roads would likely have short-term increases of soil erosion above 0.3 tons per acre per year.

Sediment from the permanent transportation system has direct effects on water quality and is not a component of the soil quality assessment process. These effects are evaluated in the Hydrology Section of this EA.

Soil Stability

A majority of the project area has high rates of slope stability, well-suited for proposed activities. The majority of ground-based treatments are planned for areas with slopes less than 30 percent, which greatly reduces the risk of mass failures. The occurrence of any mass-failure occurring on well-suited slopes from implementation of proposed actions is unlikely. The angle of repose for soils within the project area is 19 degrees, or 34% slope, just above Forest Plan standards for ground-based equipment. All areas with landslide potential will be field validated. If areas are verified as having landslide potential, Blue Mountain PDCs and a buffer will be applied to these areas to mitigate any potential mass movement.

Proposed Treatments

In Alternative 2, there are 663 acres of proposed treatments in areas with landslide potential. In Alternative 3, there are 357 acres of proposed treatments on existing landslide areas. Prior to implementation all treatments areas with landslide potential will be field validated.

Road Activities

In Alternative 2 and 3, there are 0 miles of temporary roads proposed in landslide prone areas. There are system roads that do transect some of landslide prone areas and they have and will continue to require more frequent ditch cleanout and road maintenance.

Cumulative Effects

The risk of cumulative effects was assessed within each proposed activity area. Cumulative effects consist of the impacts from all past, present, future, and proposed activities overlapping in time and space within the project area. The estimated cumulative effects for each activity area from implementation of an action alternative are displayed in Table 58. These predicted cumulative detrimental soil condition values are based on implementation of all required Project Design Criteria (PDC). See associated PDCs for the Soil Resource on p. 21.

Blue Fly Fuels reduction will not overlap within Sheep Creek units, however soil impacts may occur within Blue Fly units. Winam-Frazier OHV trails fall within the project area.

OHV use is permitted on most roads within the project area and cross-country. Cross-country travel and OHV use could create limited areas of soil compaction, displacement and puddling but would be too limited in aerial extent to measure and unlikely to measurably increase in the foreseeable future. Trail maintenance could create limited areas of soil displacement and puddling but would be too limited in aerial extent to measure, and unlikely to measurably increase in the foreseeable future. The Trail Wildlife Enhancement Closure Area would reduce OHV and cross-country travel within the closure area for part of the year, which reduces the potential for soil impacts.

Dispersed camping occurs primarily during hunting season and can occur throughout the project area since there is currently no restriction on cross-country motorized travel. Dispersed camping could create limited areas of soil compaction and displacement but primarily would occur within already disturbed areas or would be too limited in aerial extent to measure.

Firewood cutting and Danger Tree Removal could create limited areas of soil compaction, displacement, and puddling from skidding trees and off-road wood retrieval but would be too limited in aerial extent to measure.

Road maintenance within the road prism right-of-way is not part of the productive land base, therefore soil productivity concerns are not applicable. National BMPs will be implemented to ensure erosion control measures and slope stability. Road maintenance improves long-term road drainage and sediment delivery concerns.

There is active grazing in the Sheep Creek Ranch Allotment. There is potential for cattle access into project units that were previously inaccessible, however impacts would be too limited in extent to measure. Most grazing impacts are within riparian areas and water development areas. Grazing impacts could occur within areas of riparian proposed activities; however, this is limited in extent. Grazing impacts near water development areas could have limited areas of compaction or trampling of soil, however the potential soil impact would be too limited in aerial extent to be counted in DSC calculations (Page 3 of Region 6 Supplement No. 2500.98-1, USDA Forest Service, 1998).

Private land activities don’t overlap with project activities, so direct and indirect soil impacts are not expected within NFS lands. These ongoing and reasonably foreseeable activities are not

expected to add to adverse cumulative watershed effects for the soil resource because of their limited aerial extent.

Table 58 display the total acres of detrimental soil conditions expected from the proposed activities. The action alternatives are designed to reduce the amount of detrimental soil conditions by implementing the project design features described in Chapter 2.

Table 58. Detrimental Soil Conditions by Alternatives

Description	Alternative 2	Alternative 3
Acres of DSC from Past Activities	1,488	908
Acres of DSC from Proposed Activities	403	220
Acres of Cumulative DSC	1,891	1,129

Restoration efforts would be undertaken in units where DSCs are expected to exceed 20 percent. Restoration activities to improve soil conditions would include ripping heavily used skid trails and landings. The goal would be to reduce soil compaction and meet the direction provided in Region 6 Supplement 2500-98-1. Several studies discuss the effectiveness of ripping as a soil restoration activity. Seedling survival and growth can be improved by 39 percent after tilling of compacted soils (Froehlich et al., 1983).

Duration of Effects

Displacement and erosion, the loss of topsoil, is a long-term and potential permanent loss of soil productivity. However, management practices outlined in the Design Criteria would reduce the occurrence of displacement and erosion to within the Region 6 Soil Quality Standards and Guidelines.

Compaction may last from 10 to 70 years (Gonsior, 1983). Monitoring of 40-year old activities within this project area averaged 13 percent DSC, indicating recovery of compacted soils has occurred.

Reductions in organic matter content reverse quickly as vegetation is established. Organic debris accumulates on the surface and roots grow and are decomposed in the soil. These organic materials break down and release nutrients and improve the quality of the soil by improving its structure and reducing compaction and other DSCs. Loss of organic matter is a short-term change lasting about 10 years once vegetation returns to the soil.

Light and moderate severity burned areas have minor effects well within the natural range of variability for wildfire. Areas burned under conditions that produce light or moderate burn severity would vegetate quickly due to viable seeds or roots that could produce more plants and the complement of microorganisms and nutrients remaining on site (Ryan and Noste, 1985).

Changes in soil microorganisms are not permanent. Recovery would occur as soon as organic matter is present in the soil, which could be immediately after the proposed management is carried out.

Soil erosion would be controlled through erosion control measures. In addition, bare soils would naturally recover or be re-vegetated with native seed. Any erosion that occurs would be short-

lived, most likely occurring during the time between the soil disturbance, implementation of erosion control measures and re-establishment of effective ground cover on exposed soils.

Hydrology

Table 59. Hydrology indicators and measures

Indicator	Measure
Estimated change in Stream Temperature	Acres of treatment within primary shade zone by stream, approximately 50 feet
Estimated change in Sedimentation from transportation system	Miles of temporary road in RHCAs

Summary: On a scale of poor-fair-good-excellent, the hydrologic condition of the Sheep Creek Vegetation Management (Sheep) analysis area is good: low-to-moderate amounts of bank trampling and riparian browse, recent wood additions through stream restoration projects, little evidence of sediment entering streams from roadways, minor reductions to canopy closure in RHCAs for stream restoration projects, and minor recreation impacts. Stream temperatures are elevated above state standards in most streams with the greatest departure in Sheep Creek. Stream restoration efforts are ongoing in Sheep Creek with a goal to reduce stream temperature. Alternatives 2 and 3 differ very little in terms of hydrologic impact.

- No effect to stream temperature
- Minor amounts of sediment generated from maintenance activities and then haul traffic on roads; short term; a small negative impact
- Minor to moderate amounts of sediment generated from opening closed roads, temporary road construction and road reconstruction; short term; a small negative impact (low mileage)
- Increased riparian access and minor amounts of associated bank trampling and riparian browsing; medium term; a small negative impact
- Minute and likely unmeasurable reductions in stream shade; no impact
- Minor reductions in shade within the RHCA; medium term; no impact to small negative impact
- Fewer conifers in the Sheep Creek meadow; medium term; moderate positive impact

Table 60. Indicators and Measures

Indicator	Measure	Alternative 2	Alternative 3
Estimated change in Stream Temperature	Acres of treatment within primary shade zone by stream, approximately 50 feet	0	0
Estimated change in Sedimentation from transportation system	Miles of temporary road in RHCAs	0.1	0

Alternative 1

There would be no direct or cumulative effects to water resources from this alternative. Indirect effects are increased likelihood of extreme fire behavior in riparian areas, accelerated conifer encroachment into riparian meadow systems, and associated undesirable shifts in vegetation and habitat.

Alternative 2

Alternative 2 would involve some thinning in RHCAs. Modeling has shown that stream temperatures are far more sensitive to changes in shade than to changes in air temperature or discharge (Wondzell, et al. 2019). The amount of thinning proposed, however, is not likely to produce measurable reductions in shade for several reasons: (1) no thinning will occur within 50 feet of a stream channel; (2) thinning will only remove some trees beyond that 50-ft no activity buffer; (3) existing trees are not very tall and therefore most trees beyond 50 feet do not contribute directly to stream shade; and (4) there are many trees within that buffer that currently provide shade.

A recently published General Technical Review by the Rocky Mountain Research Station states that riparian areas occupy a small percentage of the natural landscape but have a disproportionate ecological importance relative to the area they occupy (Dwire et al. 2016). Dwire found that while many riparian areas are protected by administrative regulations, they have also been affected by fire suppression, land use, and human disturbance, so manipulative treatments of vegetation and other fuels may be needed in some locations to maintain riparian biodiversity and restore valued functions.

A recent study by Roon, Dunham & Groom (2021) finds that solar radiation is a primary driver of energy budgets in small streams. However, where they performed light riparian thinning treatments (in the Lost Man Watershed) they found no increase in temperature response. This is likely because the treatment produced only 5% change in shade and did not increase solar radiation enough to affect stream temperatures. However, it is also possible that the pervasive groundwater and hyporheic flow in this watershed could have mediated the influence of any increased solar radiation from thinning treatments on stream temperatures. But as we are looking for a way to make forested areas more resilient to wildfire, it is encouraging to note that changes in shade of 5% or less caused minimal changes in temperature while reductions of 20-30% resulted in much larger increases in stream temperature.

One place that we may want to actively treat in the future is in riparian meadow systems. Griffith et al. (2005) found that trees change soil characteristics where they grow, likely through the litter they produce, and in meadows, that change in the biogeochemical cycling appears to rapidly shift soil properties to support more trees rather than grass. After conifers have encroached on a meadow there is limited potential for recovery of most meadow species via the existing meadow seed bank because those seed banks lack 70% of the meadow species, and what remains is mostly just one species, the dominant sedge (Lang and Halpern, 2007; Haugo and Halpern, 2007). Once conifer invasions have begun, positive feedbacks can promote rapid conversion of meadow to forest (Halpern et al., 2010). A more effective strategy for conservation of meadow systems is to remove or kill trees at an early stage before positive feedbacks lead to irreversible changes in soil properties and species composition (Haugo and Halpern, 2007).

Alternative 2 proposes thinning conifers that have encroached on a section of wet meadow along Sheep Creek in Unit 102, aka the Wetland unit. Not all trees will be cut: trees larger than 12” dbh will be retained as will trees that are providing shade, so we are not halting the biogeochemical processes that might favor conversion of the meadow to conifers, but we hope to slow down the process. For the Sheep project we are valuing the possible protection of stream temperatures above the likely protection of meadow ecosystems, but we may decide to do differently in the future.

Treatment in RHCAs

Densiometer measurements taken pre-project in response to this issue in riparian thinning Units 62, 71 and 102 revealed that average canopy closure was 78%, 80% and 19% respectively (Appendix B). Measurements will be taken after thinning in the same locations for pre- and post-project comparison. We expect these values to remain unchanged after project activities.

Ongoing activities that may affect water resources in the analysis area include OHV use on native surface roads when they are wet and partially exposed, dispersed recreation near streams, and firewood gathering on wet roads and creation of user-created roads to access firewood. The effects of these activities are localized and very limited in magnitude. These actions will not be considered in this analysis.

There are eight culverts approved for removal or replacement to improve fish passage as part of this project, and one that is completely plugged on a stored road (5182-040) that will be removed. These culvert projects have short-term sedimentation effects but long-term water resource benefits.

Table 61. Culverts Proposed for Removal or Replacement

FS Road	Stream	Proposed Action
5100-372	Indiana Cr	Remove old log deck bridge
5182-034	East Sheep Cr Tributary	Remove
5182-035	East Sheep Cr	Remove
5182-040	East Sheep Cr Tributary	Remove
5182-100	East Sheep Cr	Remove old log bridge crossing
5182-500	Sheep Creek Cr	Replace with AOP
5182-520	Sheep Junior Cr	Remove and replace with trail bridge
5184-000	Sheep Cr Tributary, lower culvert	Replace with AOP
5184-000	Sheep Cr Tributary, upper culvert	Replace with AOP

The few roads that are actively eroding sediment in the project area are proposed to be maintained to support haul activities. Maintenance activities generate sediment, but over time there would be an overall reduction in chronic sedimentation which would be a positive benefit to water resources. Sediment would also be generated when re-opening 24.5 miles of closed roads, reconstructing 13.4 miles of road and constructing 4 miles of temporary road. All hand piles and grapple piles would be located outside of Blue Mountain PDC no activity buffers (PDC Fish-1) and it is unlikely that sediment from these areas would be transported through those buffers to nearby creeks. Prescribed fire is rarely known to generate sedimentation to creeks.

Alternative 3

Alternative 3 has less treatment area overall, no closed roads opened, no temporary roads constructed and no commercial treatment in RHCAs although the non-commercial treatment in the Wetland Unit would remain. Direct effects of this would be fewer log trucks driving and less sediment generated from road traffic, less sediment generated from road opening, road reconstruction and temporary road construction, no increase in riparian access, and no change to shade in the RHCA, all of which would be incrementally better for water resources.

Cumulative Effects

Sheep Creek Stewardship is the only project with foreseeable future actions that overlap in time and space. This project has the intended effect of benefitting water resources. Other past and present activities in the project area do not contribute to measurable water resource damage individually or combined with the Sheep Project.

The Sheep Restoration and Stewardship project in conjunction with activities proposed in **Alternative 2** would balance out and produce **no cumulative effects**; in conjunction with activities proposed in **Alternative 3** it would produce **a small amount of beneficial cumulative effects**.

Neither Alternative would produce significant cumulative effects.

Climate Change

Mean air temperatures have increased across the last century and this is predicted to continue over the next century due to climate change (USDA, 2017). Effects in the Sheep project area will include changes in precipitation type from less snow to more rain. This will likely lead to decreased snowpack and earlier melt resulting in shifts in both peak flows and low flows. Also, water temperatures are predicted to increase especially in middle elevations such as the Sheep project area.

To mitigate the effects of climate change, several tactics were identified in the Blue Mountain Climate Change Vulnerability Assessment (USDA, 2017) These include adding wood to streams and restoring beaver populations to reconnect floodplains, reduce drainage efficiency and maximize valley storage. Additionally, modifying livestock management while reducing surface fuels and forest stand densities will allow for more deciduous riparian vegetation which provides stream shading and reduces fire risk in the watershed. Another tactic identified in the assessment is increasing the resiliency of infrastructure to higher peak flows through installing higher capacity culverts and decommissioning or converting roads to alternative uses. These actions will improve natural flow regimes and decrease fragmentation of stream networks.

Both Alternatives will set the Sheep project area up for better success in the future, with Alternative 2 having a slightly better impact for climate change and for water resources.

Fisheries

Table 62. Fisheries indicators and measures

Key Issue: Treatment in RHCAs	
Indicator	**Measure**
Water Quality	Stream Temperature Sediment
Other Issues	
Fish Habitat	Large Wood Pools Bank Stability
Management Indicator Species	Species Determination

Summary: Activities with potential to affect fish and aquatic organisms and their habitat are

activities that occur within Riparian Habitat Conservation Areas (RHCAs). These areas are managed for the benefit of native aquatic organisms.

Alternatives 2 and 3 include two types of activities within RHCAs; vegetation activities and road activities. There are no vegetation activities that would result in short- or long-term direct effects to fish and aquatic organisms or their habitat. RHCA handing thinning and prescribed fire follow multi-agency Project Design Criteria (Blue Mountain PDCs, as amended 2015); these treatments would have no effect on indicators and measures in the project area. Short term indirect effects could occur from commercial harvest in RHCAs (Alternative 2), and hand thinning in the RHCA wetland unit (Alternative 2 and 3). Road activities (Alterative 2 and 3) could have short term indirect effects on the indicator water quality and measure sediment. Road activities that occur within the stream channel (culvert replacement or removal) would have short term direct effects on the indicator water quality and measure sediment (increase in turbidity) and indirect effects on fish and aquatic organisms responding to the increase in turbidity. Culvert replacement activities have predicable effects and well tested mitigations measures. Effects to fish and aquatic organisms and habitat from activities proposed are minimal and there are no direct or indirect long-term effects that would be detrimental to fish or aquatic organisms or habitat. Vegetation activities and road activities would have either no effect or a long-term beneficial effect to fish and aquatic organisms and their habitat.

1. Meadow Restoration

Alternative 1

Lodgepole and other conifer trees are actively encroaching the high terrace/historic floodplain next to the entrenched stream channel along Sheep Creek. This advancement of drier species would likely continue in this 36 acre unit. Due to recent channel restoration efforts within this unit, including aggrading the stream channel to restore elevational connection to the floodplain, we expect some conifers in the meadow to naturally die. Snags would consequently fall on the floodplain and meadow and dissipate, aiding water storage during spring storm run-off flows.

Alternatives 2 and 3

Water Quality

Stream Temperature

In alternatives 2 and 3, young conifers not actively producing shade on Sheep Creek would be selected for thinning to avoid affecting stream shade and risk of increase in solar radiation to the stream, which could affect stream temperature (Wondzell, 2019). A 50-foot buffer from the edge of stream out across the floodplain would not be thinned. This thinning treatment deliberately retains shade producing trees. Because this thinning selects young, understory conifer, and because this thinning occurs on .05% of all Category 1 RHCA in the Sheep Creek Subwatershed, there would be no measurable effect to stream temperature in the short term. The purpose of this treatment is to restore the health and vigor of native deciduous vegetation in the long term. In addition, Reeves et al (2016) found that adequately sized and stocked riparian areas could offset the potential effects of climate change on water temperature, providing long term benefits to Sheep Creek.

Turbidity/Sediment Levels

There would be no effect on sediment. There would be no ground disturbance since this is hand

thinning treatments and trees that are thinned would be left on the ground as cover and would create obstructions that cause background levels of sediment to settle out on the floodplain instead of entering the creek by overland flow.

Fish Habitat

Large Wood

Short term effects include increased down wood from thinned trees across the floodplain and meadow. Increased growth of trees retained in riparian areas are expected to improve future sources of large wood (Rentmeester 2004). Rentmeester (2004) conducted a thinning study focused on the production of snags as the primary recruitment mechanism along mainstem stream channels. Results indicate silvicultural thinning resulted in increased diameter growth within residual trees. Faster diameter growth meant trees were larger when they died, therefore, the number of snags above the target diameter were greater. Abundance of large diameter snags increased by 20-74% under thinning scenarios relative to unthinned stands.

There are no short-term effects to in-channel large wood in alternative 2 or 3. There is a long term beneficial effect for future sources of large wood that are larger in diameter due to thinning in this 36 acres unit. In addition, Dwire, et al. (2016) caution leaving riparian areas untreated when fuel loads in surrounding uplands are planned for treatment. Because riparian fuel loads have been influenced by fire suppression and administrative protection policies these areas could be considered hazardous in wildland environments, if left untreated (Dwire et al. 2016).

Pool Frequency

There will be no effect to pool frequency or quality of existing pools from meadow restoration in alternative 2 or 3, because no instream activities will take place.

Channel and Bank Stability

There will be no effect on channel and bank stability from meadow restoration in this unit in alternatives 2 or 3. No activities occur in proximity to stream banks.

2. RHCA *Commercial Thinning and HTH*

Alternatives *1 and 3*

In alternatives 1 and 3 none of the 261 acres of RHCA would be thinned. This includes the 15% (approximately 42 acres of commercial). All riparian vegetation and upland vegetation in RHCAs would remain in current condition, which is deported from the desired stand structure and fire regime (See Silviculture report). Overstocked stands dominating the majority of RHCAs in the project area would remain. No short term or long term direct effects would occur to indicators and measures. Long term indirect effects to indicators water quality and fish and aquatic habitat measures stream temperature, large wood, and pool habitat measures would not have the benefits in Alternatives 1 and 3 where silvicultural thinning has been found to result in increased diameter growth within residual trees (Rentmeester 2004). When the number of stems per hectare is very large, the leaf area of each tree could be so limited that few carbohydrates are available for height development and stagnation of growth occurs (Pothier 2002). Faster diameter growth translates into trees that are larger when they die and therefore an increase in snags above the target diameter (Rentmeester 2004). This is important to the measure large wood, because snag production is related to large wood recruitment into stream channels. It is also important because large wood forms scour pools and these larger diameter trees produce stream shade.

Alternative 2

Commercial Harvest

Stream shade would be maintained by retaining stocking of vegetation adjacent to the stream, retaining large diameter trees, invigorating growth of retained trees for future large wood recruitment, and promoting broadleaf species such as cottonwood, alder, and willow. Treatment was designed on south aspects of drainages to avoid effect of reduction of stream shade. Shade would be maintained on the stream by leaving a minimum of 50 linear feet buffer. Beyond 50 feet, residual stand density would be feathered so that higher levels of stocking would be retained near streams.

Conditions of some units proposed for these treatments, such as units 71 and 68, have higher gradient, densely forested, confined stream channels, with approximately 25 feet of riparian vegetation from the stream edge. In these conditions, the vegetation is mostly alder and some dogwood adjacent to the creek with more abundant vegetation at stream/road crossings where light infiltrates dense forest.

Commercial harvest proposed in RHCAs in Alternative 2, would treat less than <1% of total RHCA acres (by stream Category) in the project area. See table 63.

Table 63. Acres of Affected RHCAs

Stream Category	RHCA acres RHCA HTH units	RHCA acres treated with commercial harvest in RHCA HTH units	Percent treated of total RHCAs in Project Area
Category 1	192	28.8	<1%
Category 2	37	5.6	<1%
Category 4	51	7.7	<1%
Total	261	42	

Water Quality

S*tream temperature*

Units were designed to thin in these on the south facing side, with a minimum 50-foot no harvest buffer, so stream temperatures are not expected to be affected. Canopy cover over the stream channel would not be reduced. There would be no direct or indirect effect to stream temperature in Alternative 2 because existing trees are not very tall, therefore, most trees beyond 50 feet do not contribute directly to stream shade. There are many trees within the overstocked buffer that currently provide shade (See Hydrology report).

Sediment

Because harvest would occur using suspended logging systems and equipment would be limited to the road prism, ground disturbance from equipment in this prescription is not expected. There would be no measurable sediment entering stream channels from this activity. There would be no difference between alternatives 1, 2, and 3.

Obstructions in the path (i.e. downed wood, grass/forb cover) between the sediment source and the stream reduce the risk of indirect sediment delivery to the stream. Adequate filter strips (in terms of size, ground cover and downed material) are necessary to slow or prevent sediment

movement downslope of disturbed areas. The use of the riparian buffers described above has long been recognized as a mitigation measure to reduce sediment transport to streams. The structural complexity of roots and herbaceous vegetation, in addition to the absorption capability of the duff layer, limits excess sedimentation to the aquatic system. Surface runoff slows down when it comes in contact with herbaceous shrubs, mature trees and the duff layer on the forest floor and sediment is deposited within the riparian buffer before it reaches the watercourse (Decker 2003).

See Hydrology and Soils Report for more information.

Fish and aquatic habitat

Large Wood

There would be no short-term change in large wood recruitment into stream channels because a minimum of 50 feet buffer will be left. Long term effects may result in a beneficial effect of an increase in residual tree diameter. Because there would be no effect to large wood quantity in stream channels in alternative 2, there would be no difference in alternatives 1, 2, or 3.

Pools

There would be no effect on pool frequency or quality. There would be no measurable overland sediment from ground disturbance contributing to sediment that could settle in or fill pools. Equipment would stay on existing road prisms and not enter undisturbed ground. Additionally, all activities would be a minimum of 50 linear feet away from edge of stream. There is no difference between alternatives 1, 2, and 3 for change in quality or quantity of pools.

Channel and Bank Stability

No change expected due to minimum no activity buffers and no activity on or near stream banks.

Beneficial effects from all thinning treatments:

Long term benefits of thinning dense, young, uniform stands is well documented (Spies et al. 2013). Spies et al found that the greatest potential ecological benefits of thinning to accelerate the development of older forest structure (large trees, large dead trees, spatial structural and compositional heterogeneity, etc.) comes in dense uniform plantations less than 80 years old and especially less than 50 years old.

A well-known effect of precommercial, small diameter tree thinning is increased diameter growth of residual trees caused by the redistribution of the environmental resources among a smaller number of selected trees. When number of stems per hectare is very large, the leaf area of each tree can be very limited, and few carbohydrates are then available for height development. In this scenario, stagnation of growth can occur (Pothier 2002). In a study of tree growth after thinning, Homyack et al. (2004) found that six to 11 years post thinning forest standes had a greater overstory structure than similar untreated stands. In contrast, unthinned stands gained little overstory structure indicating that the application of pre-commercial thinning was responsible for the accelerated height and diameter growth. Increased growth of riparian vegetation could improve. For more benefits of thinning see Silviculture Resource Report.

3. Fuels Burn Blocks

Alternative 1

Alternative 1 would have no effect on fish and aquatic resources.

Alternatives 2 and 3

RHCAs

Alternatives 2 and 3, propose burning activities that result in low severity fire in RHCAs in the project area. Burning would occur when fuel moisture levels are high. No active lighting would occur in RHCAs. Fire would back into RHCAs from adjacent upslope areas. Low intensity fires that burn in a patchy distribution would occur in RHCAs. Tree mortality from prescribed fire in RHCAs would primarily be understory trees (≤ 8” dbh). Understory trees of this size typically do not provide stream shade.

Riparian shrubs are not expected to be impacted as a result of the proposed burning because they are present in the moister riparian areas. Where the above ground portions of riparian shrubs are impacted by fire, they would likely sprout back quickly because the low severity fire would not be hot enough to destroy root crowns.

Due to low-intensity burning in RHCAs, these activities are not expected to effect indicators and measures in either action alternative.

4. Road Activities

Alternative 1

Sheep Creek and Chicken Creek subwatersheds have high road densities (combined open and closed roads, See Fish and Aquatic resources existing conditions report). There are 331 known stream crossings in the project area. Nine culverts are confirmed barriers to fish passage. In alternative 1 all barriers and road drainage issues would remain until funding becomes available for replacing barriers and road maintenance.

Alternatives 2 and 3

Road Stream Crossings

Five road stream crossings would be removed, and additional culverts that do not meet fish passage standards would be replaced with structures designed to meet Aquatic Organism Passage standards (ARBOii as amended 2021) in alternatives 2 and 3.

Table 64. Road stream crossings

FS Road	Stream Name	Proposed action	ESA listed fish and/or Critical Habitat
5100372	Indiana Creek	Remove old log deck bridge	Yes
5182-034	Trib East Fork Sheep	Remove	No
5182-035	East Fork Sheep	Remove	Yes
5182-040	East Sheep trib		Not fish bearing

5182-100	East Sheep	Remove old log bridge crossing	Yes
5182-500	Upper Sheep Creek	Replace with AOP	Yes, SRB steelhead and CH for bull trout
5182-520	Sheep Junior	Remove and replace with trail bridge	
5184-000	Sheep Trib, lower culvert	Replace with AOP	Yes
5184-000	Sheep Trib, upper culvert	Replace with AOP	Yes

Five additional culverts may be needed on FSR 5182 500 and 552 spurs. Four of these would be on Category 2 perennial channels and one would be on a groundwater dependent ecosystem (GDE) where there is a spring on the road. In addition, Forest Service Road 5182-596 has two Category 2 stream crossings that need to have temporary culverts installed. See Transportation Effects analysis for complete road maintenance plan.

Endangered Species Act -Section 7 Consultation Supplemental Aquatic Restoration Biological Opinion ii (ARBOii as amended 2021) and National and Regional Water and Soil BMPs apply to culvert replacements and removals. Following ARBOii and BMPs, such as replacing culverts when flows are low and conditions are dry, bypassing flow around construction, and following in water work window guidelines (ODFW 2008), will minimize short term, local effects to fish and aquatic organisms from sediment input and turbidity related to construction and channel work.

Direct effects from these activities would be limited to rewatering the channel through the stream crossing after construction is complete. This would cause an initial pulse of sediment into the channel and increase suspended sediment and turbidity. Effects from increased sediment would be short term and local. Sediment is expected to settle out within 0.5 miles of construction when flows are low (Bilby 1985; Duncan 1987; Foltz et al. 2008; Lachance et al. 2008). Because the channel where work is being conducted will be dry and water will be routed around the site, direct effects are minimized. Fish salvage would occur in the main channel before it is blocked and water is diverted around it. This would follow fish handling requirements and electrofishing guidelines (NMFS, 2000).

Removal and replacement (upgrading to AOP) would have important short and long term beneficial effects to fish and aquatic organisms. These activities would improve access for fish and aquatic organisms to upstream habitat.

Effects that could directly affect water quality, discussed above, could cause indirect effects to fish and aquatic organisms or habitat. In addition, in channel work in non-fish bearing channels to install, replace or remove culverts in Category 2 channels (perennial non-fishbearing), could have indirect effects to fish and aquatic organisms, depending on proximity of stream crossing to fishbearing streams downstream.

Alternative 2 would have 11temporary culverts installed and Alternative 3 would have 1. All stream crossing culvert installations or replacements would occur at low flows or when channels are dry to minimize effects to water quality downstream. Following installation of the temporary culverts, periodic spikes in sediment input are expected during the first winter season in response to precipitation events that may mobilize sediments from disturbed areas. Sedimentation may also occur throughout the site recovery period until fill slopes stabilize (2 to 3 years following installation). An additional spike of sediment input would occur when the temporary culverts are removed after the project is completed.

For culvert replacements on perennial non fishbearing streams (Category 2) or intermittent streams (Category 4) on closed or open roads, long term effects would include an improvement to water quality and run off patterns by appropriately sizing, placing and/or designing the culverts. Replacing and maintaining this infrastructure would improve road crossings function, and eliminate some of the erosion problems caused from culverts plugging with debris. This would improve the existing conditions (Altnernative 1).

Water Quality

Stream Temperature

No measurable effects are expected on solar input to streams when replacing and removing stream road crossings. There may be limited streamside vegetation cleared/removed where the structure replacement has a larger footprint than the existing structure. Where culverts are removed, there would be daylighting of the stream through the CMP. These effects would be localized and are not expected to effect temperature of streams.

Sediment

Fine sediments are typically detectable up to 0.5 miles downstream from location of culvert replacement and removal projects. (Bilby 1985; Duncan 1987; Foltz et al. 2008; Lachance et al. 2008). Short term effects to fish and aquatic organisms by sediment pulse to the stream channel would be mitigated by following the Oregon Guidelines for Timing of In-Water Work to Protect Fish and Wildlife Resources (ODFW 2008).

Fish and aquatic habitat

Large wood, pools, stream banks

There would be no direct effect to fish habitat by removing or replacing culverts. Where undersized culverts are replaced with larger structures, habitat may be improved downstream. Stream simulation through the road crossing would improve habitat locally.

There would be an overall beneficial effect on Water Quality from reduced sediment and turbidity by installing properly sized and culverts at these locations. Short and long term benefits to fish and aquatic organisms is expected by improving connection to upstream habitat.

Road reconstruction in RHCAs

Reconstruction of roads in riparian areas would not alter stream or groundwater flow characteristics to the extent that it will impact the riparian area. Roads would be managed to minimize impact to water quality and fish and aquatic habitat. Road maintenance and drainage would prevent the influx of significant amounts of road sediment runoff into stream courses.

There would be no direct effect to fish and aquatic organisms from road reconstruction, except where a road stream crossing is installed, replaced, or removed (discussed above).

Alternative 2 would have 11 miles of road reconstruction within RHCAs and Alternative 3 would have 1 mile of road reconstruction in RHCAs. Currently closed roads would be reopened to access harvest units or for log truck hauling and heavy equipment mobilization. Closed roads that would be opened for hauling activities located within Category 1, 2, and 4 RHCAs would adhere to PDCs designed to minimize impacts to water quality, fish and fish habitat.

The actions associated with opening and reconstructing closed roads as well as traffic on closed

roads associated with mobilizing equipment and log haul could have indirect effects on water quality and fish habitat at stream crossings and where roads are located adjacent to channels. The amount of sediment entering stream channels depends on how close the road is to the channel, the size of the riparian buffer between the road and stream channel, the slope, and how much downed wood is on the ground that could capture sediment.

According to the Hydrology report, overland sediment entering stream channels from these activities would be immeasurable. Therefore, there are no effects to water quality or fish habitat indicators and associated measures from road reconstruction in Alternative 2 or 3.

Road Closures

Alternatives 2 and 3 would have 3.45 miles of roads currently open become closed. Approximately 0.4 miles of road that are in Category 1 and 4 RHCAs would be closed; .3 miles in Category 1 RHCAs and .1 in Category 4 RHCAs. Vegetation would be able to reestablish in these RHCAs because regular maintenance that includes brushing would not occur on these roads. This could stabilize slopes and increase shade production. This is a small amount of road miles compared to total road miles in RHCAs in the project area, however, there would likely be some beneficial effect to function of riparian areas in these locations. Closing these roads reduces potential sediment into channels from roads located in RHCAs.

Due to the small amount of roads that would be closed, effects would be small and no measurable change to indicators or measures would occur.

Cumulative Effects

The cumulative effects analysis area for aquatic resources is the same as the analysis area used for the direct and indirect effects analysis. Past, present and foreseeable future projects that overlap in time and space and could have an effect on indicators in this analysis are livestock grazing and continued stream and floodplain restoration projects (Sheep restoration and stewardship project).

Activities that pose a risk of cumulative effects (adverse or beneficial) are discussed in this section. Cumulative effects risk are rated as:

Low – insignificant or discountable cumulative effects on aquatic habitat may occur. Insignificant effects are defined as effects that a person, based on professional judgment, would not be able to meaningfully measure, detect, or evaluate. Discountable effects are those that are extremely unlikely to occur.

Moderate – insignificant cumulative effects on aquatic habitat are likely to occur. A moderate rating assumes potential effects on habitat. The level of effects will not result in measurable changes in survival rates or population levels of aquatic species with special management status (i.e. ESA-listed, MIS, or Sensitive).

High – measurable cumulative effects on aquatic habitat are likely to occur. Measurable effects are likely to result in changes in survival rates and population levels of aquatic species with special management status (i.e. ESA-listed, MIS, or Sensitive). A high rating assumes obvious adverse effects on habitat and aquatic species with special management status.

Livestock grazing is an ongoing management activity in the project area. Exclosure fences protect several miles of sensitive habitat including ESA listed fish habitat and the floodplain or meadows surrounding it. Sheep Creek, Chicken Creek, West Chicken Creeks, and Dry Creek met bank stability RMOs in 2019 stream surveys. This means that these streambanks on fish bearing streams are not being actively trampled and the channel is not being actively overwidened as a

result. Grazing will continue to occur and impact some vulnerable areas such as wet meadow and Category 1, 2, and 4 channels and floodplains. Effects from the Sheep Creek Allotment Management Plan was analyzed in 2003. Cumulative effects from livestock grazing and activities in alternatives 2 and 3 would be low since the effects to indicators and measures have only short term direct effects to water quality (road stream crossings) and no measureable effects from vegetation treatments in RHCAs.

The second project that overlaps with this project is Sheep Restoration and Stewardship Project. This project would benefit fish and aquatic habitat and water quality. Indicators and measures will continue to trend in a positive trajectory. Cumulative beneficial effects are expected in alternatives 2 and 3 by impoving fish passage barriers, thinning 36 acres to improve meadow habitat, and increasing rate of growth of trees in RHCAs by thinning understory. There is no risk posed to fish and aquatic habitat from cumulative effects of activities in alternatives 2 and 3 and stream and floodplain restoration work on Sheep Creek.

5. Management Indicator Species

Fish habitat in the analysis area meets the majority of PACFISH/INFISH RMOs for pool frequency, LWD, width to depth ratios, stream temperature and fine sediment. (see Fish and Aquatic Habitat Existing Conditions report).

In alternative 2, and 3, short term increase in fine sediment in stream channels would occur as a result of culvert installation, removal, and replacement activities. The predicted increases, however, would be short term and local and elevated sediment levels and increase in turbidity would be mitigated by conducting these activities when flows are low. Best management practices as well as project level PDCs (beginning on page 21) would limit effects to water quality and fish habitat.

Fine sediment entering stream channels would decrease when road maintenance activities are complete. Long-term reduction entering stream channels is expected to be reduced by upgrading and maintaining roads associated with this project. The proposed action would also improve vegetative conditions and maintain the natural fire regime in the long-term in the project area. Activities proposed in alternatives 2 and 3 would not contribute to a negative trend in viability of redband trout or steelhead on the Wallowa-Whitman National Forest for redband trout.

Implementation of alternative 2 or 3 ***may impact water quality (short term increase in turbidity/sediment), and therefore redband trout or steelhead individuals, but will not likely contribute to a trend towards federal listing or cause a loss of viability to the population or species.***

Aquatic Biological Evaluation

There are three ESA listed fish species in the project area: Columbia River Basin Bull Trout, Snake River Basin Steelhead, and Spring/summer Snake River Basin Chinook. Section 7 ESA consultation will occur with US Fish and Wildlife Service and National Marine Fisheries Service.

Summary: There are two confirmed and one suspected Regional Forester sensitive species in the analysis area (Table 3). Redband trout and pacific lamprey are confirmed and western ridged mussels are suspected. Alternative 1 would have **No Impact (NI)** on Pacific lamprey and western ridged mussels. Alternatives 1, 2, and 3 ***May Impact Individual redband trout and their Habitat (MIIH),*** in very localized locations where instream work would occur at road stream crossings but will not likely contribute toward federal listing or loss of viability to the population or

species. Alternatives 2 and 3 ***May Impact Individual western ridge mussels and their Habitat (MIIH)*** in very localized locations where instream work would occur at road stream crossings but will not likely contribute toward federal listing or loss of viability to the population or species.

I. Redband Trout (Region 6 Sensitive Species, Wallowa-Whitman NF Management Indicator Species)

Redband trout, the resident form of *Oncorhynchus mykiss,* are a Region 6 sensitive species in addition to a WWNF management indicator species. Redband trout are widely distributed in the Sheep project area and occupy all Category 1 streams; approximately 27.3 miles of habitat.

Abundance surveys for redband trout have not occurred in the Sheep Creek or Chicken Creek subwatersheds. Their abundance is not known.

Alternative 1

Alternative 1 of the Sheep Project ***May Impact Individual redband trout and their Habitat*** but will not likely contribute toward federal listing or loss of viability to the population or species (MIIH).

Watershed and aquatic habitat conditions would likely remain in their current condition for the next 5 years. The majority of the timbered stands in the project area would be represented by fuel models that are likely to exhibit moderate to severe fire severities in the case of a wildfire. Wildfires typically result in increases in fine sediment for three to five years, depending on the wildfire severity (Neary et al., 2005). Adverse impacts to aquatic habitat would likely occur where fine sediment levels exceed the 20% threshold. These levels would likely decrease spawning success for redband trout, and a decrease survival of juvenile salmonids may occur. Increases in stream temperatures can last longer depending on the severity of fire in riparian areas. If water temperatures exceed 64oF for extended periods as a result of wildfire survival of redband trout would likely be reduced.

Alternatives 2 and 3

Alternatives 2 and 3 of the Sheep Project ***May Impact Individual redband trout and their Habitat*** **(MIIH)** but will not likely contribute toward federal listing or loss of viability to the population or species. Impacts to redband trout may result from short-term increases in fine sediment at road stream crossings and up to .5 miles downstream). This would be short term. Improvement of drainage features is expected to decrease sediment inputs over time (long term effects).

Alternatives 2, and 3 are expected to improve the natural fire regime in the long-term and improve conditions of riparian vegetation in the meadow restoration unit. This long-term outcome is expected to have beneficial impacts to redband trout and their habitat in the analysis area.

Cumulative Effects

There is a low risk of cumulative effects to redband trout habitat from the proposed activities in alternative 2 or 3 and grazing activities in the Sheep analysis area. Grazing, where livestock has access to streams can also cause streambank stress and bank sheer and overwidening of streambanks, and can impact riparian vegetation. This can decrease shade and increase solar radiation and therefore increase stream temperature. Effects from grazing is minimized by

adhering to PACFISH/INFISH Standards and Guidelines for grazing activities and WWNF Forest Plan standards and guidelines for utilization. Since there would be no effect on stream temperature from vegetation treatments in alternative 2 or 3, no cumulative effect would occur from the overlap in time and space of these two actvities.

Sheep Restoration and Stewardship project would have beneficial effects to fish and aquatic habitat. There is no risk from cumulative effects from these two projects. Thinning to achieve objectives of a diverse and resilient condition for RHCA vegetation as well as removal and replacement of road crossings on fish bearing streams to improve passage to upstream habitat would result in a cumulative beneficial effect.

II. Pacific Lamprey (Region 6 Sensitive Species)

Alternative 1

Distribution in the project area has only been confirmed in Sheep Creek and that is the only location where adults were released and redds were identified in the project area. There have been no surveys or data collection for juveniles in the project area.

Alternative 1 of the Sheep Project will have ***No Impact on Individual Pacific Lamprey and their Habitat (NI),*** Watershed and aquatic habitat conditions would likely remain in their current condition for the next 5 years.

Alternatives 2 and 3

Alternatives 2 and 3 of the Sheep Project ***May Impact Individual Pacific Lamprey and their Habitat*** (MIIH), but will not likely contribute toward federal listing or loss of viability to the population or species. Impacts to Pacific Lamprey may occur as a result of short-term increases in turbidity from fine sediment (see effects Road Related Activities section) particularly if larva or juveniles are burrowed in sediment that is within .5 miles downstream of culvert replacements.

Impacts from activities proposed under Alternatives 2 and 3 are unlikely to result in degradation of habitat for Lamprey. Increases in fine sediment are expected to be minimal and short term and within habitat tolerances for Pacific Lamprey.

Under Alternative 2 and 3, the only short term potential measureable increases in fine sediment in aquatic habitat would likely occur in the vicinity of culvert replacement and installation/removal of temporary culverts or in areas where road relocation or reconstruction occurs near stream channels.

Overall, a decrease in erosion from road surfaces is expected as a result of the proposed road improvements and relocations in both action alternatives. Both Alternatives would also maintain a more natural fire regime in the long-term in the project area. Both of these long-term outcomes would have beneficial impacts to western ridge mussels and their habitat in the analysis area.

Commercial and non-commercial thinning activities would occur in RHCAs under Alternative 2. These activities would leave a minimum of one site potential tree height no activity buffer. Mechanical equipment would enter RHCAs, therefore, increases in sediment to channels could occur. In addition, temporary roads constructed in RHCAs as well as 16 road crossings in Category 4 RHCAs could contribute to sedimentation in stream channels.

Cumulative Effects

Due to their lack of mobility, there is a moderate risk of cumulative effects to western ridge mussel habitat from the proposed activities and ongoing road maintenance and grazing activities in the analysis area. Both of these activities can result in increases in fine sediment in aquatic habitat. Increases in fine sediment can reduce reproductive success and overall fitness of western ridge mussels.

For ongoing road maintenance activities, short-term effects from road maintenance activities are minimized by following INFISH standards and guidelines, and road maintenance BMPs. In the long-term, road maintenance activities reduce adverse effects to aquatic habitat by correcting drainage patterns and road beds and reducing overall erosion rates from the road system.

For grazing activities, the potential cumulative effects are minimized by adhering to INFISH Standards and Guidelines for grazing activities and WWNF Forest Plan standards and guidelines for utilization.

III. Western Ridged Mussel (Region 6 Sensitive Species)

The presence of western ridge mussels is suspected on the WWNF but has not been confirmed and therefore has not been confirmed in the analysis area.

Alternative 1

Alternative 1 of the Sheep Project will have ***No Impact on Individual western ridge mussels and their Habitat*** (NI), Watershed and aquatic habitat conditions would likely remain in their current condition for the next 5 years. Current aquatic habitat conditions in the analysis area are not likely limiting for western ridge mussels.

The majority of the timbered stands in the project area are represented by fuel models that are likely to exhibit moderate to severe fire severities in the case of a wildfire. Wildfires typically result in increases in fine sediment for three to five years, depending on the wildfire severity (Neary et al., 2005). Western ridge mussels would be vulnerable to impacts from large-scale wildfires that result in large increases in fine sediment and changes in peak flows. Western ridge mussels are adapted to habitats with fine sediment; however, large influxes of fine sediment could result in the burying of mussel beds and the death of individuals. Western ridge mussels require stable streambeds for mussel beds to develop. Increases in peak flows that scour streambed substrates destroy existing mussel beds.

Alternatives 2 and 3

Alternatives 2 and 3 of the Sheep Project ***May Impact Individual western ridge mussels and their Habitat*** (MIIH) but will not likely contribute toward federal listing or loss of viability to the population or species. Impacts to western ridged mussels may occur as a result of short-term increases in turbidity from fine sediment pulses (see effects Vegetation Treatments and Road Related Activities section).

Current levels of fine sediment in the six streams where substrate/particle size information was collected and analyzed indicate high levels of fine sediment at channel cross sections where these measurements were taken. In these areas short-term potential increases in fine sediment from proposed prescribed burning, thinning, and transportation system activities are unlikely to result in measurable, long term increases in fine sediment in streams within the analysis area.

Impacts from activities proposed under Alternatives 2 and 3 are unlikely to result in degradation of habitat for western ridge mussels. Increases in fine sediment are expected to be minimal and short term and within habitat tolerances for western ridge mussels.

Under Alternatives 2 and 3, the only short term potential measurable increases in fine sediment in aquatic habitat would likely occur in the vicinity of culvert replacement and installation/removal of temporary culverts or in areas where road relocation or reconstruction occurs near stream channels.

Overall, a decrease in erosion from road surfaces is expected as a result of the proposed road improvements and relocations in both action alternatives. Both Alternatives would also maintain a more natural fire regime in the long-term in the project area. Both of these long-term outcomes would have beneficial impacts to western ridge mussels and their habitat in the analysis area.

Cumulative Effects

Due to their lack of mobility, there is a moderate risk of cumulative effects to western ridge mussel habitat from the proposed activities and ongoing road maintenance and grazing activities in the analysis area. Both of these activities can result in increases in fine sediment in aquatic habitat. Increases in fine sediment can reduce reproductive success and overall fitness of western ridge mussels.

For ongoing road maintenance activities, short-term effects from road maintenance activities are minimized by following INFISH standards and guidelines, and road maintenance BMPs. In the long-term, road maintenance activities reduce adverse effects to aquatic habitat by correcting drainage patterns and road beds and reducing overall erosion rates from the road system.

For grazing activities, the potential cumulative effects are minimized by adhering to INFISH Standards and Guidelines for grazing activities and WWNF Forest Plan standards and guidelines for utilization.

Transportation

Table 65. Engineering issues and indicators

Key Issue: Access	
Indicator	**Measure**
Access	Miles of Road Closure
Open Road Density	Miles of open roads commensurate to Forest Plan Standards
Road Surface Improvements	Miles of road maintenance/reconstruction

Summary: Effects related to roads are generally addressed as impacts to other resources such as aquatics, soils, invasive weeds, and wildlife. To address the effects on the transportation system this analysis will focus on road density and maintaining a road system to a physical standard for safe operation by the intended users. Forest Plan direction to meet open road density is discussed in the engineering specialist report as well as the Forest Plan.

No alternative would increase open road densities, because none of the alternatives include adding permanent Forest Service roads, open or closed, to the transportation system. Both alternatives 2 and 3 would close 3.45 miles of open roads and decommission 0.16 mile of road.

Alternatives 2 and 3 would equally move the operationally (drivable) open roads closer to the objectively (desired) open road mileage, as identified in the Minimum Road System (MRS - Travel Management, Subpart B) Analysis. Alternative 3 utilizes 26.03 fewer miles of open road than alternative 2 for project related activities, which would result in fewer miles of post-haul road improvements.

Alternative 1

This alternative would have no effect on the project area's existing transportation system. All the same conditions from the existing condition would continue (see engineering report). There would be some routine road maintenance of the main roads in the analysis area on a cyclical basis and some roads would receive more drainage maintenance, aggregate placement, or pavement preservation. These actions would be ongoing and dependent upon funding. There would still be use of the transportation system from ongoing forest management, recreation, and special use permits.

The open road densities would be the same from the existing condition with 72.72 miles of objectively open roads and 98.77 miles of operationally open roads. The Forest Service would continue to reinforce berms, construct or implement new physical closures to move the open road densities towards the objective maintenance level.

Alternatives 2 and 3

Alternatives two and three would add trail designation to several roads where the motorized trail will share a template with an existing road for portions of its alignment. These trails will not affect the use of these roads or future uses.

- 5160-012, 5160-014, 5160-043, 5160-045
- 5164, 5164-180, 5164-182, 5164-200
- 5175-010
- 5182-035, 5182-040, 5182-580, 5182-800

Open Road Density

The Sheep Vegetation Management project would change the following maintenance levels:

- 5160-030: 0.4 miles for storage, beginning at 5160-033 junction
- 5160-039: 0.02 miles proposed for storage
- 5160-050: 0.16 miles proposed for decommission from 5160 to the 5160-051 junction
- 5160-140: 0.4 miles proposed for storage
- 5175-020: 1 mile proposed for storage, beginning at 5175-030 junction
- 5178: 1.6 miles proposed for storage by moving the existing gate to the 5178-083/5175-050 junction

Closing 3.42 miles of open road and decommissioning 0.16 mile of road will lead to the following objective maintenance level road densities in:

Table 66. Open road density per alternative

Subwatershed	MAS Code	Total Acres	Sq. Area (Acres/640)		Open Rd Miles	Existing Condition Open Rd Density	Alt 2 & 3 Open Rd Density
Chicken Creek	1	6,716.42	10.49		8.98	1.02	0.91
	15	680.49	1.06		1.58	*	*
	1W	2,490.15	3.89		2.74	0.81	0.70
	3	1,083.15	1.69		4.46	2.64	2.64
Sheep Creek	1	11,111.62	17.36		29.12	1.70	1.66
	15	79.88	0.12		0.02	*	*
	1W	4,992.15	7.80		14.7	2.04	1.88
	3	2,661.68	4.16		7.69	1.85	1.85

The only management areas where objective open road densities are above forest plan direction are the Chicken Creek and Sheep Creek management area (MA) 3 densities. All alternatives would leave the open road densities above the plan direction of 1.5 road miles per square mile. This is caused by the MA 3 boundaries including the junctions and initial portions of the arterial roads, 51, 5160, 5175, 5178 leading to a road density above the forest plan direction.

MA 1W in the Sheep Creek subwatershed is proposed to remain above the forest plan direction of 1.5 road miles per square mile. 1W is winter range and these roads will be closed during the winter months as outlined in the Forest Plan “On winter ranges adequate road closure will normally result from snow” (Forest Plan, 4-60).

Access

Closing 3.42 miles of open road would reduce the open road densities in both the Chicken Creek and Sheep Creek subwatersheds. Decommissioning the 0.16 miles of National Forest System Road (NFSR) 5160-050 will reduce the long-term maintenance of the transportation network, take advantage of alternative access, and remove the need to realign a junction onto the NFSR 5160 where an alternative junction already exists. This alternative also provides the means to reinforce existing or install new road closure devices to move the operational maintenance levels of roads closer to the objective maintenance levels.

Alternative 3 also provides the means to reinforce existing or install new road closure devices to move the operational maintenance levels of roads closer to the objective maintenance levels to the same extent as alternative 2.

Extending the closure period in the Trail Creek travel management area from the start of rifle bull elk season to the start of bow hunting season will reduce vehicle access in the travel management area during the time frame of 8/26 to 10/25. This could lead to more people concentrating in a smaller network of roads that are available to vehicles during this period and increasing wear and tear maintenance on these roads.

Table 67. Transportation Activities Summary by Alternative

Transportation Activities	Alternative 2 Miles	Alternative 3 Miles

Maintain NF System Roads	101.59	75.56
Open Roads (Maintenance Levels 2-5)	61.87	56.56
Stored Roads (Maintenance Level 1)	39.72	19
Danger Tree Removal Along System Roads	101.59	75.56
Reconstruction of Existing Roads	22.38	7.1
Culvert Replacements	11	1
Fish Passage Barrier Removals	2	2
Total Temporary Road Construction	3.75	3.03
Temporary Road Construction on existing templates	0.44	0.44
Proposed Road Closures	3.42	3.42
Decommission Existing Roads	0.16	0.16

Road Surface Improvements

Maintenance of 101.59 miles of road done by the timber purchasers during the sales would have a beneficial effect on forest service roads. Maintenance generally includes clearing vegetation from the roadway, improving sight distance, performing surface and drainage maintenance which will have both short and long term benefits to the transportation system. This will benefit forest management, public use, and the transportation network effects to other resources.

Alternative 2 includes opening 39.72 miles of closed road for use during treatment. These roads will be used for commercial haul, then reclosed after use. An estimated 22.38 miles of roads will require reconstruction as defined in the timber sale contract. This generally includes clearing and grubbing vegetation from an existing roadbed, adding permanent surface drainage beyond water bars, and short road realignments of up to 500 feet. Reconstructing these roads will bring them back up to the standard appropriate for commercial haul. This alternative includes 3.75 miles of non-system temporary roads for timber harvest. These non-system roads are not added to either the Forest Service system or the open road density calculations.

Alternative 3 utilizes 75.52 miles of roads, 26.03 fewer miles than alternative 2, and won't reduce the road maintenance backlog to the same extent as alternative 2, but greater than alternative 1. Alternative 3 reduces the reconstruction mileage to 7.1 miles which means fewer roads won't be returned to their intended standard for the safe use of commercial vehicles. This alternative includes 3.03 miles of non-system temporary roads for timber harvest. These non-system roads are not added to either the Forest Service system or the open road density calculations.

Cumulative Effects

The cumulative effects area is the Sheep Creek Project Area during the five-year period following the NEPA decision. During this five-year period road maintenance performed by the harvest activities will alleviate the road maintenance backlog in the project area. Ongoing stream restoration activities, forest management, and special use permits will have little cumulative effects with this alternative other than additional use of the transportation network.

There could be an increase in motorized public accessibility with full sized vehicles to closed

roads in the area under this alternative because some actions will open closed roads during operations. This increase should be for a short duration of time as treatment operations will be required to maintain all road closures.

The cumulative effects for alternative 3 are similar to alternative 2. There could be an increase in motorized public accessibility with full size vehicles to closed roads in the area under this alternative because some actions will open closed roads during operations. Using 20.72 fewer miles of closed roads will reduce this effect from alternative 2 but be an increase from alternative 1. This increase should be for a short duration of time as treatment operations will be required to maintain all road closures.

Invasive Plants

Summary: The differences between the indicator measurements are quantified in Table 68. The relevant differences between the action alternatives relate to the number of treatment acres proposed.

Table 68. Summary comparison of proposed activities and resultant environmental effects to noxious weeds

Resource Element	Indicator/Measure	Alt 1	Alt 2	Alt 3
Potential to spread	1. Are invasive species on the state and county weed list present in the analysis area?	198 acres	198 acres	198 acres
Potential to spread	2. What is the change in potential vectors for spread of invasive plants?	Unknown quantity associated with wildfire suppression activities.	11,598 acres	7,368 acres
Potential to spread	3. What is the change in potential receptive seed bed for establishment due to disturbance?	Unknown quantity associated with wildfire suppression activities.	26,076 acres	21,691 acres
Potential to establish	4. What is the potential of noxious weed seeds being transported to the project area from outside of the sub watershed?	Unknown quantity associated with wildfire suppression activities.	Number of vehicles and personnel entering the project area associated with the project activities.	Number of vehicles and personnel entering the project area associated with the project activities.

The risk of a stand replacing large-scale wildfire is increased due to increased fuel loading, and the potential for invasive species spread and establishment would increase beyond the rate found in the absence of a large disturbance. This effect, plus continuing risks from other types of activities occurring in the analysis area, would favor the expansion of invasive species within the project area to levels beyond that found without large-scale wildfire activity.

Although risks are present with or without project activities, the danger of invasive species

establishment due to project activities under alternatives 2 and 3 is increased (although slightly lower under alternative 3). However, the potential to spread invasive species under either of the action alternatives is likely less than under the no action. This is due in large part to the reduction in wildfire risk associated with the action alternatives (slightly more risk under alternative 3 due to a smaller reduction in overall fuel loading). With implementation of project design features to reduce and control the introduction and spread of invasive species we can minimize the impacts that do exist. Specific mitigations and required standards would continue to reduce the chances of new introductions, spread, and establishment of invasive plants and we could predict a spread and establishment rate at the natural level for either of the action alternatives (see p. 21 of the EA for PDCs).

Alternative 1

Potential to establish

There would be no direct effects to the establishment potential of invasive species because no activities would be authorized. Many vectors for the establishment of new populations would still exist from ongoing recreation and vehicle travel, livestock and big game transport activities within the project area. Over time, with no additional disturbances to known sites, further treatment success, and no reduction to existing desirable vegetation cover and vigor the known sites could be eradicated or substantially reduced. However, without fuel reduction activities within the project area, indirect effects may exist from wildfire. Wildfire suppression activities could increase the risk of establishment of new invasive species through transport of invasive species seeds and material from personnel and equipment. The potential for this impact would be rated as **High** due to the risks of a stand replacing wildfire.

Wildfire and the activity involved in suppression would also increase the risk of spread of noxious weeds, but wildfire occurrence is unpredictable. Large scale and intense wildfire disturbance would create ideal areas for the spread of noxious weeds. With increasing numbers of wildfires, the numbers of noxious weed species could increase (Merriam, et al., 2006), with the largest increases found in those areas with pre-existing noxious weed populations (Zouhar, et al. 2008).

Potential to spread

There would be no direct effects to the spread potential of invasive species because no activity would be authorized; however, as described above, vectors which can spread seeds from known populations would still occur (recreation, vehicle travel, livestock, big game, etc.) within the project area. In the long-term, with no additional disturbances to known sites, further treatment success, and no reduction to existing desirable vegetation cover and vigor the known sites could be eradicated or substantially reduced. Without fuel reduction the indirect effect due to the risk of large-scale wildfire would continue to be an issue in the project area. Ground disturbance from wildfire and the associated suppression activities create ideal situations for the spread of current invasive species sites. The movement of personnel and equipment through existing invasive species sites could allow for an increased rate of spread. Therefore, the potential spread in the event of a wildfire would be Moderate.

Table 69. Resource indicators and measures for alternative 1

Resource Element	Resource Indicator	Measure	Effect
Potential to spread	1. Are invasive species on the state and county	198 acres	Moderate

	weed list present in the analysis area?		
Potential to spread	2. What is the change in potential vectors for spread of invasive plants?	Movement of vehicles, dozers, and personnel crossing land within the sub watersheds while engaged in wildland fire suppression activities.	Low
Potential to spread	3. What is the change in potential receptive seed bed for establishment due to disturbance?	35,964 acres of wildfire burned areas including dozer and handline constructed in wildland fire suppression activities.	Moderate
Potential to establish	4. What is the potential of noxious weed seeds being transported to the project area from outside of the sub watershed?	The number of vehicles and personnel required in wildfire suppression activities. *Weed inspection not required for vehicles engaged in initial attack on wildfire suppression.	Moderate

Alternative 2

Potential to Spread

The potential for noxious weeds to spread from project activities would occur by the movement of weed seeds/materials on project personnel and equipment. As the number of total treatment acres increases, the amount of personnel and equipment increases, thus the risk of weed spread also increases. Alternative 2 proposes 4,230 more acres of non-commercial thinning and commercial treatment than alternative 3. All of these activities have a potential to increase the risk of spread to non-infested sites. The riparian treatment proposed also have the potential to increase spread of weeds, but due to the equipment exclusion this would generally occur only in those areas that have little to no understory cover. These areas are at risk for spread, not due to ground disturbance, but due to lack of competition from existing native vegetation.

However, with project activities that are designed to reduce fuel loading within the project area, indirect effects in terms of a reduction in the risk of spread may exist. This benefit is due in part to the decreased fuel loading and decreased risk of large-scale wildfire that will result from this vegetation management project. With a decrease in wildfire potential, there would be a reduced need of suppression activity which could indirectly lower the opportunity for the transportation weed material and thus the enlargement of existing sites or the spread to non-infested sites within the project area.

The overall effect intensity of this alternative on the potential to establish invasive species is estimated to be **Moderate**, due to the area of proposed activity but the large number of acres proposed for fuels reduction and the subsequent decrease in wildfire risk.

Potential to Establish

Direct effects to the establishment potential of invasive species due to project activities would occur due to movement of invasive species materials on project personnel and equipment from outside of the analysis area. This, combined with ground disturbance from project activities, would potentially be a risk for the establishment of various weed species within the project area. Personnel and equipment associated with prescribed fire, non-commercial thinning, commercial treatment, temporary road construction, and road reconstruction activities are the potential agents of transport for weed seeds/material from outside of the project area.

However, with the goal of fuel load reduction, indirect effects in terms of a reduction in the risk of spread may exist. This benefit is due, in part, to the decreased fuel loading and reduced risk of large-scale wildfire that will result from this vegetation management project. The mitigation measure requirement for inspection of vehicles for weed seed and material is not applied to initial attack wildfire suppression activities. With a lowered risk of wildfire potential, there would be a decrease in the potential number of vehicle entry and ground disturbance associated with wildfire suppression. Thus, the establishment of weed species beyond their current extent would also be reduced.

The overall effect intensity of this alternative on the potential to establish noxious weeds is estimated to be **Moderate**, due to the requirement to clean equipment associated with the project prior to entry along with the potential decrease in risk of large-scale wildfire.

Table 70. Resource indicators and measures for alternative 2 direct/indirect effects

Resource Element	Resource Indicator	Measure	Alternative 2 Direct/Indirect Effects
Potential to spread	1. Are invasive species on the state and county weed list present in the analysis area?	198 acres	Moderate
Potential to spread	2. What is the change in potential vectors for spread of invasive plants?	11,598 acres of timber treatments	Moderate
Potential to spread	3. What is the change in potential receptive seed bed for establishment due to disturbance?	25,947 acres burn treatments 22.38 miles road reconstruction 101.59 miles road disturbance 11 culverts replaced	Moderate
Potential to establish	4. What is the potential of noxious weed seeds being transported to the project area from outside of the sub watershed?	Number of vehicles and personnel entering the project area associated with the project activities.	Moderate

Alternative 3

Similar direct and indirect effects would be expected for alternative 3. The decrease in acres treated decrease ground disturbance and vehicle entry, but would increase the potential for catastrophic wildfire effects on the untreated land.

Potential to Spread

The effects on the potential to spread for this alternative are estimated to be less than those in alternative 2 due to the decreased acres of ground disturbance. However, untreated would be more vulnerable to intense wildfire.

Potential to Establish

The potential to establish is estimated to be less due to the decrease in equipment and personnel entry into untreated areas. However, the untreated area, having an increased potential for intense

wildfire, is potentially more vulnerable to entry of equipment associated with wildfire suppression.

Table 71. Resource indicators and measures for alternative 3 direct/indirect effects

Resource Element	Resource Indicator (Quantify if possible)	Measure (Quantify if possible)	Alternative 3 Direct/Indirect Effects
Potential to spread	1. Are invasive species on the state and county weed list present in the analysis area?	198 acres	Moderate
Potential to spread	2. What is the change in potential vectors for spread of invasive plants?	7,368 acres timber treatments	Moderate/Low
Potential to spread	3. What is the change in potential receptive seed bed for establishment due to disturbance?	21,605 acres burn treatments 7.1 miles road reconstruction 75.56 miles road disturbance 1 culvert replacement	Moderate/Low
Potential to establish	4. What is the potential of noxious weed seeds being transported to the project area from outside of the sub watershed?	Number of vehicles and personnel entering the project area associated with the project activities.	Moderate/Low

Cumulative Effects

Generally, the risk of large-scale wildfire combined with unregulated travel, road use, private land activities, and grazing has the greatest chance for cumulative effects on weeds within the analysis area. However, predicting wildfire occurrence is problematic. Large-scale and intense wildfire disturbance would create ideal areas for the introduction and spread of weeds. With increasing numbers of wildfires, the numbers of invasive species could increase (Merriam, et al., 2006), with the largest increases found in those areas with pre-existing noxious weed populations. One benefit of this project is the decrease of current fuel loading and therefore the risks of uncontrolled wildfire, so future large-scale burns should be reduced. This reduction may further decrease the risk for areas outside of the treatment area boundaries (Merriam, et al., 2006).

Of the activities with predictable timetables, the effects of activities of this alternative (increased risk of ground disturbance, transportation of weed seed/materials, and reduction in competition) coupled with road maintenance, private land activities, recent and concurrent stream restoration projects, the recent Blue Fly Fuels Reduction Project, and grazing have the highest possibility of detrimental cumulative effects within the analysis area. Roads are a vector of weed spread and transport, thus unregulated road use increases this risk. Grazing could also increase the risk of spread and introduction of weeds. Livestock are vectors of plant material and can transport seeds and other plant reproductive material over many miles. Another unknown factor is the large amount of disconnected private land holdings inside the analysis area. The invasive plant management practices on these lands is outside the knowledge and authority of the USFS. The La Grande Ranger District invasive plant control program would have a beneficial effect on preventing the spread and establishment of noxious weeds.

Potential to Spread

Ground disturbance that would occur in concert with impacts from grazing, OHV travel, road maintenance, and unknown activities on private land. The combined effects of these areas of ground disturbance would have a **Moderate** cumulative effect over the effected analysis area. Active invasive plant monitoring and treatment would mitigate these effects on Forest Service land. Private land weed management within the area being considered is unknown.

Potential to Establish

The movement of personnel, machinery, and animals and animal movement are means of the potential for the establishment of weeds due to project activities. Grazing, OHV travel, road travel and maintenance, and travel through private land are factors contributing to these phenomena. In addition, invasive plant spread into RHCAs compounds their spread by facilitating the dispersion of seed downstream through water movement.

Table 72. Resource indicators and measures for alternatives 2 and 3 cumulative effects

Resource Element	Resource Indicator	Measure /Project	Alternatives 2 and 3 Cumulative Effects
Potential to spread	1. Are invasive species on the state and county weed list present in the analysis area?	Wallowa-Whitman Invasive Plant Program activities.	Reduces the extent and amount of weed sites throughout the project area through on-going treatments of existing invasive populations.
Potential to spread	2. What is the change in potential vectors for spread of invasive plants?	Grazing Stream Restoration - 21 miles OHV travel – x miles trails Unregulated off-road use	Unregulated use of off highway vehicles and grazing pose a risk to spread of weeds due to the movement of plant material and the ability to introduce these materials to random areas that are difficult to identify for treatment. Restoration and fuel reduction projects increases the potential for spread of weed material.
Potential to spread	3. What is the change in potential receptive seed bed for establishment due to disturbance?	Blue Fly Project - 4,034 acres Stream Restoration - 21 miles OHV travel – x miles trails Unregulated off road use Grazing	Ground disturbance from road maintenance, restoration, and fuel reduction projects adds to that resulting from Sheep activities.
Potential to establish	4. What is the potential of noxious weed seeds being transported to the project area from outside of the sub watershed?	1.Cattle entering the analysis area from outside the area. 2.Machinery and personnel coming into the area associated with: -Stream Restoration -Blue Fly 3. Entry of people and vehicles associated with recreational activities. 4. Entry of people and vehicles associated with private land owners.	1.Cattle could carry weed seed/material to project area. 2. Regional standards regarding equipment inspection for noxious weeds would help to reduce the risk of this potential effect. 3. Recreators would intersect project areas with ground disturbance. 4.Private land owners have unknown activities and would cross onto to project areas.

Range

Table 73. Range indicators and measures

Indicator	Measure
Disturbance	Qualitative assessment of avoidance patterns
Forage	Qualitative assessment of food quality

Alternative 1

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 fuel-wood removal, mining, and various types of recreation.

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

The lack of implementation of the action alternatives would over time increase the likelihood of declining forest health associated with overstocked stands and insect infestations. The continued loss of understory vegetation from canopy closure in areas where lack of wildfire and stand re-initiation following past harvest activities, would continue until unmanaged wildfire or insect infestations change this condition. The potential for catastrophic wildfire would remain high. A high intensity wildfire would likely result in loss of available grazing capacity for permitted livestock.

Alternatives 2 and 3

Summary: Both action alternatives treat vegetation similarly resulting in improved potential for forage development. Alternative 2 treats the largest number of acres and will result in the greatest forage improvement whereas Alternative 3 treats the least. This difference acres across the active allotments may contribute to improved forage production and livestock distribution for 5-20 years following harvest over the other action alternatives.

Acres treated with prescribed fire are similar throughout the action alternatives and have no meaningful differences.

The action alternatives differ in several ways based on treatment type and unit. The resulting reduction in canopy closure following treatment within each unit will allow an increase in herbaceous and shrubby vegetation for 5-20 years until tree regeneration converts treated stands back to a closed canopy arrangement. Follow-up maintenance burns would retard this process and allow for improved forage availability for wildlife and domestic ungulates. Table 74 describes the total acres within the Sheep Creek project by treatment type. These treatment acres are expected to show an increase in understory forage vegetation following completion, providing additional forage resources for wildlife and permitted livestock. Table 75-77 describe the acres treated in each allotment by treatment type.

Table 74. Vegetation treatment comparison for Sheep Creek Veg project by acre.

Treatment Type	Alternative 2	Alternative 3
Commercial Harvest	3,367	1,308
Non-Commercial	9,418	7,012
Nat Fuels Prescribed Fire	9,521	9,521
Post-Harvest Prescribed Fire	16,426	12,084

Table 75. Total mechanical and non-mechanical treatment acres within the Sheep Ranch, McCarty, Chicken Hill and Limber Jim allotments by alternative.

Allotment	Alternative 2	Alternative 3
Sheep Ranch	6,261	3,969
McCarty	16	16
Chicken Hill	4,321	2,637
Limber Jim	1,038	792

Table 76. Prescribe natural fire acres within the Sheep Ranch, McCarty, Chicken Hill and Limber Jim allotments by alternative.

Allotment	Alternative 2	Alternative 3
Sheep Ranch	6,599	6,599
McCarty	57	57
Chicken Hill	1,446	1,446
Limber Jim	1,418	1,418

Table 77. RHCA treatment acres within the Sheep Ranch, McCarty, Chicken Hill and Limber Jim allotments by alternative.

Allotment	Alternative 2	Alternative 3
Sheep Ranch	455	337
McCarty	0	0
Chicken Hill	546	432
Limber Jim	116	108

Harvest Treatment

Disturbance

Direct effects from biomass removal include disturbance to wild and domestic ungulates during harvest activities, hazards created by wild ungulates 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. Equipment use in conditions with wet soils may result in soil compaction and loss of soil productivity and recruitment/retention of desirable native vegetation. Indirect effects are an increase in transitory rangeland and improved access for wild ungulates into areas where down wood has accumulated due to lack of fire.

Forage Quality

The proposed action would result in more potential acres available for transitory rangeland conversion. Transitory range is defined as “forested lands that are suitable for grazing for a

limited time following a complete or partial forest removal" (Spreitzer 1985). Increased forage production made available as a result of forest management that reduces overstory shading, (Hedrick D.W. 1975) will allow for distribution of wild and domestic ungulates over a larger area within the allotment boundaries. The forage produced following development of transitory range is highly variable depending on site conditions and treatment. Transitory forest range is temporary and will become less productive as the trees regenerate. Forage production for wild and domestic ungulates can be expected to peak from a few years to 20 or more years (depending on understory regeneration) after removal. Grass and forb production peaks earlier than shrub production (Bedunah and Willard, 1987).

Noncommercial Treatment

Disturbance

Direct effects due to pre-commercial thinning would be a reduction of wild and domestic ungulates access to thinned areas from debris left on the site until the thinned material decomposes or is burned. Units where piling of thinned material is conducted would allow ungulates to access areas where dense small diameter vegetation has been the limiting factor. Units where mechanical thinning using mastication devices is used would create mulch on the ground surface. Wild and domestic ungulate access through these areas would not be limited or reduced by slash. Domestic ungulates tend to avoid areas following pre-commercial thinning until the slash has been reduced in height by snow loading.

Forage Quality

These areas would be used as transitory rangeland and show an increase in understory vegetative growth because of reduced canopy closure. Hand thinning does not create disturbance to herbaceous forage the way mechanical equipment would. Pre-commercial thinning would indirectly allow increased sunlight and allow improved photosynthetic activity in areas where canopy closure has occurred. This would allow for increases in vegetative growth, plant vigor and possible improvement in plant diversity.

Post-harvest treatments are designed to bring surface fuels loads and pre-commercial sized trees to desired levels. Direct effects of mastication treatment will include increased access for wild and domestic ungulates to areas where dense understory vegetation precluded free access. Reduced understory competition and reduced canopy closure would allow for increased forage production on those stands where sunlight and soil resources had otherwise been intercepted by dense conifer stands.

Direct effects due to thinning within RHCAs would be to initially reduce wild and domestic ungulates access to the stream corridor. Hand thinning does not create disturbance to herbaceous forage in the way that mechanical equipment would. RHCA thinning would indirectly allow increased sunlight and allow improved photosynthetic activity in areas where canopy closure has occurred. This would allow for increases in vegetative growth and possible improvement in plant diversity.

Mitigations measures for whitebark pine will have no direct or indirect effect for livestock management or rangeland vegetation. Mitigation measures for Richardson's needlegrass will have no direct effect on livestock management. Re-seeding areas of disturbance with collected and propagated Richardson's needlegrass seed will allow for recovery of foraging areas for wild and domestic ungulates. The limited areas of restoration and the wide distribution of Richardson's needlegrass within the project area, will have no measurable effect for livestock distribution or rangeland vegetation.

Prescribed Fire

Disturbance

Direct effects due to creating mechanical fireline within the project area would be a potential increase in domestic and wild ungulates use of the new trail. Temporary firelines immediatelyclosed following use would not be used by wild ungulates if slash is placed on the surface. There would be no measurable effect on rangeland resources following fireline construction activities.

Forage Quality

Direct effects from the implementation of the proposed action include an immediate reduction in available forage where burning occurs. This would be short term (1 year) until the following growing season. This reduction can span up to two years but is expected to return within 3-5 years if grazed conservatively (Valentine 1989). If prescribed fire is implemented during the normal grazing season some displacement of domestic ungulates is expected.

Snowberry and huckleberry understory shrub-lands would benefit from prescribed fire and show increased crown density for 3-7 years post treatment (USDA, GTR INT-239). Higher severity burns may damage below ground rhizomes and reduce sprouting (Hansen et al, 1988) however snowberry and huckleberry is generally resistant to severe burns.

Proposed prescribed burning and future maintenance burns would allow retention of understory forage vegetation released during forest thinning projects. Many of the mixed conifer stands within the project area are outside the historic level of canopy closure expected in a stand where natural fire cycles would have reduced stems per acre and allowed for full canopy closure, precluding maintenance of understory grasses and shrubs.

Connective corridors are untreated areas where wildlife movement can be better accommodated between differing habitats. Left untreated, overstory vegetation will continue to move the stands to a closed canopy condition where forage production decreases. This indirectly reduces potential distribution opportunities for livestock and decreases over time browse based forage for wildlife.

Road Activities

Disturbance

Direct effects due to temporary roads will be opening of travel routes that could be utilized by livestock during the time they are open. Following restoration of the temporary road, access would return to pre-project conditions.

The condition of the previously closed road, and stored roads designated for OHV use, helps managers anticipate new livestock use on the re-opened road. Roads that have already been used as defacto OHV routes would remain unchanged. Indirect effects would include better access for permittees to check for cattle however, livestock may use a newly opened road to access areas where increased livestock use is not desired like riparian areas. An indirect result of new OHV routes would be potential displacement or harassment of livestock from areas needed to maintain distribution within the allotments.

Direct effects due to road decommissioning will be reduction of travel routes utilized by livestock and permittees to access portions of the Sheep Ranch allotment. The roads proposed for

decommissioning are scattered across the landscape and some are used occasionally for access to manage livestock and maintain structural improvements.

Forage Quality

Indirect effects of temporary road construction will be a potential decrease in forage vegetation until natural recovery/revegetation occurs. Seeding disturbed soils will restore native vegetation to pre-disturbance levels. Common shrubs huckleberry (VAME/VASC) and snowberry (SYAL/SYOR) sprout following disturbance and will re-colonize within 3-7 years.

A potential direct effect would be loss of vegetation that has recovered since the road was closed. Many closed roads have native grasses and trees within the road prism.

Indirect effects of road decommissioning will be an increase in native vegetation due to increases in soil productivity following decommissioning.

A potential direct effect from designating OHV routes on specific closed roads would be loss of vegetation that has recovered since the road was closed. Many closed roads have native grasses and trees within the road prism.

Cumulative Effects

The only reasonably foreseeable future action which would overlap in time and space within this project which may have a potential to have a long-term effect to rangeland resources is Noxious Weed treatment. This project focuses on invasive non-native vegetation treatment to reduce impacts to native vegetation and soil resources. Reducing or preventing establishment of invasive species will allow native plants to maintain dominance, providing forage for native species, cover for migratory birds and small mammals, and protect soil from surface erosion.

No other present or reasonably foreseeable future activities would overlap in time and space with the project area, no would they have a measurable cumulative effect on rangeland resources.

Consistency with Laws and Policy

All action alternatives would ensure that the basic needs of the forage and browse plants and the soil resource are met. Forage that is in excess of the basic needs of the plants and soils resources to be utilized by wildlife and domestic livestock would remain available under all alternatives in this project meeting rangeland management Forest Plan goals.

Recreation

Table 78. Recreation indicators and measures

Indicator	Measure
Dispersed Recreation	Qualitative assessment of use
Developed Recreation	
OHV Trails	Qualitative assessment of improvements
Snowmobile Trails	Qualitative assessment of use

Permitted Uses	

Summary: Alternative 1 would have no direct or indirect effects to recreation within the project area. Alternatives 2 and 3 would have similar effects which include short-term disruptions to dispersed recreation and permitted uses from potential displacement, avoidance, or sense of place which would likely resolve when project activities are complete. Off-highway vehicle (OHV) trails would be enhanced from trail improvements and new designations, but the rider experience would be temporarily reduced by project activities.

Table 79. Summary of effects from alternatives 2 and 3

Activities	Alternatives 2 and 3 Effects
Acres of Timber Harvest (commercial harvest of timber, post harvest noncommercial thinning, and noncommercial thinning)	• Restricts/discourages access into harvest units due to closures or work activity • Discourages/displaces use due to physical obstacles (i.e. slash), dust and noise • Decreases of habitat for forest products (i.e. berries) or increases habitat for forest-products (i.e. mushrooms) • Increases localized use by visitors wanting more open stands, and decreases localized use by visitors wanting more closed or untreated stands, and larger trees • Loss or change of vistas, scenery, natural features or wildlife viewing opportunities from developed sites • Increases roadside safety from hazard tree removal
Acres of Post-harvest Fuels Treatments (grapple pile, hand pile/burn)	• Restricts/discourages access into units due to closures or post-harvest activity • Discourages/displaces use due to physical obstacles (i.e. slash piles), and noise • Decreases habitat for forest products (i.e. berries) and increases habitat for forest-products (i.e. mushrooms) • Increases localized use by visitors wanting more open stands, and decreases localized use by visitors wanting more closed or untreated stands, and larger trees • Loss or change of vistas, scenery, natural features or wildlife viewing opportunities from developed sites
Acres of Prescribed Fire (post harvest activity fuels treatment and 'stand alone' prescribed fire only)	• Restricts/discourages access into treatment units due to closures or work activity • Discourages/displaces use due to active fire or residual smoke • Loss or change of vistas, scenery, natural features or wildlife viewing opportunities from developed sites and dispersed areas
Miles of Road Reconstruction (Deferred maintenance on open/closed roads, road realignment)	• Restricts/discourages access into dispersed area or developed sites due to work activity • Loss of access after temporary roads closed • Increases roadside safety from hazard tree removal
Miles of Temporary Road Construction	• Temporarily decreases opportunities for dispersed activities away from motorized uses
Miles of Danger Tree Removal along Roads	• Increases visitor safety

Miles of Road Decommissioning	• Decreases motor-vehicles use when roads are decommissioned • Increased opportunities for dispersed activities away from motorized uses

Alternative 1

There would be no direct or indirect effects under Alternative 1. Vegetation densities or characteristics would not be modified, and the forest would continue to be influenced by natural processes and limited management actions, such as fire suppression. Since no implementation activities will result under this alternative, no change is anticipated in the number of visitors, frequency or season of use in dispersed recreation activities, developed recreation sites, trails, or permitted uses. Recreational visits within the project area would remain near the same levels as previous years and under this alternative traditional use patterns and recreational opportunities would not be impacted. Hunting, hiking, dispersed recreation, permitted uses, and access, are expected to remain unchanged.

Alternatives 2 and 3

The specific project activities with potential to impact recreation are common to Alternatives 2 and 3. Both action alternatives propose different levels of activities, but the effects to the public involved in different recreation endeavors common to the area are similar. Both alternatives would include four main project activities that could affect recreation:

- Timber harvest and thinning (i.e. commercial harvest of timber, commercial, noncommercial, improvement, and riparian thinning)
- Post-thinning activity fuels treatments (i.e. grapple pile, hand pile/burn)
- Prescribed fire (i.e. post-harvest activity fuels treatment and 'stand alone' prescribed fire prescriptions)
- Road and Access activities (i.e. danger tree removal along open system haul roads, haul roads, temporary road construction, road realignment, road decommissioning, OHV route designation etc.)

Dispersed Recreation

Dispersed recreation activities will be affected by all four types of project activities mentioned above. In the short term, thinning and prescribed fire activities may restrict user access into a treatment unit due to safety purposes, or users may be discouraged from entering a unit due to the presence of equipment and workers. This may occur in peak summer visitations or during the fall hunting seasons. Downed trees, slash piles, loss of forest-products (i.e. mushrooms, berries), active fire and residual smoke will also discourage visitor use in an area. Noise and other disturbances may affect the quality of the recreation experience for an individual regardless of the proximity to the activity.

A change in natural features or landscape characteristics may elicit different responses in visitors. As discussed above one attraction to an area may be linked to visitors 'sense of place' (Farnum, et al., 2005). A visitor's sense of place includes attachments to external factors like natural features or landscape characteristics. Important landscape features may consist of a variety of tree species, an open or closed tree canopy, rock formations, water bodies, and natural appearing openings (USDA-FS, 1995). The proposed treatments such as harvesting trees, reducing slash or altering canopy cover will change or remove some of these natural features. In some cases the changing

landscape will displace or discourage certain types of dispersed recreational activities (i.e. studying nature, viewing wildlife). In other areas it may encourage new dispersed recreational activities (i.e. big game hunting, photography) not available under the previous landscape.

For Alternatives 2 and 3 there are dispersed camps within harvest units. Depending on the timing and proximity of the treatment, campers at these sites may be displaced or have a less quality experience due to noise, equipment activity, and dust. In some cases, project activities may close or alter dispersed campsites that currently contribute to environmentally degraded conditions.

Direct effects to recreationists accessing dispersed camps in the project area or other areas would occur on roads during haul periods. The presence of large trucks or an increased frequency of traffic may discourage road use to these sites as well as associated activities until the road work subsides. When roads are being constructed/reconstructed visitors may expect delays or closures during work periods. OHV activities may increase if roads are opened. If roads are used for winter haul, they may be available for access by winter recreationists like cross-skiers which is uncharacteristic in most years due to closure by snow.

Long term effects of harvest and post-harvest treatments will elicit various responses from recreationists. Recreators seeking more open stands of forest may enjoy increased scenery views, improved cross country skiing or snowmobiling, and some types of big-game hunting and wildlife viewing. Other visitors may view a loss of forest density as a reduction in opportunities to view natural features and scenery, observe wildlife, and take self-discovery hikes. Another long-term effect will provide safe and adequate roaded and trail access for the recreating public, through the cutting of danger trees and improving roadside visitor travel. This is also a long-term effect for developed recreation and permitted uses.

Developed Recreation

Although there are no developed recreation sites within the project area, access to adjacent developed sites may be delayed or restricted during haul periods or road construction. The presence of large log trucks and other equipment on haul routes may discourage users from driving the main access route to developed sites or other associated activities outside of the developed recreation area. The noise, dust, smoke and equipment activity during harvest, post-harvest and prescribed fires may affect the quality of the recreation experience for a visitor regardless of the proximity to the activity. The frequency and intensity of these activities may vary from a few hours to several weeks.

OHV Trails

The O-1932 Big Ridge, O-1932A Outlaw, O-1941 Chicken Hill, O-1941A Chicken Hill A, and O-1945 Chicken Rock OHV trails are located within the project area. Use and access may be affected by the proposed activities and associated traffic and these trails may be temporarily closed for safety reasons.

Portions of the 5164, 5164-180, 5164-182, 5164-200, 5182-580, 5160-012, 5160-014, 5160-043, 5160-045, 5175-010, 5182-800, 5182-035, and 5182-040 roads may become designated OHV trails after project completion, potentially adding 6.98 miles with signed intersections to the OHV trail system. This would enhance rider safety by designating these stored roads to OHV use, which would reduce the potential for an encounter with full-size vehicles. Additionally, 6.3 miles of the existing trails would be formally adopted into the Forest Service database with signed intersections which would enhance user safety by improving navigation tools.

Noise, dust, smoke and equipment activity during harvest, post-harvest and prescribed fires may

affect the quality of the trail users' experience as well. Modifications to trails made to facilitate project activities may diminish the recreation experience. This would eventually return to a more natural appearance over time as vegetation reestablishes.

Snowmobile Trails

Several Forest System Roads have been designated as snowmobile trails. A local snowmobile club grooms the trails when there is adequate snow coverage, typically between the months of December and March. These trails have the potential to be impacted if a designated snowmobile route is plowed for winter haul. Coordination with the local snowmobile clubs may alleviate the concern if alternate temporary routes are groomed during the short term.

Permitted Uses

All permitted uses are authorized under the terms and conditions of a permit which allow activities not available to a non-permitted user. Most of these uses are intrinsically tied to road access, and the removal of forest products is dependent upon specific areas or vegetation. Permitted uses will be affected by all four project activities mentioned above. Like dispersed recreation, timber harvest, post- harvest, and prescribed fire activities have short term effects and may restrict or discourage entry into a harvest unit. Depending on the level of treatment activity, permit users may be displaced to other areas inside or outside the project area. Increased obstacles like downed trees and slash piles, or loss of forest-products (i.e. mushrooms, berries) will also change harvest patterns. Residual smoke, dust, fire, noise and equipment activity is also not conducive to a quality recreation experience. The same effects for road use described in 'Dispersed Recreation' is also applicable to this recreation use. If roads are used for winter haul, they may be available for access by winter recreationist like Christmas tree cutters who normally do not have access due to deep snowpacks. Firewood cutters may find some benefits from roadside 'salvage' but may lose opportunities if firewood is removed from a unit as part of the fuel reduction prescription.

Long term effects of harvest and post-harvest treatments will solicit various responses from permit users. Permit holders, like mushroom pickers, will find short term benefits from open, disturbed mixed-conifer forest stands, whereas berry pickers may view the loss of berry patches as a negative impact.

Cumulative Effects

Past projects and actions which have affected recreation uses include timber harvest, road construction, and recreation uses. Residual effects of past timber harvest influence dispersed recreation activities by displacing some uses (i.e. big game hunters may go to areas with more dense canopy covering, berry pickers may go to areas where plants are more abundant) whereas it may encourage other uses (i.e. open areas allow better viewing background scenery). Road construction has had both a positive and negative effect. It has been viewed by some users as increasing access to areas, yet has had a negative affect for non-motorized users who may have previously used an unroaded area. The allowance of cross- country travel has affected some non-motorized recreation activities due to sight, sound and emissions of vehicles. The establishment of dispersed camps has provided traditional camp sites by making user created routes to the sites and expanding the 'camp-able' area.

Compliance with Forest Plan and Other Relevant Laws, Regulations, Policies and Plans

<u>Forest Plan Recreation Resource Goal</u> - The project will meet this goal because the current wide variety of recreation opportunities will still be available to all segments of the public during and

after project implementations. The elimination of any recreation opportunity is not part of the project alternatives. All action alternatives will meet the visual quality objectives as directed in the Forest Plan (See Visuals/Scenery Resource section).

Desired Future Conditions- The project will meet the DFCs because a wide variety of recreation opportunities will still be available to all segments of the public during and after project implementations. However, there may be changes in the amount and location of some opportunities in the short term due to harvest activities and fuel treatments. Quality roaded natural opportunities will remain on most of the project area. Trail related activities may be affected by the project in the short term but should be added to after completion. Harvest activities and fuel treatments will change the surrounding lands adjacent to some dispersed recreation sites. Fuelwood permits will still be issued under the terms of the permit for areas for many locations within the project area.

ROS - The ROS goals will be met for the Roaded Natural setting because the project involves timber harvest activities with compliance of the Visual Quality Objectives (VQO). (See Visuals/Scenery Resource section). Road management activities will continue to provide for dispersed recreation. The project does not propose any changes to the dispersed site development levels or developed site user densities. The ROS goals will be met for the Semi-Primitive Motorized setting because the project involves timber harvest activities with compliance of the VQOs (See Visuals/Scenery Resource section). Motorized harvesting from primitive roads will be conducted during low public use periods. Public access on road and trails will remain with the allowed difficulty range, and road management objectives.

Economics

This section directly addresses Purpose and Need element 5 (socioeconomics). The following resource indicators are used to compare the effects of action alternatives on the Key Issue of economics.

Table 80. Economic indicators and measures

Indicator	Measure
Investments	Dollars
Wages	Dollars
Employment	Jobs Created
Economic output	Dollars

Summary: Numerous contracts would be offered to accomplish the project activities identified in each alternative. Service contract types could be used in areas where the value of products would be insufficient to offset the cost of work in all action alternatives. Stewardship contracts could trade the value of timber for project work done in this area. Contracts may include a variety of work such as timber harvest activities (including costs associated with stump to truck, haul, road maintenance, reconstruction and temporary road costs), forest road improvements (fish passage culvert), and fuels reduction treatments.

Potential investments have been incorporated into a model that provides a relative comparison between alternatives in terms of potential economic effects to local communities. Contract costs were estimated based on removal volumes for harvest type work, treatment acres of fuels/vegetation management work and treatment miles for road reconstruction work.

Table 81. Contract Investment Assumptions and Alternative Comparison

Type of Work	Investment Value	Acres by Alternative		
		Alternative 1	Alternative 2	Alt. 3
Ground Based Logging	$150/MBF	0	12 MBF	5.5 MBF
Skyline Logging	$300/MBF	0	0	.6 MBF
Tethered Logging	$150/ MBF	0	2 MBF	0
Road Reconstruction	$25,000/mile	0	1.7	1.7
Road Maintenance	$500/ mile	0	23.06	7.78
Road Decommissioning	$2434/ mile	0	.16	.16
Culvert Replacement Fish Passage	$100,000	0	0	0
Temporary Culverts	$5,000	0	11	1
Meadow Restoration	$200/ ac	0	36	36
PCT – Hand Precommercial thin	$225ac	0	935 ac	263 ac
FUH- Hand Fuel Reduction	$ 200 ac	0	2416 ac	2012 ac
FUM-M Fuel Reduction Mechanical	$200/ac	0	3855 ac	3326 ac
PCT- M Precommerical thin Mechanical	$200/ ac	0	989 ac	423 ac
Whipfell Hand work	$75ac	0	3367 ac	1308 ac
Jackpot Burn	$100/ ac	0	8231 ac	6060 ac
Pile Burn	$85/ ac	0	4844 ac	3749 ac
Planting	$600/ac	0	1480 ac	528 ac

Alternative 1

This alternative would not implement any of the activities proposed in the action alternatives, and as a result there would be no investment revenue received, jobs produced or wages earned from logging, fuels reduction, and road work within the counties surrounding the Sheep Creek project area. Economic contributions from recreation related activities would continue, such as hunting or ATV use.

Alternatives 2 and 3

Investments

The following table summarizes the total estimated investment for each type of work and the total

for each action alternative.

Table 82. Investments by Alternative

Alt	Type of Work	Expected Investment for Each Type	Total Investment
2	-Harvest Related Work (Ground based and tethered logging systems) -Reconstruction, Maintenance, Decommissioning, Culverts Replacement (temp./ permanent) -Fuels Reduction/Vegetation Management/ Prescribed burning -Reforestation - Meadow Improvement	$2,4000,000 $109,419 $2,897,215 $592,000 $7,200	$6,005,834
3	-Harvest Related Work (Ground based and skyline systems) -Reconstruction, Maintenance, Decommissioning, Culverts Replacement (temp./ permanent) -Fuels Reduction/Vegetation Management/ Prescribed burning -Reforestation -Meadow Improvement	$1,005,000 $51,779 $2,196,040 $211,200 $7,200	$3,471,219

Wages

Contract work would produce local wages (see table 81). Total wages earned on a project vary by the proportion of hand work versus mechanical work on a project, with hand labor wages typically lower than equipment intensive work.

Table 83. Direct Wages, Indirect Wages and Total Wages earned for each alternative

Alternative	Direct Wages	Indirect Wages	Total Wages
2	$1,683,610	$2,581,130	$4,264,739
3	$1,389,093	$1,829,801	$3,218,894

Employment

Within Oregon, contract investments could generate between 15.7 – 23.8 jobs depending upon the work (labor intensive versus equipment intensive), as well as additional indirect jobs for each $1 million invested (Economic and Employment Impacts of Forest and Watershed Restoration in Oregon, University of Oregon Ecosystem Workforce Program – Working Paper Number 24, spring 2010). Direct effect employment includes jobs created or maintained in businesses contracted to perform the work on the ground. Indirect effect employment includes those jobs associated with the demand for materials, supplies, equipment and other services needed to support the contract work.

Table 84. Jobs by Alternative (based upon dollars invested)

Alternative	Direct Jobs	Indirect Jobs	Total Jobs
2	59	72	131

3	44	49	94

Economic Output

Total economic activity is the value of all goods and services produced by project work (Direct Output), as well as through the purchase of goods and services needed to support project implementation and the value of goods and services supported by household spending of income earned during project implementation (Indirect/Induced Output).

Table 85. Total Economic Direct and Indirect Outputs for Investments

Alternative	Direct Outputs	Indirect Outputs	Total Outputs
2	$9,388,374	$7,242,713	$16,631,087
3	$8,326,654	$5,676,324	$14,002,978

While Alternative 2 has the potential for the largest economic output for investments, followed by Alternative 3, we must consider the likelihood that adequate funds would be available to fully implement the project and whether or not a biomass market becomes established in surrounding communities. Diminishing federal budgets have the potential to affect the Forest's ability to make these investments, particularly related to noncommercial fuel reduction activities. Each alternative is projected to produce viable sales that will help offset the cost of non-commercial thinning, road work, and slash treatments.

Funding for fuels related service work such as those proposed in the Sheep Creek project is typically associated with hazardous fuel treatment funds. The past 10-year average annual hazardous fuel funding allocation to the Wallowa-Whitman National Forest is less than $2 million. These funds support not only the federal personnel to do the planning, contract preparation and administration, but also pay for the implementation of contract work. In the Sheep Creek project, fuel reduction funding needs (Table 82) for completion of the contract work alone ranges from approximately $2.2 - $2.9 million. Given current funding levels, it would take at least 1-2 years to complete the noncommercial fuels reduction work in the Sheep Creek area with no funding available for any other fuel reduction work on the remainder of the forest. Additional funding support would most likely be needed to complete all of the fuels reduction work for this project. Alternative 3 would have the least need, followed by Alternative 2.

Cumulative Effects

The cumulative effect of Alternatives 2 and 3 are similar. They would all provide the counties surrounding the project area with timber receipts which otherwise would be dollars out of taxpayer pockets. They would provide jobs as described under the direct and indirect effects above. 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 nearby counties. The greatest incremental positive impact on the local economy would be associated with alternative 2 followed by 3. In addition, the alternatives and the effects would be similar when considering utilization of materials at manufacturing facilities. The products produced from this project under both action alternatives would not support the local businesses and mills alone; however, when added to the wood products being removed from other private, adjacent state, and corporate lands, as well as other national forest timber sales, it contributes to the overall viability and sustainability of local mills and businesses. The acres treated would provide seasonal work/benefits over a period of 8-10 years. Economic

contributions from recreation related activities are not expected to change due to proposed forest management and restoration activities.

Scenery Resources

Table 86. Scenery indicators and measures

Indicator	Measure
Integrity	Qualitative measurement of visible disturbance
Stability	Qualitative measure for degree to which desired characteristics can be sustained through time

Summary of Effects

Alternative 2 would treat 4,465 more acres than Alternative 3. Deferring treatment of non-fire resilient stands would perpetuate the existing condition in these stands thus reducing the effectiveness of the treatments to improve their vegetative resiliency to disturbance factors such as fire, insects, and disease. Scenic stability is expected to improve under alternatives 2 and 3 due to increased vegetation resilience to wildfire and other disturbances. Scenic integrity will be maintained and enhanced through application of scenery project design features and improved views in to treated areas highlighting existing large trees/boles and increased understory grass, forb and shrub abundance and diversity adding to the color and textural diversity in foreground areas. The action alternatives all meet Forest Plan VQOs and objectives and standards, and all alternatives retain existing VQOs consistent with Forest Plan Standards and Guides for Scenery. The following table shows the summary and compliance of the action alternatives.

Table 87. Summary of Scenery Effects and Compliance

Alternatives	Overall Scenic Integrity	Existing Scenic Stability	Achieved Scenic Stability	Forest Plan Compliance
Alternative 2	Partial Retention	Very Low	Low	Meets Forest Plan VQOs
Alternative 3	Partial Retention	Very Low	Low	Meets Forest Plan VQOs

Alternative 1

The No Action alternative would allow existing conditions and trends to continue on their current trajectory. Although a no-action alternative would create no effects to the scenic integrity and meet all the visual quality objectives, it would leave conditions that place scenic attributes at risk.

A no action alternative would have no short-term effects to scenic integrity, or scenic stability. Existing scenery integrity and scenic stability would remain the same, and the visual quality objectives would be met.

The indirect long-term effects related to the existing conditions and trends could be substantial and long term. Overstocked stands experience increased stress likely to lead to insect and disease outbreaks affecting scenic character and stability. Fuel loads within the stands increase the risk for stand replacement fire. In the event of stand replacement fire, the scenic integrity would be

greatly reduced by widespread tree mortality.

In addition to the loss of large stands of trees, there are also other effects such as those associated with fire suppression efforts in and around developed areas such as trailheads and defensible spaces (see fuels effects). Widespread wildfire also produces favorable conditions for invasive plants (see invasive species effects), impacting visual character and stability.

Alternatives 2 and 3

Commercial Thinning- (HTH and RHCA - HTH)
Thinning from below opens the stands by removing the smallest diameter trees. This provides greater viewing distances into the stand allowing for improved views of any remaining large diameter tree boles. The reduction in tree densities improves stand resilience by reducing competition for resources, reducing the risk of insect and disease severity, and reducing risk for stand replacement wildfire (see silviculture report). This prescription preserves large, fire resilient species. These are benefits that contribute to the improvement of scenic stability when carried out at a landscape scale.

This treatment will create stumps, slash and duff disturbance visible from foreground views. These effects will be most noticeable from one to two years following treatment. As shrubs and grasses reestablish these effects will become less apparent. This prescription does not create openings visible from middleground or background distances. The effects of this prescription are not anticipated to reduce the scenic integrity of treated areas.

Improvement Thinning (HIM)
This prescription removes some of the dominant and codominant trees to release the more viable adjacent and understory trees promoting stand health and more resistance to stand replacement fires, insects, and disease. These treatments open the canopy and produce textural change visible from middleground views. Foreground views will be affected by stumps, slash and occasional skid trails. The resulting open canopy will allow more sunlight to reach the forest floor, creating a dappled shadow appearance. These treatments result in short term impacts to immediate foreground and are addressed and mitigated with project design criteria (see Design Features and Mitigations section p. 36).

Group Selection Treatments: Shelterwood Establishment (HSH) and Patch Opening (HPO)
Patch openings transition Stem Exclusion and Understory Reinitiation structures at high risk for mountain pine beetle mortality into Stand Initiation patches. Patches consist of irregularly shaped openings, 3-5 acres each, across 30-40% of proposed units. Treatments retain desired species (western larch, Douglas-fir and ponderosa pine) and trees suitable for snag recruitment within the openings. This treatment mimics patch disturbances observed within mixed severity fire regimes and promotes regeneration of early seral species. Planting may occur in areas where natural regeneration of desired species is unlikely. Variable thinning in stands adjacent to patches would promote large tree development and structural diversity.

These treatments would create stumps, slash and soil disturbance that would be visible from foreground views. These effects would be minor within the first one to two years. As regrowth of shrubs and grasses occur these effects would be significantly reduced. Single tree selection would not create openings that are visible from middleground or background distances. Small openings from group selection treatments would be consistent in size and shape with historic patterns and could be visible from middleground distances.

Prescribed Burning

Underburning natural fuels is a treatment used to reduce litter and ladder fuels. Effects to scenery are generally minimal and short lived. One growing season reduces the effects to remaining scorched tree trunks and dead saplings. Scenery is best preserved when thorough site preparation is done prior to underburning. Low intensity fire is a natural occurrence in this area, and its effects do not degrade the scenic quality. This treatment can greatly improve a stands resiliency to large stand replacement fire which can affect the scenic quality.

Pre-commercial Thinning (PCT), Fuels Thinning (FUH/FUM/RHCA – PDC)

This treatment reduces stocking levels to promote growth of desirable species, reduce disease, the treat of future insect outbreaks and ladder fuels that increase fire intensity and the occurrence of crown fires. Removal of these trees opens views into stands. The effects to scenery are limited to foreground view effects of stumps, and slash.

These treatments reduce stocking levels within young, post disturbance stands to promote growth of desirable species and increase spatial heterogeneity toward the range of variability. Direct effects to scenery would be minimal and short term. The effects to scenery are limited to the foreground view effects of stumps, and slash. This treatment can improve stand resiliency to stand replacement fire, which can affect the scenic quality.

Scenic Stability

Alternatives 2 and 3 include a suite of thinning and fuels treatments designed to address the purpose and need (see prescription effects above). Treatments would improve long-term scenic integrity by opening stands for increased visibility and visual diversity. Partial removal and commercial harvest treatments would retain pine and larch with large and old tree characteristics and greater fire resiliency. These treatments will improve species composition, stand density, and reduce ladder fuels and canopy closure enhancing scenic character and stability.

Both action alternatives would improve scenic stability from low to high where “all dominant scenery attributes of the valued scenic character are present and are likely to be sustained” (SMS Appendix J). Alternative 2 would increase visibility into stands in the project area by opening the mid canopy, improving stand conditions and textural diversity on approximately 1,213 acres of stands with a VQO of partial retention, 10,640 acres of modification, and 917 acres of maximum modification. Alternative 3 would treat approximately 822 acres with a VQO of partial retention, 7,181 acres of modification, and 554 acres of maximum modification.

Scenic Integrity

Thinning and fuels treatment activities will cause short-term effects that reduce scenic integrity for a period of 1-3 years from ground disturbance and slash. Tractor yarding and skyline cable yarding create visible effects for the first year including ground disturbance, slash, and debris. After a growing cycle these effects will be negligible.

There are approximately 3,116 acres of foreground within the project area that have a VQO of partial retention. Alternative 2 would treat approximately 725 acres of partial retention foreground, 0 acres of middlground, and 488 acres of background. Alternative 3 would treat approximately 653 acres of foreground, 0 acres of middleground, and 169 acres of background. No regeneration harvests are proposed, therefore both alternatives are within Forest Plan visual standards for less than 14% of the viewshed perceived as “opened” from regeneration harvest.

Cumulative Effects

The treatments proposed are designed to reduce ladder fuels and overall tree densities and provide greater firefighting opportunities for future wildfire events This in turn will likely indirectly affect the size and severity of future fire events reducing potential wildfire effects to scenery resources. It will be much more likely that effects of fires in this area will remain within the size and severity characteristic to the historical range once treatments are completed.

Fuel reduction units totaling approximately 400 acres (Rooster units 503, 504, 505, 506, 509, 510, 511A and 512) and commercial thinning units totaling approximately 70 acres (Rooster units 22 and 34) lie adjacent to Forest Service road 5100. The views from this road are "cleaned up" and the appearance of the understory is more open. Low stumps are visible from these roads. The effects would not be apparent from a middleground or background view. The additional 725 acres of treatment in alternative 2 and 653 in alternative 3 within partial retention foreground would contribute to the mosaic of stand structures within the viewshed and complement the treatments completed under the Rooster project.

The timber sale history in this area includes sales from 1954 to 2003. Openings created during this time that have repopulated with trees taller than 20 feet are no longer considered visually open (Forest Plan 4-44). Textural differences are still evident in areas with intermixed regeneration units with unnatural shape and sized patches created by past regeneration harvests. Continued development of these patches over the next several decades will reduce textural contrasts as trees grow and structure diversifies in old regeneration units. The harvest activities since 1989 have been primarily intermediate treatments that did not create openings or negatively affect the scenic integrity . These treatments primarily addressed density and species composition in immature stands through precommercial thinning. Alternatives 2 and 3 would include treatment in many past regeneration units helping to facilitate stand development and reduce some of the textural and color contrasts on the landscape. Beyond unpredictable future wildfires, no present or reasonably foreseeable future activities which overlap in time and space with the Sheep Creek project would have a measurable effect on scenery and visual resources when combined with the activities proposed under the action alternatives in Sheep Creek (Appendix D of the EA). In the event of a future wildfire, alternatives 2 and 3 provide greater cumulative scenic stability than alternative 1 resulting in reduced potential for negative cumulative effects to scenic integrity resulting from a wildfire.

Other Undeveloped Lands

The term "other undeveloped lands" is presented and used in this document to provide a consideration for the unroaded areas identified during public scoping efforts. There are no forest-wide or management area standards specific to other undeveloped lands in the 1990 Wallowa-Whitman Forest Plan. All lands, including other undeveloped lands, are managed consistent with forest-wide standards and guidelines and by designated Forest Plan management area allocations.

Table 88. Undeveloped lands indicators and measures

Indicator	Measure
Undeveloped Lands	Biophysical values (soils, water, fish, plants, wildlife)
	Social values (apparent naturalness)

Summary: Direct and indirect effects to both biophysical and social intrinsic values would be the

same across alternatives 2 and 3, only varying in the number of acres treated. For more detail regarding each sub-category, refer to specialized effects sections within this report.

Wilderness and Roadless Areas

There are no wilderness or roadless areas within or immediately adjacent to the Sheep Creek project area.

Preliminary Administratively Recommended Wilderness Area

The Sheep Creek project area does not include lands identified as preliminary administratively recommended wilderness areas (PARWA).

Other Undeveloped Lands

Approximately 625 acres of undeveloped lands exist within the project area.

Alternative 1

The entire undeveloped area would remain as described below, as there would be no direct or indirect effects under this alternative.

Vegetation

Of the forested landscape in the project area approximately 28% is dry potential vegetation group, 21% moist PVG, and 49% cold PVG. Existing conditions can be found in the Forest Health and Sustainability report.

Fisheries and Water

Category 1 streams within undeveloped areas of the Sheep Creek project boundary include portions of Indiana Creek and Little Fly Creek. Existing conditions for these riparian areas can be found in the Fisheries report.

Soils

Approximately 22,650 acres of the project area are on sensitive soil types. See soils effects for reference.

Threatened & Endangered Wildlife

There are no threatened or endangered wildlife species within this undeveloped area. Nine species listed as sensitive either have potential habitat within the project area or have been documented to occur in the project area, and one candidate species has potential habitat but is not known to occur on the Wallowa-Whitman National Forest. See the Wildlife Biological Evaluation for more information.

Opportunities for Solitude

The undeveloped area shares a border with NFS roads 5100 and 5182. Both roads provide access to recreation sites within the project area year-round. Many older roadbeds border the undeveloped area leaving most of the identified undeveloped land within 1,000 to 2,500 feet from a road. Opportunities for solitude are limited within the identified area due to steep slopes, campgrounds, OHV trail use, and proximity to roads.

Apparent Naturalness

Past management activity and areas where older roadbeds within the undeveloped areas reduce the apparent naturalness of the undeveloped land. Vegetation in the undeveloped area is not unique or unusual.

Alternatives 2 and 3

Table 79 displays proposed treatment acreages within the undeveloped area and maps provided in Appendix C reveal their adjacency to existing roads and recreation facilities. Alternatives 2 and 3 propose treatment in units 71, 72, 73, 75, 77, 78, 89, 90, 92, 221, 223, 250, 254, 255, 257-267, 269, 270, 272, 275, 308, 311, 312, 329, 336, 351; a portion of each is located within the undeveloped area. For more information on individual treatments, refer to the Forest Health and Sustainability report.

Table 89. Proposed treatments in undeveloped areas

Alternative	Noncommercial Acres	Commercial Acres
2	505	120
3	505	7

Vegetation

Proposed commercial, noncommercial, and prescribed burning treatments reduce densities in overstocked stands to improve the health, vigor and sustainability of forested stands (see Fire Behavior/Forest Health and Sustainability effects). These treatments reduce stand susceptibility to insects and diseases and reduce the potential for stand replacement in the event of a wildfire. Prescribed burning also increases forage availability. Due to requirements restricting direct ignition in riparian buffers incorporated into project design no sensitive plant species would be impacted within this undeveloped area, and white bark pine sites would be protected.

Soils

Restoration activities would occur after ground-based activities are complete. The contractor would be required to subsoil or decompact landings and used or old skid trails as needed to bring DSCs below 20% in units that exceed DSC minimums (see soils effects and PDCs). Ground-based operations would occur only when soils are dry, snow covered, or frozen. Grapple piling and burning would generate minimal detrimental disturbance. Mastication and hand treatment is not expected to contribute to DSCs. Literature and local monitoring on soils similar to those in the project area indicate that skyline logging would meet the Regional Soil Quality Standards. The effects from skyline harvest would impact less soil than ground-based harvest (including proposed tethered logging units) when used on appropriate slopes.

Fisheries and Water

Approximately 24 acres of undeveloped Riparian Habitat Conservation Areas would be eligible for commercial removal under Alternative 2 and 0 acres under Alternative 3. Less than 15% of these units would undergo commercial harvest with heavy equipment reaching trees from the road. Acres that exceed the distance of machine capabilities would be hand thinned. In general, prescribed fire would be allowed to back into riparian areas. Burn treatments would most likely occur during the spring or fall and would produce a mosaic of low intensity burned and unburned areas. The prescribed burning and harvest would not likely negatively impact this area. See fisheries report for effects to RHCAs.

Threatened & Endangered Wildlife

Proposed project activities would either have a beneficial impact on proposed or sensitive species, or may impact individuals or their habitat, but would not cause a trend toward listing of the species. Implementation of project design criteria would mitigate negative impacts to wildlife. See Wildlife Biological Evaluation for species specific detail.

Opportunities for Solitude

As described under alternative 1, opportunities for solitude are limited within the identified area due to steep slopes, OHV trail use, and proximity to roads. The few opportunities for solitude that exist could be temporarily disrupted by project activities.

Apparent Naturalness

Fire is a natural occurrence. Prescribed fire activities proposed within this area would not affect apparent naturalness. Mechanical treatments along existing roads and adjacent to recreation facilities would change the appearance of treated stands. Application of variable density thinning, visual corridor mitigations, special harvest system considerations and retention of large diameter overstory trees would help mitigate visual effects and impacts on apparent naturalness.

Cumulative Effects

Impacts to apparent naturalness in this area include the existing activities (roads, OHV trails, past management). The limited harvest and prescribed burning acres proposed in this area are short-term and limited in acres. They would not impact opportunities for solitude or the apparent naturalness, and there would be no cumulative effects from the activities proposed in the Sheep Creek project.

Greenhouse Gas Emissions

This proposed action would affect between 1,308 to 3,367 acres of forest by commercially thinning smaller trees from the stand, retaining a residual stand between 40-100 square feet/acre, depending on Potential Vegetation Group (PVG-See Forest Health and Sustainability effects for more detail on prescriptions). This scope and degree of change would be minor, affecting up to 11% of the 29,935 acres within the Sheep Creek and Chicken Creek subwatersheds. In addition, the effect of the proposed action focuses on aboveground carbon stocks, which typically comprise a fraction of the total ecosystem carbon stocks in the proposed managed area; 50 percent or more of the ecosystem carbon is in the soils, a very stable and long-lived carbon pool (McKinley et al. 2011, Domke et al. 2017).

Climate change is a global phenomenon, because major greenhouse gasses (GHGs)[5] mix well throughout the planet's lower atmosphere (IPCC 2013). Considering emissions of GHGs in 2010 were estimated at 49 ± 4.5 gigatonnes[6] carbon dioxide (CO_2) equivalent[7] globally (IPCC 2014) and 6.9 gigatonnes CO_2 equivalent nationally (US EPA 2015), a project of this size makes an extremely small contribution to overall emissions. Because local GHGs emissions mix readily

[5] Major greenhouse gases released as a result of human activity include carbon dioxide (CO_2), methane, nitrous oxide, **hydrofluorocarbons, and perfluorocarbons.**

[6] Gigatonne is one billion metric tons; equal to about 2.2 trillion pounds.

[7] Equivalent CO_2 (CO_2e) is the concentration of CO_2 that would cause the same level of radiative forcing as a given type and concentration of greenhouse gas. Examples of such greenhouse gases are methane, perfluorocarbons, and nitrous oxide.

into the global pool of GHGs, it is difficult and highly uncertain to ascertain the indirect effects of emissions from single or multiple projects of this size on global climate. Therefore, at the global and national scales, this proposed action's direct and indirect contribution to GHGs and climate change would be negligible. In addition, because the direct and indirect effects would be negligible, the proposed action's contribution to cumulative effects on global GHGs and climate change would also be negligible. Lastly, carbon emissions during the implementation of the proposed action would have only a momentary influence on atmospheric carbon concentrations, because carbon will be removed from the atmosphere with time as the forest regrows, further minimizing or mitigating any potential cumulative effects.

The Fifth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) summarized the contributions of global human activity sectors to climate change (IPCC 2014). From 2000 to 2009, forestry and other land uses contributed just 12 percent of the human-caused global CO_2 emissions[8]. The forestry sector's contribution to GHG emissions has declined over the last decade (IPCC 2014, Smith et al. 2014, FAOSTAT 2013). The largest source of GHG emissions in the forestry sector globally is deforestation (Pan et al. 2011, Houghton et al. 2012, IPCC 2014), which is defined as the removal of all trees to convert forested land to other land uses that do not support trees or allow trees to regrow for an indefinite period of time (IPCC 2000) (e.g., conversion of forest land to agricultural or developed landscapes). However, forest land in the United States has had a net increase since the year 2000, and this trend is expected to continue for at least another decade (Wear et al. 2013, USDA Forest Service 2016).

The Sheep Creek project is not considered a major source of GHG emissions. Forested land will not be converted into a developed or agricultural condition or otherwise result in the loss of forested area. In fact, forest stands are being treated to mimic historic disturbance patterns to maintain a vigorous condition that supports enhanced tree growth and productivity, thus contributing to long-term carbon uptake and storage. In 2010, forests in the United States removed about 757 megatonnes[9] of CO_2 from the atmosphere after accounting for natural emissions (e.g., wildfire and decomposition) (US EPA 2015).

Some assessments suggest that the effects of climate change in some United States forests may cause shifts in forest composition and productivity or prevent forests from fully recovering after severe disturbance (Anderson-Teixeira et al. 2013), thus impeding their ability to take up and store carbon[10] and retain other ecosystem functions and services. Climate change is likely already increasing the frequency and extent of droughts, fires, and insect outbreaks, which can influence forest carbon cycling (Kurz et al. 2009, Allen et al. 2010, Joyce et al. 2014). In fact, reducing stand density, one of the goals of this proposed action, is consistent with adaptation practices to increase resilience of forests to climate-related environmental changes (Joyce et al. 2014). This proposed action is consistent with options proposed by the IPCC for minimizing the impacts of climate change on forests, thus meeting objectives for both adapting to climate change and mitigating GHG emissions (McKinley et al. 2011).

Forests have a "boom and bust" cycle with respect to carbon, as forests establish and grow, experience mortality with age or disturbances, and regrow over time. Forest management activities such as harvests and hazardous fuels reduction have characteristics similar to

[8] Fluxes from forestry and other land use (FOLU) activities are dominated by CO_2 emissions. Non-CO_2 greenhouse gas emissions from FOLU are small and mostly due to peat degradation releasing methane and were not included in this estimate.
[9] A megatonne is one million metric tons; equal to about 2.2 billion pounds.
[10] The term "carbon" is used in this context to refer to carbon dioxide.

disturbances that reduce stand density and promote regrowth through thinning and removal, making stands and carbon stores more resilient to environmental change (McKinley et al. 2011). The relatively small quantity of carbon released to the atmosphere and the short-term nature of the effect of the proposed action on the forest ecosystem are justified, given the overall change in condition increases the resistance to wildfire, drought, insects and disease, or a combination of disturbance types that can reduce carbon storage and alter ecosystem functions (Millar et al. 2007, Amato et al. 2011). Furthermore, any initial carbon emissions from this proposed action will be balanced and possibly eliminated as the stand recovers and regenerates, because the remaining trees and newly established trees typically have higher rates of growth and carbon storage (Hurteau and North 2009, Dwyer et al. 2010, McKinley et al. 2011).

In the absence of commercial thinning, the stands within the project area will thin naturally from mortality-inducing natural disturbances and other processes resulting in dead trees that will decay over time, emitting carbon to the atmosphere. Conversely, the wood and fiber removed from the forest in this proposed action will be transferred to the wood products sector for a variety of uses, each of which has different effects on carbon (Skog et al. 2014). Carbon can be stored in wood products for a variable length of time, depending on the commodity produced. It can also be burned to produce heat or electrical energy, or converted to liquid transportation fuels and chemicals that would otherwise come from fossil fuels. In addition, a substitution effect occurs when wood products are used in place of other products that emit more GHGs in manufacturing, such as concrete and steel (Gustavasson et al. 2006, Lippke et al. 2011, McKinley et al. 2011). In fact, removing carbon from forests for human use can result in a lower net contribution of GHGs to the atmosphere than if the forest were not managed (McKinley et al. 2011, Bergman et al. 2014, Skog et al. 2014). The IPCC recognizes wood and fiber as a renewable resource that can provide lasting climate-related mitigation benefits that can increase over time with active management (IPCC 2000). Furthermore, by reducing stand density, the proposed action may also reduce the risk of more severe disturbances, such as insect and disease outbreak and severe wildfires, which may result in lower forest carbon stocks and greater GHG emissions.

In the absence of prescribed fire to reduce stand density and fuel loads, the fire-adapted forest where this proposed action would take place may be more at risk to a high-severity wildfire, resulting in decreased ecosystem services and potentially increased carbon emissions. Prescribed fires typically target surface and ladder fuels and are typically less severe than wildfires (Agee and Skinner 2005), because they are conducted only when weather conditions are optimal and fuel moisture is high enough to keep combustion and spread within predetermined limits. Thus, prescribed fires result in minimal overstory tree mortality and typically combust less than 50 percent of the available fuel (Carter and Foster 2004, Hurteau and North 2009), producing lower GHG emissions than might be emitted if the same area were to burn in a high-severity wildfire (Wiedinmyer and Hurteau 2010). Also, a large portion of the emissions associated with prescribed fires is from duff, litter, and dead wood which comprise carbon pools that would otherwise decay quickly over time, releasing carbon to the atmosphere. Hazardous fuels reduction and restoration treatments can help reduce the severity of wildfires in forests where fire exclusion has resulted in high fuel loadings and high tree densities (Agee and Skinner 2005, Stephens et al. 2013). High-severity fires, especially when they occur repeatedly, can affect human health and safety, infrastructure, and ecosystem services, and can cause a transition of forests to non-forest ecosystems in some areas (Roccaforte et al. 2012, Anderson-Teixeira et al. 2013). By reducing the threat of high-severity wildfire, the proposed action would create conditions more advantageous for supporting forest health in a changing climate and reducing GHG emissions over the long term.

In summary, this proposed action affects a relatively small amount of forest land and carbon on

the Wallowa-Whitman National Forest and, in the near term, might contribute an extremely small quantity of GHG emissions relative to national and global emissions. This proposed action will not convert forest land to other non-forest uses, thus allowing any carbon initially emitted from the proposed action to have a temporary influence on atmospheric GHG concentrations, because carbon will be removed from the atmosphere over time as the forest regrows, or will transfer carbon to the product sector where it may be stored for decades and substitute for more emission intensive materials or fuels. This proposed action is consistent with internationally recognized climate change adaptation and mitigation practices.

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. Appropriate protection and avoidance measures have been designed and applied to the known sites existing within the project area in conjunction with the project Archaeologist.

Tribal Treaty Rights

Treaties ensure 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 first food resources such as fish, wildlife, and riparian areas.

Many plants that can be found in eastern Oregon may have cultural significance, and some of the plants may be present in the Sheep Creek Project area. The following plants which may be of cultural significance may be found in environments similar to that of the Sheep Creek Project: Grouse whortleberry, Blue huckleberry, Russet buffaloberry, Bulrush, Blue elderberry, Scarlet elderberry, Geyer’s willow, Willow, Gooseberry/Currant, Alderleaf buckthorn, Yampah, Bolander’s yampah, Bitter cherry, Common chokecherry, Lodgepole pine, Mock orange, Gray’s biscuitroot, Fernleaf biscuitroot, Cous biscuitroot, Bitterroot, Ocean spray, Strawberry, Hawthorne, Lanceleaf springbeauty, Horsehair lichen, and Saskatoon serviceberry. (It should be noted that no official survey was conducted by WWNF botanists for presence/absence of these plants in the project area). First foods are those individual resources, reserved in their Tribal treaties, to which Tribal members retained rights. These rights, such as hunting, fishing, and gathering roots and berries, have been acknowledged by the United States Supreme Court. The Tribes mission is to protect, restore, and enhance the first foods (including water, salmon, deer, cous, and huckleberry) for the perpetual cultural, economic, and sovereign benefit of the Tribe. They measure the success of resource management by the availability and utilization of these resources. The sustainability of these resources is considered by them the minimum ecological condition necessary to meet the trust responsibility of the United States.

This project has shared in the federal government’s overall trust responsibility to Indian tribes where treaty or other legally defined rights apply to National Forest System lands. Consultation has incorporated opportunities for tribal comments and contributions to the proposed action. (See EA p. 4). All alternatives are relatively equal in their treatment of treaty rights and are expected to

maintain treaty rights and opportunities into the future.

Biological Diversity

All existing native and desirable introduced species and communities are maintained with all alternatives. Erosion control measures (seeding) would use native species when possible (EA, Alternatives section). Biological diversity is not expected to be affected.

Research Natural Areas, Experimental Forests, and Wilderness

There are no research natural areas, experimental forests, or Wilderness areas within or immediately adjacent to the Sheep Creek project area. 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.

The only potential impacts on Wilderness areas from this project are from potential smoke incursion as discussed under Fire and Fuels section of this EA; however, any potential for smoke incursion from prescribed fire between July 4 and Labor Day would be restricted.

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 commonly used roads. 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 changes in vegetation or access.

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 will be negatively affected.

Impacts to soil and water are controlled by best management practices, project design criteria, and mitigation measures and would not represent an irreversible resource commitment. 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 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 effect 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 what

impact this type of change may have on unidentified nest sites of management indicator species.

Energy Requirements of Alternatives

The need for less energy-efficient and more expensive harvest or fuel reduction techniques is often due to the need to mitigate visual concerns, 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 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 or outside the National Forest. There are no prime farmlands affected by the proposal.

Wetlands and Floodplains

Executive Order 11190 requires the Forest Service to "avoid to the extent possible the long and short term adverse impacts associated with the destruction or modification of wetlands". The Sheep Creek Project is consistent with this EO because it does not propose to destroy or modify any wetlands.

Executive Order (EO) 11988 requires the Forest Service to "avoid to the extent possible the long and short term adverse impacts associated with the occupation or modification of floodplains. The Sheep Creek Project is consistent with this EO because it does not propose any actions with adverse effects to floodplains.

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).

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