Jigsaw Environmental Assessment
#DOI-BLM-ORWA-L040-2016-0013-EA

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Lakeview District - Klamath Falls Resource Area

ABSTRACT: The following Environmental Assessment addresses the environmental effects associated with a variety of proposed treatments in the Jigsaw analysis area, located in the northwestern portion of the Bureau of Land Management (BLM) Klamath Falls Resource Area (KFRA). Proposed treatments include commercial timber harvesting, small diameter thinning, and tree planting.

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https://eplanning.blm.gov/epl-front-office/eplanning/nepa/nepa_register.do

FREEDOM OF INFORMATION ACT AND RESPONDENT'S PERSONAL PRIVACY INTERESTS:
The Bureau of Land Management is soliciting comments on this Environmental Assessment. Comments, including names and street addresses of respondents, will be available for public review at the above address during regular business hours. Before including your address, phone number, e-mail address, or other personal identifying information in your comment, please be aware that your entire comment – including your personal identifying information – may be made publicly available at any time. While you can ask us in your comment to withhold your personal identifying information from public review, we cannot guarantee that we will be able to do so. All submissions from organizations or businesses, and from individuals identifying themselves as representatives or officials of organizations or businesses, will be made available for public inspection in their entirety.

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1- INTRODUCTION

The Klamath Falls Resource Area (KFRA) of the Bureau of Land Management (BLM) has prepared the Jigsaw Environmental Assessment (EA) #DOI-BLM-ORWA- L040-2016-0013-EA to evaluate the effects of vegetation treatments on wildlife habitat, soils, and other resources. The proposed project area consists of approximately 422 acres of BLM land, located in southwest Klamath County (see maps in Appendix A).

The Jigsaw Project was originally a portion of the Walter's Glade Project consisting of 3,300 acres of treatment which was scoped in November of 2013, but was postponed when priorities shifted due to the Oregon Gulch Fire of August 2014. The majority of the project area for Walter's Glade was within Designated Critical Habitat for the northern spotted owl. In order to minimize impacts to the NSO, the project was reduced to the Summit Project which was scoped in October of 2015. The Summit Project proposed 2-3 years of timber sales and consisted of 690 acres of treatment. In December of 2015, the Summit Project was further reduced into the Jigsaw Project due to complexities of project planning in anticipation of the release of the new Resource Management Plans for Western Oregon in the summer of 2016. The Jigsaw Project consists of 422 acres with 354 acres of treatments proposed to meet 1-2 years of timber volume. The intent was to reduce the amount of acreage proposed for timber harvest in order to reduce the effects to the northern spotted owl (NSO).

The entire Jigsaw project area is located within Designated Critical Habitat for NSO and proposed management actions have been designed to be consistent with the NSO Critical Habitat Rule (USFWS 2012) and the Recovery Plan (USFWS 2011) for the NSO. Both the Critical Habitat Rule and the Recovery Plan provide recommendations on proposed management within designated critical habitat and spotted owl sites. These recommendations include the following:

- focus management on areas outside of LSRs (i.e., Matrix)
- avoid or minimize activities in active NSO territories (or the high-quality habitat within these territories)
- prioritize known and historic NSO sites for conservation and/or maintenance (Recovery Action (RA)10), and maintain and restore older and structurally complex forests (RA 32)

The Jigsaw project was designed to meet timber harvest requirements for fiscal years 2016 and 2017 while minimizing impacts to the northern spotted owl (NSO). The proposed treatments are outside of any known NSO territories and surveys for the project area have been completed with no spotted owls detected. The Jigsaw project area of 422 acres includes proposed treatments on approximately 354 acres of BLM lands and would include thinning and regeneration harvest. The lands in the Jigsaw project are allocated as 402 acres of Matrix lands and 20 acres of Riparian Reserves (RR). There are no lands designated as District Designated Reserve (DDR) or Late Successional Reserve (LSR) within the Jigsaw project area.

1.1 Management Direction and Conformance with Existing Plans

Initial direction for this project comes from the land use allocations, management direction, and objectives of the 1995 Klamath Falls Resource Area Record of Decision and Resource Management Plan (RMP). Table 1-1 displays the acreage and summary of RMP objectives by land use allocation in the Jigsaw project area.

Table 1-1. Summary of RMP Objectives by Land Use Allocation in Jigsaw Project Area

Land Use Allocation	**Approximate acres in project area (out of 354 acres proposed for treatment)**	**Definition/Objectives from 1995 RMP**	**Page numbers in RMP**
Matrix (General Forest Mgmt. Area)	334 acres	As stated in the RMP and Oregon and California (O&C) Lands Act of 1937, Matrix (General Forest Management Area) lands have objectives to produce a sustainable supply of timber and other forest commodities to provide jobs and contribute to community stability.	pp.22-23
Riparian Reserves (RR)	20 Acres (13 acres proposed for treatment)	Riparian Reserves (RR) are lands along streams and unstable and potentially unstable areas where special standards and guidelines direct land use. Goals are to meet Aquatic Conservation Strategy (ACS) objectives.	pp.12-18

Management direction and recommendations for project design and implementation are also contained in a number of supporting documents, including the following:

- Record of Decision and Standard and Guidelines for Amendments to the Survey and Manage, Protection Buffer, and other Mitigation Measures Standards and Guidelines (2001)
- Survey and Manage Settlement Agreement, July 6, 2011, *Conservation Northwest et al. v. Sherman et al.*, Case No. 08-1067-JCC (W.D.Wash).
- Revised Recovery Plan for the Northern Spotted Owl (USDI FWS 2011)
- Final Rule for Designation of Critical Habitat for Northern Spotted Owl (USDI FWS 2012)
- Jenny Creek Watershed Analysis (February 1995)
- Spencer Creek Watershed Analysis (August 1995)

1.2 Purpose and Need for Action

The purpose of this project is to implement the 1995 KFRA Record of Decision (ROD)/Resource Management Plan (RMP). Purposes for implementing the Jigsaw project include:

- Contribute to meeting KFRA's annual Allowable Sale Quantity (ASQ) of 5.91 million board feet (MMBF). This project is expected to provide approximately 1-2 years of ASQ volume.
- Improve montane meadow habitat by maintaining and restoring favorable conditions to support a diverse community of riparian-dependent species.
- Improve the resiliency of forest stands to drought, insect, and disease.
- Reduce hazardous fuels to lower the risk of high intensity, stand-replacing wildfires

Need

There is a need for timber that the proposed action would generate in order to contribute toward KFRA's declared annual ASQ target. This project is expected to provide the remaining balance needed for fiscal year 2016's ASQ target and to meet the ASQ volume target for fiscal year 2017. KFRA's annual achievement of its ASQ target is dependent upon the sale or offering of timber volume in individual timber sales, which in the aggregate, total the KFRA's ASQ target. Because timber sale planning requires two to three years to complete, the inability to proceed with a given sale for any particular fiscal year has the potential to prevent KFRA from achieving its ASQ target for that year. According to KFRA's 10-year timber sale plan and anticipated changes in management direction due to the new Resource Management Plan for Southwestern Oregon (Record of Decision expected in summer of 2016), foregoing maximized harvest of these stands now would result in a lost opportunity to utilize timber resources that are less valuable for NSO habitat, compared to the remaining lands KFRA has available for timber harvest.

The BLM has a statutory obligation under the Federal Land Policy and Management Act (FLPMA), which directs that "[t]he Secretary shall manage the public lands in accordance with the land use plans developed by him under section 202 of this Act…" The KFRA RMP of June 1995 is the current land use plan that guides and directs management on these BLM lands. The RMP has allocated the majority of lands being analyzed to Matrix. The RMP objective of Matrix lands is to produce a sustainable supply of timber and other forest commodities as stated in the Oregon and California (O&C) Lands Act of 1937, which can be met by offering commercial timber products and other forest commodities to local and regional timber-related businesses.

1.3 Public Input Summary and Issue Development

A public scoping letter was mailed to landowners near the project area, as well as individuals and organizations who had previously requested to be informed of KFRA BLM activities, on December 18, 2015. It was also posted on BLM's ePlanning website on the same day for a 30-day scoping period. Scoping comments were received from two organizations. One organization expressed support for the project while the other organization opposed regeneration harvesting and proposed a "Citizen's Alternative." Following the scoping period, over 600 emailed copies of the same (or similar) comments were received from members of Klamath-Siskiyou Wildlands Center during the month of February 2016. The comments primarily expressed opposition to "clearcut logging" on federal lands, which is not proposed in any alternative.

Some comments were not related to the decision to be made, were procedural concerns, or were already decided by law, regulation, policy, or direction (such as in KFRA's RMP). Issues and concerns raised were considered in the formulation of alternatives, project design features, or environmental effects. Issues are points of discussion, dispute, or debate about the impacts of proposed actions. As a result of internal and external scoping comments, a broad range of alternatives was developed that included analysis of no regeneration harvest in Alternatives 3 and 4 and no harvest of trees over 20" diameter at breast height (DBH) in Alternative 3.

Issues Presented in Detail

In the NEPA process, issues are further defined as cause and effect relationships based on the proposed action. The interdisciplinary team developed a list of key issues which were used to

guide the analysis and develop alternatives for the Jigsaw EA. The following key issues also represent those issues that the decision maker needs to consider in selecting an alternative:

1. What are the effects of proposed project actions on stand structure and characteristics?

2. What are the effects of timber harvest and associated activities on northern spotted owls and Designated Critical Habitat?

3. What are the effects of timber harvest and associated activities on fisher?

4. What are the economic differences between proposed timber harvest alternatives?

5. What are the effects of proposed activities on soil compaction and displacement?

6. What are the effects of proposed activities on hazardous fuels in the project area?

7. What are the effects of small diameter tree thinning on meadow associated plant species?

Issues Considered But Not Presented in Detail

The Council on Environmental Quality (CEQ) National Environmental Policy Act (NEPA) regulations require that agencies "…identify and eliminate from detailed study the issues which are not relevant or which have been covered by prior environmental review…" (40 CFR 1501.7 (a) (3)). "Most important, NEPA documents must concentrate on issues that are truly significant to the action in question, rather than amassing needless detail" (40 CFR 1500.1).

The project's interdisciplinary team and public scoping comments raised additional concerns related to resources that had the potential of being affected by proposed project actions. For some issues, the IDT conducted substantial analysis, including inventory and assessment, before concluding that the impacts would be negligible, or would have little to no bearing on the decision to be made. For reasons described below, the following issues were not carried forward to be presented in detail in this EA, but are documented further in the project record.

What are the effects of clear cutting?

The vast majority of comments received during (and after) the scoping period expressed direct opposition to clear cutting of forest stands as part of the proposed action. Clear cutting is a timber harvest method defined as "removal of the entire stand in one cutting with reproduction obtained artificially or by natural seeding from adjacent stands or from trees cut in the clearing operation" (Smith, 1986). Clear cutting is a silvicultural method that can be applied to forested stands for reproducing an even-aged stand. Concerns with clear cutting were expressed both for concerns of ecological habitats and concerns for social values such as visuals. The Jigsaw Project does propose regeneration harvesting, but does **not** include clear cutting as part of any alternative.

The following clarification has appeared in the KFRA Annual Program Summary each year since 1999 under Section 35. Plan Maintenance (2014 APS, pp. 61-62):

Plan Maintenance for Fiscal Year 1999

- *On pages 23, of the KFRA RMP, for Westside Matrix lands, Management Actions / Directions states: "When an area is **regeneration harvested**, limit patch size to 3 acres." The above sentence erroneously includes the word "regeneration" where "density management" was intended. The KFRA will modify the patch cut size limit from 3 acres to 5 acres. The limit on patch cuts to 15% or less of the density management harvest area, which was intended, and was used in modeling, was not mentioned in the RMP. Therefore, the correct wording for this maintenance should be modified to read:*

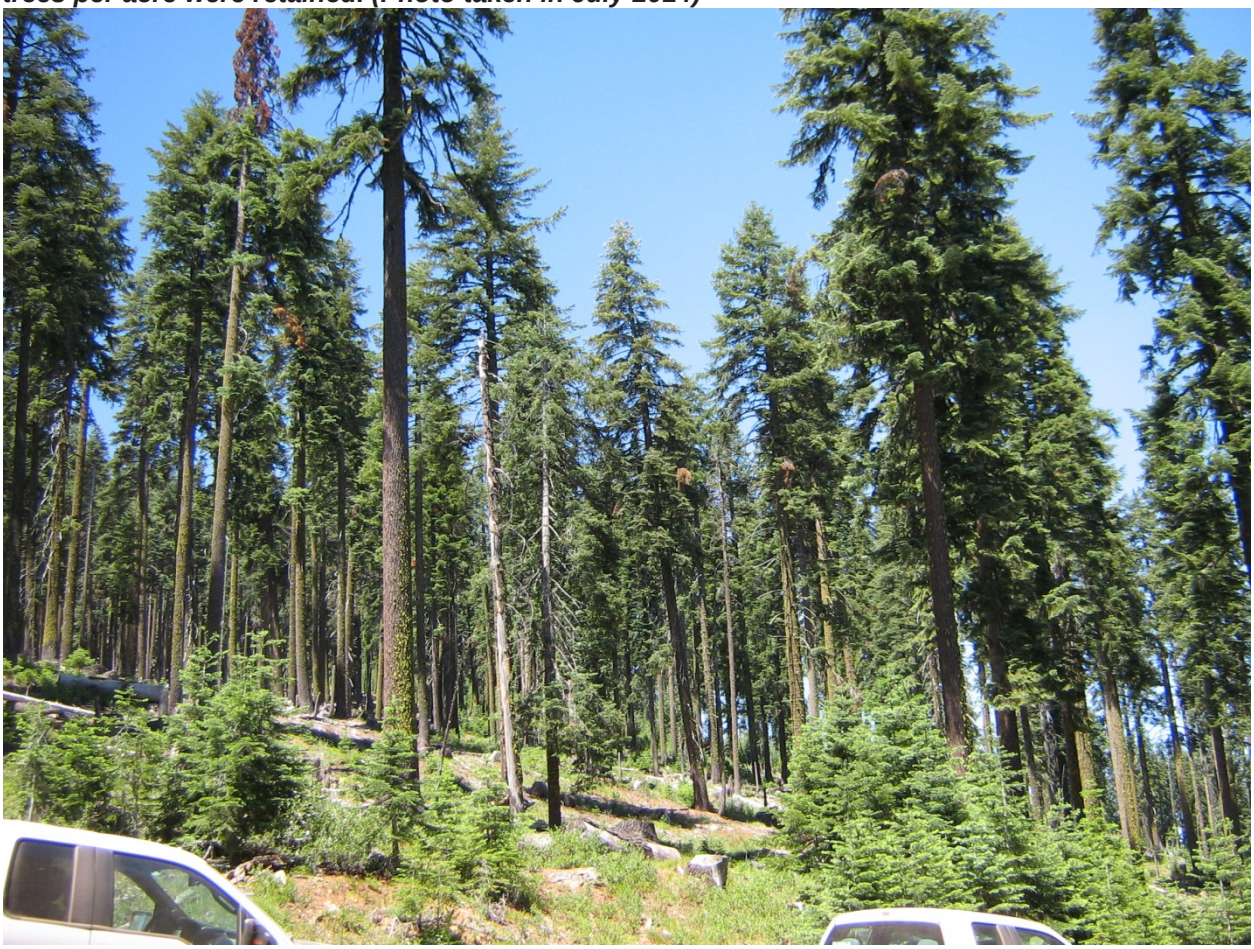
"Patch cuts within a density management unit are limited to 5 acres in size, to no more than 15% of the density management treatment area, and 5 to 10 of the larger trees per acre will be retained."

Rationale for Change:
*A clarification is needed between patch cuts and **regeneration harvests**. Patch cuts are small openings in relatively large density management units. The primary objective of cutting small patches/openings is to regenerate under-represented species in the stand; normally pines and Douglas-fir. Due to past harvesting practices and fire suppression, the species composition of stands has trended from shade intolerant species (pines and Douglas-fir) towards stands dominated by tolerant species (white fir). On page E-10 (Appendix E) of the RMP, Table E-1 lists the "Desired Species Composition (by percent conifer basal area)" for the South General Forest Management Area (SGFMA). The RMP states on page E-10 that the KFRA is to "Manage so that trees species over time trend toward ..." these composition levels. One of primary reasons for this objective is to improve the resiliency of the stands to natural disturbances (insects, disease, and fire). The small patch cuts are one of the prescriptions the KFRA is using to meet the species composition objective.*

- ***Clarification of What a Regeneration Harvest Is, and the Constraints Involved When Implementing**.*
A regeneration harvest is a silvicultural system discussed in a number of places in the RMP. The partial objective of regeneration harvests (See Glossary, page 6-14, Vol. 1 of the FEIS) is to open "a forest stand to the point where favored tree species will be reestablished." There are two constraints to regeneration harvests. The first is mentioned in Appendix E, page E-10 of the RMP that states, "Regeneration harvests would not be programmed for stands under 120 years of age and generally would not be programmed for stands under 150 years of age within the next decade unless required by deteriorating stand condition, disease, or other factors that threaten the integrity of the stand." The second constraint relates to the Plan Maintenance items mentioned above that states; retain at least 16 to 25 large green trees per acre in regeneration harvest units. The KFRA projected 131 acres of regeneration harvests [annually] on the Westside and 33 acres on the Eastside.

The photo below illustrates that a regeneration harvest is not a "clear cut." Figure 1-2 displays a regeneration harvest unit in the 2006 Surveyor Timber Sale where 16 to 25 large green trees were retained per acre (photo taken in July 2014).

Figure 1-2. Regeneration Harvest Unit from 2006 Surveyor Timber Sale in which 16-25 large green trees per acre were retained. (Photo taken in July 2014)



What are the effects of proposed project actions on Cultural Resources?

Cultural Resources was not considered a relevant issue to be presented in detail because no cultural resources would be affected by the proposed Jigsaw Project. This proposal constitutes an undertaking under Section 106 of the National Historic Preservation Act (NHPA). The Area of Potential Effects (APE) for this undertaking is determined to include the aggregate of the proposed treatment polygons and access routes for all alternatives. Due to the nature of cultural resources in the general area there is no potential for indirect effects. The APE was completely inventoried for cultural resources at a Class III level and no cultural resources were identified. The undertaking is determined to result in No Historic Properties Affected under the terms of the Oregon Protocol. This protocol was developed through a national programmatic agreement for NHPA compliance procedures on BLM land under 36 CFR 800.14. Since no historic properties would be affected, this issue was not forwarded for analysis.

What are the effects of proposed activities on invasive weed spread?

Three noxious weed species populations are located on BLM lands within the project area. Two populations of Canada thistle (*Cirsium arvense*) exist within a previously disturbed area approximately 0.5 acres within the southeast portion of the project area. The third population is St. Johnswort (*Hypericum perforatum*) which is located within the middle of the project area and

is approximately 0.5 acre (refer to the project record for a map of locations). The Oregon Department of Agriculture (ODA) Noxious Weed Control Policy and Classification System for 2013 classify these two species as "B" designated weeds (a weed of economic importance that is regionally abundant, but may have limited distribution in some counties). There is an ongoing programmatic agreement with ODA to treat noxious weeds within the KFRA including these populations within the Jigsaw project area. The no action and action alternatives along with implementation of project design features (PDFs) are expected to minimize impacts to invasive weed spread within the project area (See Section 2.7 for PDFs) therefore, this issue is not analyzed further in this EA.

What are the effects of proposed project actions on Special Status Plant Species, including vascular and non-vascular plants, bryophytes, lichens, and fungi?

Botanical surveys were completed in the field season of 2013 over 3,880 acres in the analysis area and in 2014 over 2,120 additional acres of which included the Jigsaw EA treatment area. Surveys for BLM Sensitive and Strategic fungi species and surveys for Survey and Manage (2001 Survey and Manage ROD) were conducted within stands greater than 180 years of age within the project area and the analysis area over the course of two years. No Federally-listed threatened or Federally-listed endangered plant species were found within the Jigsaw project area. No BLM Sensitive vascular or nonvascular species were found in the project area. However, six BLM Strategic and Survey and Manage nonvascular species were found including *Albatrellus ellisii*, *Choiromyces alveolatus*, *Cortinarius magniveletus*, *Cortinarius verrucisporus*, *Ramaria coulterae*, and *Hygrophorus caeruleus*. Although suitable habitat exists for some special status plant species within the project area, none were observed during recent surveys. The no action and action alternatives, along with PDFs, are expected to minimize impacts to special status species within the project area (refer to Section 2.7 for PDFs).

What are the effects of the small diameter tree thinning on ACS objectives?

There is only one intermittent stream and no perennial streams within the project area. No regeneration harvest or density management is proposed with riparian reserves. Attainment of Aquatic Conservation Strategy (ACS) objectives was only considered for Unit 7-4 because that is the only riparian reserve treatment proposed in the Jigsaw Project. There is a total of approximately 20 acres of riparian reserve in the project area consisting of a meadow and two spring/seep areas that are both less than one acre in size. The meadow received a riparian reserve buffer of one site potential tree, 160 feet. The spring/seep riparian reserves were delineated to the extent of the saturated soil and the outer edge of the riparian vegetation. An ACS Consistency Report was completed for the Jigsaw Project and is filed in the project record.

What are the effects of the proposed action on wolves?

***Gray Wolf* (*Canis Lupus*) - Federally Endangered**

The Gray wolf is listed as endangered under the Endangered Species Act (ESA) in Oregon west of Highway 395. In 2015, the Oregon Department of Fish and Wildlife designated an area of "Known Wolf Activity – Keno Pair" centered in the Johnson Prairie area south of the project area. The Jigsaw project area falls within the perimeter of this designated area. At this time there is no indication that there is a den or any other sites of importance associated with this designated area. In discussions with the Oregon Department of Fish and Wildlife (Collom, pers. comm. 2016) there is no indication that the wolves are actually using the project area. In fact, since the spring of 2015 there has been only one detection from trail cameras, sign, or sightings

of the wolves that the area was designated for (Collom, pers. comm. 2016). Track surveys conducted by BLM biologists during fisher surveys within the project area have found one set of wolf tracks adjacent to the project area. ODFW and USFWS confirmed that it was a radio collared wolf (OR-25) that passed through the area on a couple of occasions but he is not considered a resident wolf (Collom, pers. comm. 2016).

Absent a den or site of importance in or near the project units, none of the action alternatives are likely to affect gray wolves. The PDFs associated with all action alternatives would provide protection if a den site was located. Wolves are considered habitat generalist and will move with their primary prey species (deer and elk). Green tree retention or the presence or absence of snags or the implementation of the restoration activities is unlikely to measurably affect the abundance of the wolves' primary prey species in the project area. The BLM will continue its on-going discussions and data sharing with both the USFWS and ODFW regarding wolves in this area. The BLM has made a "No Effect" determination on the gray wolf from proposed actions.

What are the effects of the proposed actions on special status wildlife species?

This section focuses on special status species that may be affected from management activities. These will include species listed under the BLM special status species policy as Bureau Sensitive, species listed as Survey and Manage (USDA/USDI 2001 plus annual species reviews (ASR)), and land birds classified as Species of Concern (USDI FWS 2008a) by the U.S. Fish and Wildlife Service (FWS). Table 1-3 is a list of terrestrial wildlife species that may be affected and were considered in the analysis for this EA. For a list of other species and a description of their habitat that may occur in the proposed project area, refer to the 1994 Klamath Falls Resource Area FEIS (pages 3-37 to 3-41). A complete list of BLM Special Status Species that occur on the Lakeview District, Klamath Falls Resource Area may be found at: http://www.fs.fed.us/r6/sfpnw/issssp/agency-policy.

Table 1-3. Special Status Species that may occur within the Analysis Area and Potentially Affected by the Proposed Actions

Common Name	Scientific Name	Status*	Key Habitat Association within the KFRA	Comments
White-headed Woodpecker	*Picoides albolarvatus*	BLM Sen. FWS BCC	Forging - Large Ponderosa Pine Nesting – Large Snags	Minimal ponderosa pine in the project area. Low quality to no foraging habitat, not expected to occur within project area
Lewis's Woodpecker	*Melanerpes lewis*	BLM Sen. FWS BCC	Foraging – Open Woodlands Nesting – Large Snags	Low quality habitat - not expected to occur within project area.
Northern Goshawk	*Accipiter gentilis*	None	Foraging and Nesting - Mature Mixed Conifer	No known sites within project area
Great Gray Owl (GGOs)	*Strix nebulosa*	S&M	Mature Conifer –Nesting Meadow Habitat - Foraging	Surveys completed in the project area in 1999-2001 and again in 2012. No great gray owls were detected during surveys. Surveys for GGOs have been completed within available habitat throughout Surveyor Mountain area in the past 20 years and no great gray owl territories have been documented.

Common Name	Scientific Name	Status*	Key Habitat Association within the KFRA	Comments
Bald Eagle	*Haliaeetus leucocephalus*	BLM Sen.	Mature Conifer Tree – Nesting Open Water - Foraging	No known nests within project area
Flammulated Owl	*Otus flammeolus*	FWS BCC	Foraging - Open Mixed Conifer Nesting – Snags Roosting –Dense thickets	No past detections and habitat considered low quality for the OTFL
Pallid Bat	*Antrozous pallidus*	BLM Sen.	Roosting – Primarily caves and rocks but may use large snags	Surveys (Cross *et al* 1995) were conducted approximately a ½ mile from the project area and no pallid bats were detected. But they may occur in the EA analysis area. Green tree retention and snag retention pdfs will continue to provide roosting habitat. Foraging habitat will not be affected.
Fringed Myotis	*Myotis thysanodes*	BLM Sen.	Roosting – Primarily caves, rocks but may use large snags	Surveys (Cross *et al* 1995) were conducted approximately a ½ mile from the project area and no pallid bats were detected. But they may occur in the EA analysis area. Green tree and snag retention pdfs will continue to provide roosting habitat. Foraging habitat will not be affected.
Evening Fieldslug	*Deroceras hesperium*	BLM Sen., S&M	Moist forest in low vegetation, litter, debris, rocks. Priority habitat is considered forested habitat within 30 m (98 ft.) of perennial water (USDA/USDI 2003).	Pre-disturbance surveys were conducted in 2013 within and adjacent to project area. No Evening Fieldslug documented.
Crater Lake Tightcoil	*Pristiloma arcticum crateris*	BLM Sen., S&M	Moist to wet sites such as riparian areas, near springs, wetlands and mountain meadows. Priority habitat is considered forested habitat within 10 m of perennial water (USDA/USDI 2003).	Pre-disturbance surveys were conducted in 2013 within the project area and adjacent to project area. No Crater Lake tightcoil documented.
Chase Sideband	*Monadenia chaceana*	BLM Sen., S&M	Talus and rock slides in and adjacent to conifer and oak woodlands. It may be found within 30 m (98ft.) of rocky areas, talus deposits and in associated riparian areas in the Klamath physiographic province (USDA/USDI 2003).	Pre-disturbance surveys were conducted in 2013 within the project area and adjacent to project area. The area is considered low quality habitat for the Chase Sideband and none were documented.

Survey and Manage

Terrestrial Mollusks

Terrestrial mollusk habitat was delineated in 2012 and surveyed to protocol (USDI 2004) in the spring and fall of 2013. No survey and manage terrestrial mollusk were located during those surveys.

Great Gray Owl (GGO)

Surveys were completed in the project area in 1996-2001 and again in 2012. No great gray owls were detected during surveys. Surveys for GGOs have been completed within available habitat throughout the Surveyor Mountain area in the past 20 years and no great gray owl territories have been documented.

Appendix B provides Survey and Manage compliance information.

What are the effects of proposed project actions on greenhouse gases and climate change?

The primary factors leading to the expectation of global warming are substantial increases in atmospheric carbon dioxide, nitrous oxide, methane, chlorofluorocarbons, and other trace gasses. The BLM's proposed land management activities in the Jigsaw analysis area would primarily only affect the amount of carbon dioxide being released into the atmosphere. The action alternatives would have direct impacts related to harvest of growing trees and release of greenhouse gases through burning of forest residue and fossil fuels, especially through vehicle and heavy equipment emissions.

The Jigsaw EA is tiered to the 1995 RMP/FEIS which concluded that all alternatives analyzed in the FEIS, in their entirety including all timber harvest, would have only slight (context indicates that the effect would be too small to calculate) effect on carbon dioxide levels. Analyses completed for projects of similar scope, treatment type, stand type, and scale have supported the conclusion of the 1995 RMP that project emissions would be negligible (Hayden Fox EA 2014; Keno EA 2013; LOST EA 2012). Detailed analysis for the Jigsaw Project is not warranted because greenhouse gas emissions are not expected to be a factor in the decision, and would not help distinguish between no action and action alternatives.

1.4 Decision to be made

This EA will provide the decision maker, the KFRA Field Manager, with a summary of current information on key issues to aid in the decision-making process. It will also determine if an Environmental Impact Statement (EIS) needs to be prepared or if a Finding of No Significant Impact (FONSI) is appropriate.

2- PROPOSED ACTION & ALTERNATIVES

The Interdisciplinary Team identified four Alternatives for the Jigsaw EA as outlined below.

2.1 Alternative 1 (No Action)

Under this alternative, management activities considered in this project would not occur. Activities proposed in and adjacent to the analysis area that have been analyzed and approved in other NEPA/Decision documents could still occur, such as fuel reduction treatments, road maintenance as needed, forest inventory and surveys, and fire suppression. Selection of the No Action Alternative would not change land allocations or the direction the BLM has to manage these lands. The No Action alternative serves as a baseline or reference point for evaluating the environmental effects of the action alternatives.

2.2 Alternative 2

The following treatments have been identified as part of Alternative 2 and are shown on the map in Appendix A:

(1) Timber Sale – Thinning- These units would include thinning trees of all size classes using uneven-aged silvicultural prescriptions. Approximately 38 acres of this treatment is proposed. Mechanical harvesting methods would be used to cut and remove designated timber. Group selection (patch cuts) would be used to reduce tree densities within areas of less than five (5) acres. This tool helps create variability within the stand while treating insect and disease problems, promoting early seral habitat. Patch cuts are proposed in up to 15% of the total acreage. Thermal clumps (retention areas up to five (5) acres in size) would be implemented on up to 15% of the total acreage. Other elements of this treatment include mistletoe retention in clumps and retention of individual trees with desirable mistletoe structure for wildlife.

Timber sale areas may also be treated with understory thinning, hazardous fuels reduction, and conifer planting where applicable. Harvesting would be done with ground based equipment and whole tree yarding would be required.

(2) Timber Sale-Regeneration Harvest - Up to 262 acres of regeneration harvest is proposed. In these areas 16 to 25 large green trees would be retained for each acre harvested, however, retention trees may be dispersed or aggregated. Therefore, 16-25 trees may not be retained on each individual acre. All snags (that do not pose a danger to operations) and coarse woody debris would be retained. Harvesting would be done with ground based equipment and whole tree yarding would be required.

Timber sale areas may also be treated with understory thinning, prescribed fire (jackpot burning), and conifer planting where applicable.

(3) Understory Thinning- These treatments refer to areas where trees less than 20” DBH would be removed. Approximately 40 acres of thinning in previously planted stands is proposed throughout the treatment units. Approximately 13 acres of trees less than 12” DBH would be

removed in riparian reserves (see below). Manual and mechanical ground based harvesting methods would be used to cut and remove designated trees.

(4) Conifer Planting - Following treatments, areas that are understocked (i.e. group selection or regeneration areas) or where natural seeding is expected to be ineffective, may be planted with conifer seedlings.

(5) Prescribed Burning- Jackpot underburning is proposed in regeneration harvest areas to reduce fuels. Stands would be evaluated following harvest to determine if jackpot underburning is necessary.

(6) Road Management – Harvesting would occur from existing roads; the condition of the road system would be improved as needed for forest product removal. Roads which have previously been closed would be reopened for the duration of the sale(s) and then closed.

(7) Riparian Reserves – Meadow restoration would take place in Unit 7-4 on approximately 13 acres in the inner riparian reserve (RR). Seven acres of outer RR would not be treated. All trees less than 12" DBH would be manually cut, and slash and limbs would be hand-piled and burned in order to reduce encroachment into the meadow and reduce fuel loads.

2.3 Alternative 3

Alternative 3 was developed based on public scoping comments regarding diameter limits and regeneration harvest. Alternative 3 includes density management with a 20" diameter limit, no meadow restoration treatment in riparian reserves, no prescribed burning, and no regeneration harvest. Treatments in Alternative 3 are identical to those in Alternative 2 with the exception of differences described below and displayed on the map of Alternatives 3 and 4 in Appendix A:

(1) Timber Sale – **Thinning-** Silvicultural prescriptions would be similar to Alternative 2 except that there would be **no patch cuts** and a **20" diameter limit would be applied**. Approximately 301 acres of this treatment is proposed.

(2) Timber Sale-Regeneration Harvest – No regeneration harvest.

(3) Understory Thinning- Same as Alternative 2 except there would be no meadow restoration (RR) treatment on 13 acres.

(4) Conifer Planting - Following treatments, areas that are understocked or where natural seeding is expected to be ineffective, may be planted with conifer seedlings.

(5) Prescribed Burning- No treatments proposed.

(6) Road Management – Same as Alternative 2.

(7) Riparian Reserves – No treatments proposed.

2.4 Alternative 4

Alternative 4 was developed based on public scoping comments regarding regeneration harvest. The main components of Alternative 4 are density management without a diameter limit and no regeneration harvest. Treatments in Alternative 4 are identical to those in Alternative 2 with the exception of the differences described below:

1) Timber Sale – **Thinning-** This treatment would include thinning trees of all size classes using uneven-aged silvicultural prescriptions just as in Alternative 2, including patch cuts and thermal clumps. Approximately 301 acres of this treatment is proposed. No harvest diameter limit would be applied to this treatment.

(2) Timber Sale-Regeneration Harvest – There would be no regeneration harvest under this alternative.

(3) Understory Thinning - Same as Alternative 2 except there would be no meadow restoration (RR) treatment on 13 acres.

(4) Conifer Planting - Following treatments, areas that are understocked (i.e. group selection) or where natural seeding is expected to be ineffective, may be planted with conifer seedlings.

(5) Prescribed Burning- No treatments proposed.

(6) Road Management – Same as Alternative 2.

(7) Riparian Reserves – No treatments proposed.

2.5 Alternatives Eliminated from Detailed Analysis

Reduce Road Density

One of the scoping comments we received requested that we reduce road density in the project area. Within the 422-acre project area, there are 3.4 miles of road. Of these roads, 0.65 miles have been closed and 2.7 remain open. After analysis of the 2.7 miles of open road, it was determined that the majority of these open roads are major thoroughfares which we could not reasonably close.

2.6 Comparison of Alternatives

Table 2-1 is an overview of the treatments proposed for each action alternative.

Table 2-1. Comparison of Alternatives

Area or Treatment	Alternative 2	Alternative 3	Alternative 4
Timber Sale-Density Management	• 38 acres • Thinning throughout all age classes and diameter classes • Patch cuts	• 301 acres • 20" diameter limit • No patch cuts	• 301 acres • Thinning throughout all age classes and diameter classes • Patch cuts
Timber Sale-Regeneration Harvest	• 263 acres • 16-25 large green trees retained per acre	None	None
Understory Thinning	• Thin trees 20" and less • 53 acres (including 13 acres in RR below)	• Thin trees 20" and less • 40 acres • No RR treatments	• Thin trees 20" and less • 40 acres • No RR treatments
Riparian Reserves (RR)	• In Unit 7-4, 13 acres of manual thinning (<12" DBH) for meadow restoration • Slash and limb material would be hand cut, piled and burned • No treatment in the outer riparian area	No RR treatments	No RR treatments
Prescribed Burning	• Jackpot underburning may be applied in regeneration harvest areas • Hand pile and burn 13 acres (RR acres)	None	None
Planting	All understocked areas	All understocked areas	All understocked areas
Road Construction	No new road construction	No new road construction	No new road construction

2.7 Summary of Best Management Practices and Project Design Features

Appendix D of the RMP (pages D1-D46) describes the Best Management Practices (BMPs) that are "designed to achieve the objectives of maintaining or improving water quality and soil productivity and the protection of riparian-wetland areas." BMPs are defined as methods,

measures, or practices selected on the basis of site-specific conditions to ensure that water quality will be maintained at its highest practicable level (D-1, Appendix D, RMP). In addition to BMPs that focus on water quality and soil production, the interdisciplinary team also developed project design features (PDFs) with the objective of meeting other resource goals. For instance, the PDFs listed below under Wildlife and Vegetation are designed to meet resource objectives associated with these resources, and not necessarily water quality.

Soil Resources

- Limit detrimental soil conditions to less than 20 percent of the total acreage within the activity area. Use current soil quality indicators to monitor soil impacts. Though not expected, if post-treatment soil monitoring ascertains that the 20 percent detrimental soil disturbance standard is exceeded, then, as mandated by the RMP (p. D-11), additional treatments such as seeding, planting, or other appropriate measures will be required. Should additional treatments be required, BLM will implement the mandate as prescribed in the RMP to minimize soil productivity losses. It is expected that the effect on soil productivity would be readily apparent, offset adverse effects, and would likely be successful.
- Limit mechanical cutting and yarding operations to periods when the soil moisture is below 20 percent at a six inch depth. *Soil moisture content can be estimated by digging a shallow (6 inch deep) hole and collecting a soil sample. When squeezed firmly in the hand, dry soils (of the type found in the project area) will crumble into a powder, will not hold together or form a ball, and will not leave a stain on the hand or fingers.*
- Permit ground-based logging activities during the wet season (typically October 15 through May 15) if soil moisture requirements are met, or if frozen ground or sufficient snow is present. This is normally when snow depths are in excess of twenty (20) inches.
- Utilize existing skid trails where practical. Decommission landings not needed for future harvest activities after operations are complete. Rip (no deeper than 10 inches), lop and scatter slash or wood chips over the surface, and seed or plant with native vegetation.
- Construct adequate waterbars on skid roads and yarding corridors. For water bar spacing, follow guidelines in RMP based on slope gradient and erosion class. Soils within the project area are derived from rock types that qualify as the “moderate” erosion class (RMP, page D-25).
- On slopes greater than 12%, place residual slash (broken tops and branches) on skid trails upon completion of yarding operations.
- Retain minimum effective ground cover amounts to prevent erosion from ground-disturbing activities. Effective ground cover is all living or dead herbaceous or woody materials and all rock fragments greater than 0.5 inch in diameter. Exceptions may be made due to site-specific resource considerations. Vegetative retention and establishment is 20-30% in the first year and 30-40% in the second year on disturbed sites of low erosion hazard (RMP, page D-11).
- Retain sufficient small woody (dead and down) material to sustain soil nutrients. Follow KFRA RMP, page D-11 specifications. Plan prescribed fire (jackpot underburning, handpile and slash pile burning) when soils are moist or wet (typically from October 15 through May 15). Soil moisture content can be estimated collecting a surface soil sample. When squeezed firmly in the hand, moist soils (of the type found in the project area) form a ball, are very pliable, and leave a light water staining on the hand. When wet, squeezing the soil sample releases free water and leaves a soil/water coating on the hand.

Hydrology & Riparian Reserve Treatments

Timber Harvest

- Delineate Riparian Reserve widths as described in the RMP (pg F-8, ROD pp. C-30 to 31). Refer to Table 2-2 below.
- Avoid placement of skid trails and landings in areas with potential to collect and divert surface runoff such as the bottom of draws and ephemeral drainages.

Table 2-2. Riparian reserve types and widths from the KFRA RMP

Riparian Reserve Type	Reserve Width (for each side of streams/wetlands)
Perennial non-fish-bearing streams and Intermittent (seasonal) non-fish-bearing streams; Constructed ponds and reservoirs; and Wetlands greater than one acre	At a minimum, the reserve width will include: ▪ Slope distance equal to the height of one site potential tree (160 feet); or, ▪ The stream channel (or waterbody/wetland) and the area extending to the top of the inner gorge; or, ▪ The area extending to the outer edges of riparian vegetation; or, ▪ The 100-year floodplain (for streams) or the extent of seasonally saturated soil (for waterbodies and wetlands); or, ▪ The extent of unstable or potentially unstable areas, whichever is greatest.
Wetlands less than one acre and Unstable or potentially unstable areas	At a minimum, the reserve width will include: ▪ The wetland and the extent of seasonally saturated soil; or, ▪ The area extending to the outer edges of riparian vegetation; or, ▪ The extent of stable or potentially unstable areas, whichever is greatest.
*A site-potential tree is defined as the average maximum height of the tallest dominant trees (200 years old or more) for a given site class. In the Jigsaw project area, the site potential tree height was determined to be 160 feet.	

Prescribed Burning

- In riparian reserve (meadow) treatment, manually cut with chainsaws, all trees less than 12" DBH. Limb branches and tops (down to 6" top) and hand pile slash. Burn hand piles in accordance with an approved prescribed fire burn plan.
- In regeneration harvest units, the need for jackpot burning will be determined by the resource area fuels and forestry specialists post-harvest. In units where jackpot burning is implemented, hand line may be constructed to keep fire from spreading outside of the unit. Concentrations of activity generated and natural fuels would be burned to reduce fuel loading.
- Slash piles that are burned at landings may be contained by dozer fireline.

Cultural Resources

- If subsurface cultural resources are unearthed during operations, activity in the vicinity of the cultural resource will cease and a BLM representative notified immediately.

Noxious Weeds

- Pressure wash vehicles and equipment that will travel off system roads prior to entry onto BLM-managed lands. This will remove loose seeds, grease, plant parts, and dirt that may contain viable noxious weed seeds, thereby reducing potential introduction of new noxious weeds into the project area and into newly disturbed sites. If the job site includes a noxious weed infestation, require cleaning of all logging and construction equipment and vehicles prior to leaving the job site.

- Monitor the project area 1-3 years after harvest is complete and treat noxious weeds as detected in areas that were disturbed by project implementation.
- Road graders used for road construction or maintenance will grade towards any known noxious weed infestations. If no good turn around area exists within one half mile that would allow the operator to grade towards the noxious weed infestation, then the operator will leave the material that is being moved within the boundaries of the noxious weed infestation. No noxious weed contaminated soil will be translocated in order to contain the infestation and prevent further spread.
- Identify and use weed-free staging areas and minimize travel and disturbance within weed infested areas.

Survey and Manage Species (mollusks, fungi, and vertebrate)

- Delineate sites on the ground and buffer as described in Appendix B: Survey and Manage. When possible, known sites will be combined to provide connectivity in the landscape.

Wildlife - Terrestrial Species

Snag Retention

- Approximately 2.5 snags per acre will be retained with a minimum diameter at breast height (DBH) of 20", or largest available if less than 20 in unavailable" (1995 RMP/ROD, Page 23). This includes the snag mitigation measures (100 percent population potential) for white-headed woodpecker, black-backed woodpecker, pygmy nuthatch and flammulated owl (2001 ROD)

Coarse Woody Debris (CWD)

- In timber sale units, approximately one hundred and twenty (120) linear feet of decay class 1 and 2 down logs per acre will be retained. Logs shall be greater than or equal to sixteen (16) inches in diameter and sixteen (16) feet long (RMP/ROD, Page 22) where available.

Seasonal Restrictions (Wildlife)

- There are no known nests of these species in the project area. Seasonal restrictions will be required where the following wildlife species are actively nesting: bald eagle, northern spotted owl, northern goshawk, osprey, and special status species. If any are found prior to or during implementation, these protection measures would apply. Seasonal restrictions for specific species can be found on pages 231-240 of the 1995 KFRA FEIS.
- Wolves have been documented near the project area but no wolf den sites have been documented. Seasonal restrictions would be required if a wolf den sites is found prior to or during the implementation of the project. Restrict activities that create noise or visual disturbance(s) above ambient conditions within one mile of known active gray wolf dens from April 1 to July 15.

Nesting Areas

- There are no known nests of any species of concern in the project area. If nests are found prior to or during operations protect nesting areas as described on page 38 of KFRA RMP.

Forest Stand Structural Diversity

- In stands treated with density management prescriptions, or commercial thinning prescriptions, retain untreated areas up to three acres in size, and cumulatively comprising up to 15% of the total unit acreage. These areas (thermal clumps) would be selected and delineated around areas of important and limited structural features such as snag patches, patches of unusually high tree density, rock outcrops, high concentrations of CWD, etc. Where possible, thermal clumps would be overlain on top of areas retained for protection of known sites of special status plants, animals, and fungi.

NSO Habitat – Recovery Action 32 Stands

- Silvicultural treatment in Recovery Action 32 stands will maintain habitat at its current habitat category (i.e. nesting habitat will be maintained as nesting habitat). In RA 32 stands retain all trees greater than 20" and retain basal area greater than or equal to 200.

Fisher

- Fishers have been documented in the project area but no fisher den sites have been documented. Seasonal restrictions would be required if fisher den sites are found or suspected prior to or during the implementation of the project. Restrict activities that create noise or visual disturbance(s) above the ambient conditions within 0.5 miles of known fisher natal or maternal den sites from February 1st to June 30th.

3- AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

The affected environment reflects the existing condition that has developed from all past natural events and management actions within the project area (or 5th field watershed). It is a combination of natural and human-caused fires, fire suppression, road building, timber harvesting, grazing, fuel reduction treatments, and the effects of recreational use. The current condition assessed for each affected resource is a result of all past natural events and management actions. It is therefore unnecessary to individually catalog all past actions in this EA. Such detail would be irrelevant to making a rational decision among alternatives. The important value of this EA is to assess and display for the deciding official the impacts of the alternatives on those resources as they exist today, to allow a determination if the resulting project effects and/or cumulative effects are either significant or are greater than those analyzed in the RMP EIS.

3.1 Consideration of past, ongoing, and reasonably foreseeable actions in cumulative effects analysis

43 CFR § 46.115 states that when considering cumulative effects analysis, the agency must analyze the effects in accordance with relevant guidance issued by the Council on Environmental Quality (CEQ). As the CEQ points out in guidance issued on June 24, 2005, the "environmental

analysis required under NEPA is forward-looking," and review of past actions is required only "to the extent that this review informs agency decision-making regarding the proposed action." Use of information on the effects of past action may be useful in two ways according to the CEQ guidance: for consideration of the Proposed Action's cumulative effects, and as a basis for identifying the Proposed Action's direct and indirect effects.

The CEQ stated in this guidance that "[g]enerally, agencies can conduct an adequate cumulative effects analysis by focusing on the current aggregate effects of past actions without delving into the historical details of individual past actions." This is because a description of the current state of the environment inherently includes the effects of past actions. The CEQ guidance specifies that the "CEQ regulations do not require the consideration of the individual effects of all past actions to determine the present effects of past actions." The importance of "past actions" is to set the context for understanding the incremental effects of the Proposed Action. This context is determined by combining the current conditions with available information on the expected effects of other present and reasonably foreseeable future actions.

The analysis of the effects of other present and reasonably foreseeable actions relevant to the effects of the proposed action is necessary. Actions considered for cumulative effects are specific to each resource and are described within the cumulative effects for each resource section. How each resource analysis uses information concerning other ongoing or reasonably foreseeable activities is dependent on the geographic scale of concern and attributes considered during each resource analysis.

3.2 What are the effects of proposed project actions on stand structure and characteristics?

Affected Environment

The analysis area for this issue is the area of contiguous Shasta red fir zone above 5,500 feet in elevation. This analysis area was chosen because it encompasses the immediate area in which this forest type exists; therefore variation in stand characteristics would be relevant at this scale. This area is 8,611 acres and includes all ownerships (BLM, USFS, State land and private) as displayed in Table 3-1. The temporal scale for this analysis will examine both short term (0-30 years after harvest) and long term (up to 100 years) effects of the proposed treatments.

Table 3-1. Ownership in the analysis area

	Acres	%
BLM	5805	67%
FS	377	4%
Private	2349	27%
State	80	1%
	8611	

This analysis will also refer to the project area. This is the 354-acre area encompassing only the treatments proposed in this EA.

The indicator that will be used to compare the effects of the proposed action will be acres of forest land that occur in one of three stand structure categories. These categories will be young (Y), mature-single (M-S) and mature-complex (M-C), as defined below in Table 3-2.

Table 3-2. Definition of stand structure categories

Stand Structure Category	Definition
Y (young)	**Young** stands are categorized as stands that have been recently harvested. Although some of these stands will have residual remnant trees that may be larger than the rest of the stand, the stands themselves will generally function as a young stand.
M-S (mature-single)	**Mature-single** stands are stands that have reached maturity, but do not contain complex stand structure. These stands are often even-aged.
M-C (mature-complex)	**Mature-complex** are mature stands that contain multiple canopy layers and individual trees throughout a variety of diameter classes.

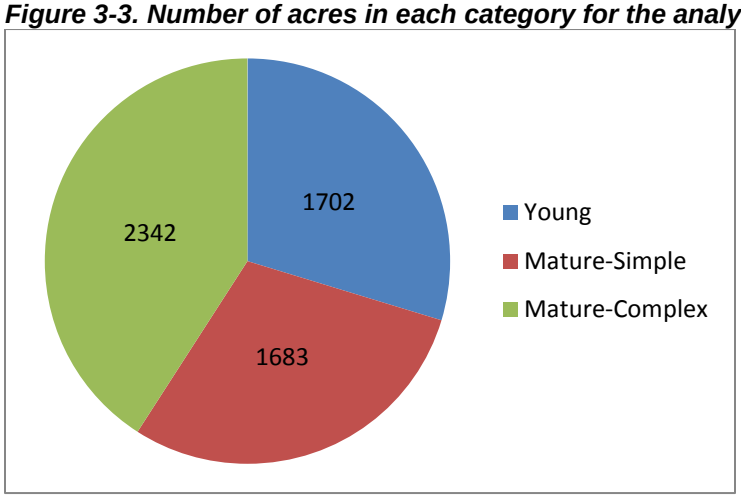
Many of the stands have been selectively cut in the past, leaving an array of tree sizes and ages. From the 1950s through the present, most of these stands were entered once or more for selective thinning and overstory removals. The Surveyor Timber Sale that occurred in 2006 was a combination of thinning and regeneration harvest on the western edge of this analysis area. Fire suppression has left some of these stands at a higher density than is recommended for the site (see the methodology section in environmental consequences below). In some portions of the analysis area, past wildfires have simplified stand structure resulting in areas of even-aged stands.

Currently, active management is occurring on private lands within the analysis area. The majority of those stands have already been cut and currently fall into the young (Y) category. For the purposes of this analysis, it will be assumed that all private land falls into the Y category, as it is all likely to be cut if it has not been already. State and USFS land in the analysis area has not been actively managed in the past 20 years or so, therefore, for this analysis it will be considered to be M-C. A variety of management is occurring on BLM land. There is some young plantation and understory thinning planned for the area. This will not change the structure of those stands, just reduce density in the younger size classes. For the purposes of this analysis, these treatments will not alter the structural type.

Three general types of forests occur in the analysis area including forest that can be generally described as multi-aged, multiple canopy, mixed conifer stands of white fir and Shasta red fir, with minor components of ponderosa pine, Douglas-fir, western white pine, sugar pine, incense cedar and some lodgepole pine; forests that are generally single layers of Shasta red fir and white fir; and forests that are young small diameter mixed conifer stands. The majority of these stands are currently at or above recommended stocking levels as described in the methodology of the environmental consequences section. Tree sizes range from saplings to large trees over 60” diameter at breast height (DBH). Tree ages range from one to over 500 years old with the majority of the stand’s ages averaging greater than 100 years old.

The indicator categories present in the analysis area are displayed in Figure 3-3.

Figure 3-3. Number of acres in each category for the analysis area.



Present in the forested stands of the proposed project areas are an array of bark beetles that can infest and kill different species of pine and true fir trees. There are a number of insects that can cause damage to individual trees and groups of trees within these stands, including western spruce budworm (*Choristoneura occidentalis*), western pine beetle (*Dendroctonus brevicomis*), mountain pine beetle (*Dendroctonus ponderosae*), and fir engraver beetle (*Scolytus ventralis)*. Density control is the most common recommendation for reducing mortality from these bark beetles. Western spruce budworm is a defoliator that can lead to mortality after several consecutive years of defoliation. Complex forests with several ages of trees are the most heavily damaged (Simpson 2007). Additional stress from defoliator damage can often lead to damage by bark beetles or root disease.

The fir engraver beetle has been responsible for substantial mortality to both white fir and Shasta red fir along the entire eastern slopes of both the southern Cascade Mountain Range and northern Sierra Nevada Mountain Range, which is reflected in the Spencer Creek and Jenny Creek watersheds within this analysis area.

Insect outbreaks are likely to occur following wildfire, and insects target trees experiencing stress from a variety of factors, one of which is competition (Filip et al. 2007, Parker et al. 2006, Jenkins et al. 2014). Stands in which density levels exceed stocking recommendations are likely to be targeted and experience higher levels of mortality. Increased insect activity can also spread pathogens between trees and cause increased mortality from disease (Parker et al. 2006). The only practical method to reduce further mortality due to competition stress, insects, and disease on trees in this project area would be to thin to a recommended stocking level.

Tree pathogens are also present within the project area. Dwarf mistletoe (*Arceuthobium* spp.) is one of these, caused by a parasitic plant that attacks conifers and occurs throughout the project area. It was found on 35% of CVS plots in this plant series (Simpson 2007). Mistletoe brooms create microhabitat preferred by nesting northern spotted owls; at the same time, however, the disease is highly infectious in stands, deforms trees inducing bole and branch cankers that result

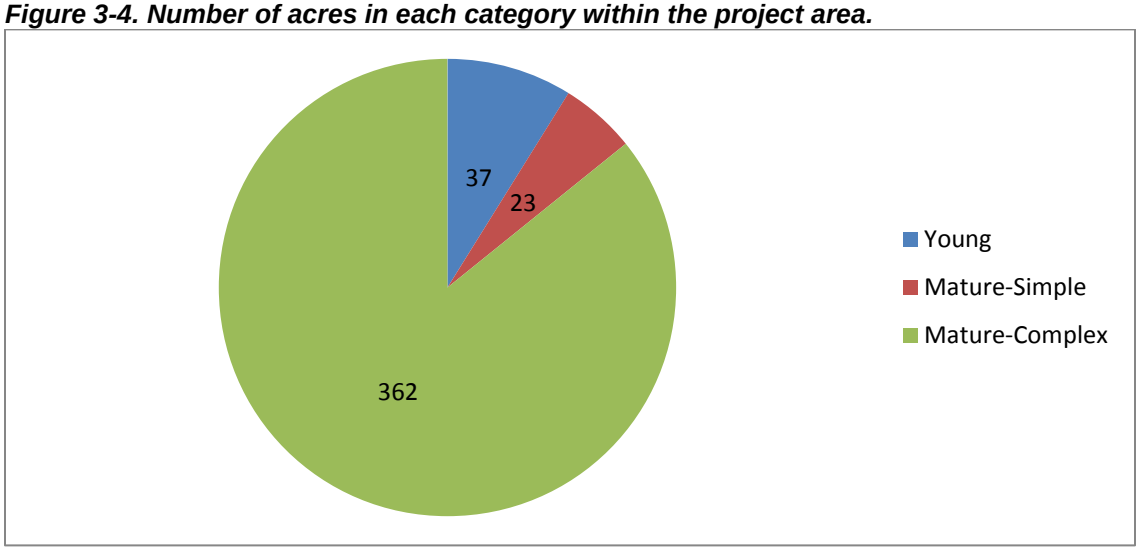
in timber volume loss, and can kill trees. Dwarf mistletoe can be heavy in Douglas-fir and ponderosa pine and can cause both growth loss and mortality (Hopkins 1979). Young stands that are heavily infested will not develop into a large, tree dominated forest (Simpson 2007). None of these stands are heavily infected, in most of them about 1-2% of the trees per acre are infected.

Root diseases such as Annosus (*Heterobasidium annosum*), *Armillaria (ostoyae)*, and laminated root rot (*Phellinus weirii*) are the most common in this area and occurred on 36% of plots examined (Simpson 2007). Late successional true fir stands, such as those within this project area, are the most susceptible species to all root diseases (Simpson 2007).

Forested plant communities in the proposed project area are part of the ABCO-ABGR/CACH plant association (Simpson 2007) for the Oregon East Cascade region. Although they may be referred to as moist in the plant association description, moist ABCO-ABGR associations are considered to be at the drier end of the plant association spectrum and are considered dry plant associations by Johnson and Franklin (2009). Plant communities in the EA analysis area are within those plant associations described by Hopkins (1979) for the Klamath Ranger District, Winema National Forest and by Atzet and McCrimmon (1990) for the Southern Oregon Cascade Mountain Province.

Within the project area, the acres in each category are displayed in Figure 3-4.

Figure 3-4. Number of acres in each category within the project area.



Stand level data for most stands in the project area are available in the project record. Stand metrics are defined in Appendix C: Glossary. The average diameter distribution for merchantable (>8” DBH) trees in the proposed timber sale units is shown in Figure 3-6. The quadratic mean diameter (QMD) for all of these stands is 21”. The average number of trees per acre is 175. The average basal area is 200 sq. ft./ac.

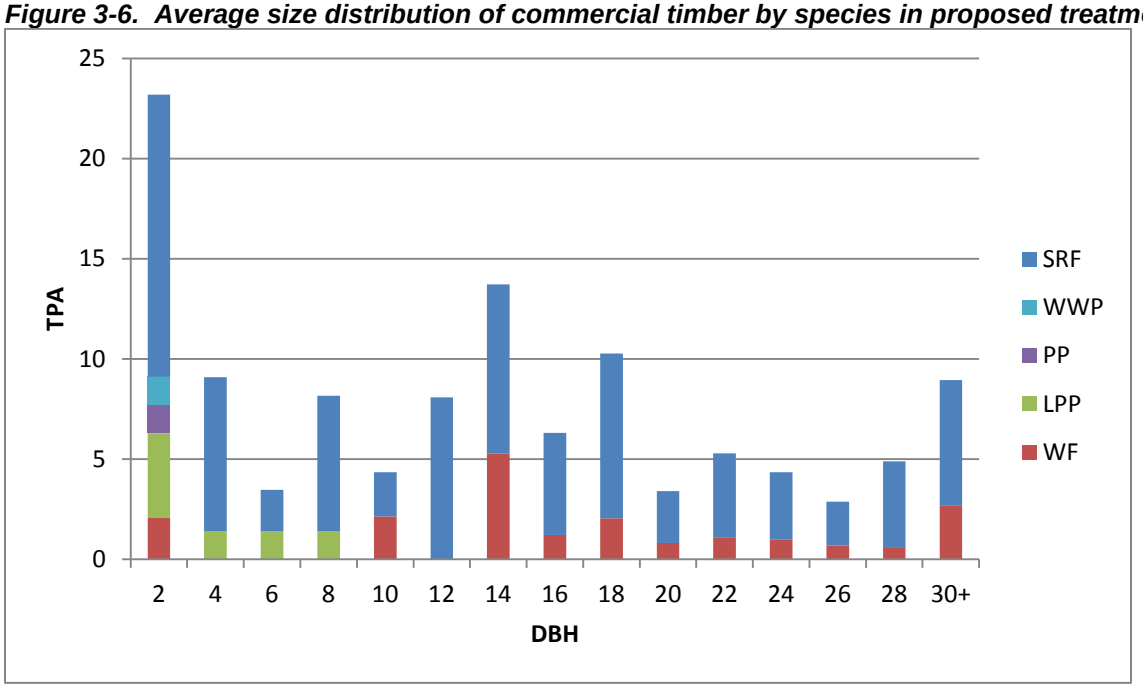
It is accepted that reducing stand density will increase diameter growth of trees (Tappeiner et. al. 2007, Simpson 2007, Oliver and Larson 1990). Target stocking levels are recommended in order to keep the stand from exceeding its carrying capacity and to increase individual tree growth.

Currently, annual diameter growth in this area is approximately 0.02”/year. Diameter distribution and age class structure data are shown in Table 3-5 and Figure 3-6.

Table 3-5. Land ownership and Age Class Structure in the Jigsaw Analysis Area.

Owner	Age Class	Acres	% of BLM Land	% of Analysis Area
BLM Unforested Land		82	0%	0%
BLM Forested Land	0-10	132	2%	2%
BLM Forested Land	20-80	1571	27%	18%
BLM Forested Land	90-160	3149	54%	37%
BLM Forested Land	170+	951	16%	11%
Total BLM Land		5885		68%
USFS Lands		377		4%
Private Land		2349		27%
Total Analysis Area		8611		

Figure 3-6. Average size distribution of commercial timber by species in proposed treatment units



SRF= Shasta red fir, WF= White fir, LPP= Lodgepole pine, PP=Ponderosa pine, WWP= Western white pine

Environmental Consequences

Methodology

The Forest Vegetation Simulator (FVS) was used to model a 100 year analysis period. Thinning treatments were repeated every 30 years. Regeneration treatments were not modelled to repeat as subsequent regeneration harvests would not be expected within the 100 year period. It is expected that there would be thinning treatments within the regeneration units within this 100 year period. As the majority of these lands are matrix lands, meant to be managed for sustained yield, it is expected that future harvests would occur on these lands. No treatments were modelled under Alternative 1 within the 100 year period. Trees with mistletoe were not targeted within the model, although some of them were harvested. This model is used to compare different treatments as applied to the same stands. It is not intended to provide accurate quantitative estimates of forest metrics (timber volumes), either post treatment or in the future. Modelling is used to compare the alternatives to each other, given similar assumptions, in order to aid in making a decision. **Stand metrics are described in Appendix C: Glossary.**

The treatments in the areas designated for thinning are designed to maintain or promote a multistoried stand and to improve forest resiliency to fire, insects and disease by reducing stand density. The treatments in the areas designated for regeneration harvest are designed to maximize harvested volume, promote early seral habitat, and to regenerate decadent stands. Prescriptions are site-specific and based on stocking guidelines taken from Simpson 2007, Cochran et al. 1994 and Cochran 1998. Stocking guidelines of 50-75% of Growth Basal Area (GBA) were recommended by the local forest pathologist (Eglitis, 2013, personal communication). GBA is defined as the basal area at which dominant trees grow at 1.0 inch in diameter per decade at age 100. This is a metric used to estimate site potential stockability using current stand growth (GBA). These guidelines would maintain the stand at a low enough density to reduce the risk of density-dependent mortality due to insects and disease, especially in the instance of a drought. In these stands, the desired GBA range is between 115 and 172.5 sq. ft./ac. BA. Thinning treatments were modeled to be harvested to 120 sq. ft./ac. BA. Dwarf mistletoe is not currently much of a problem in these stands, therefore it will not be discussed further in the EA. Additional information is available in the project record.

Table 3-7. Comparison of alternatives. Figures were averaged over the 100-year period and based on model results.

Alt	Growth (Cu. Ft/Yr)	Mortality (Cu. Ft./Yr)	Basal Area (Sq. ft./ac.)	SDI	QMD (inches)	Volume (MBF/AC)
1	88	59	218	263	29	64
2	64	13	135	247	10	37
3	81	37	199	314	15	62
4	75	14	156	284	11	41

*****(Stand metrics are defined in Appendix C: Glossary)***

Alternative 1 (No Action)

Under this alternative, there would be no immediate timber harvest or other vegetation treatments in the project area.

Stand structure in both the analysis area and the project area would remain at the levels shown in Table 3-5 and Figure 3-6 above. Alternative 1 has the highest average density, volume and tree size of the four alternatives (see Table 3-7), due to the fact that no trees are removed throughout this time period. Basal area remains well above the recommended GBA described above. Modeling shows that without any treatments, an increase in volume and stand density would occur in all units. Growth declines steadily over the 100 year period, while mortality remains relatively constant.

Forest stands would grow denser and continue to move beyond recommended stocking levels, making them more susceptible to insect and disease attacks and increasing density-dependent mortality. Greater mortality as compared to the action alternatives is expected to result in increased fuel loadings of dead material, both standing and on the ground level. This would potentially increase the severity of any wildfire that would take place. Alternative 1 has the highest mortality and the highest growth (Table 3-7) of the four alternatives.

Stands proposed in the action alternatives for understory thinning would have an increased fire risk if Alternative 1 is implemented. Without treatment, ladder fuels will continue to accumulate which would lead to higher mortality in the event of a fire. See Hazardous Fuels Section 3.7 for additional information. In addition, bypassing the reduction of the understory trees would increase the chances of density-dependent mortality due to increased stand density.

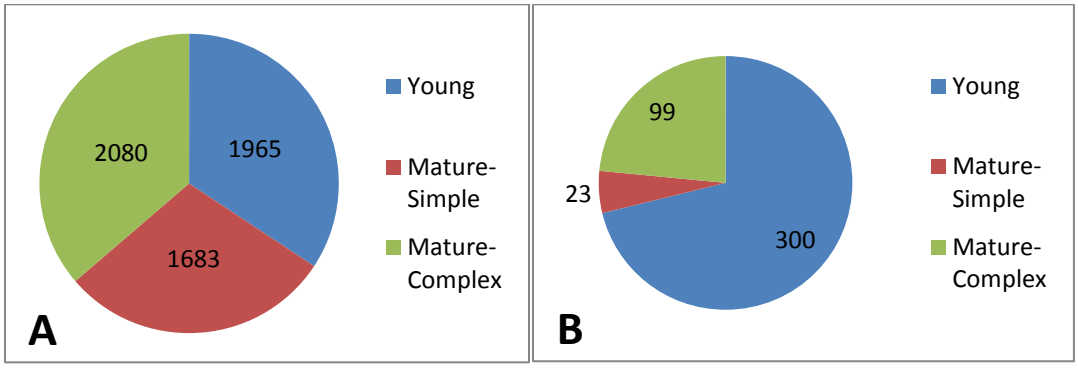
This alternative would fail to improve resiliency to drought, insects and disease. Fuel loadingwould increase and no forest products would be produced. Stand structures would remain as they are currently. Over time, the stands would continue to grow denser. More trees would succumb to density-dependent mortality, causing more mortality than in the action alternatives. Young stands would develop into mature stands over the 100 year time period.

Alternative 2

Alternative 2 maintains basal area within what would be considered a healthy range for this forest (see Table 3-7). Alternative 2 and alternative 4 are similar in terms of average stand metrics over this time period.

Stand structure would shift, as shown in Figure 3-8. The young stands would increase by 262 acres that are proposed for regeneration harvest in this alternative. The M-C stands would be reduced by the same 262 acres. Areas treated under a density management prescription would remain in their current structure class, M-C.

Figure 3-8. Acres in each stand structure group for the A. Analysis area and B. Project area for Alternative 2.



Mortality in the stands would be reduced at every harvest and then would increase over time until the next harvest. This alternative has the lowest mortality of the four alternatives (see Table 3-7).

Stand growth would increase in the thinning stands following harvest. In comparison with the other alternatives, growth is the lowest of the four in this alternative over the 100 year period.

Understory thinning in this alternative would lead to a reduction in ladder fuels and stand density. This would lower density dependent mortality levels, as compared to Alternative 1. Under this alternative, conifer trees will be removed from all diameter classes. This would leave a residual stand with less density and a variety of diameter classes.

In areas of regeneration harvest or where patch cuts are created, post-harvest stocking would be evaluated and areas would be planted with conifers or left to regenerate naturally, depending on surrounding seed sources. The openings created would allow for the establishment of a new cohort of trees. The combination of density management, regeneration harvest, and group selection would create a more heterogeneous stand structure. Likewise, leaving thermal clumps (unthinned areas) would ensure a more heterogeneous residual stand.

In summary, Alternative 2 would convert the most ground into young stands. Regular harvests reduce the risk of mortality within the stand and allow that mortality to be captured and used as forest products.According to the FVS model, stand density and volume would fluctuate with each harvest (every 30 years) over a 100-year period. These regular harvests keep the stands within recommended stocking and stand density ranges. This alternative would improve resiliency to drought, insects and disease, reduce fuel loading, restore fire-dependent processes, and utilize materials from treatments to produce forest commodities.

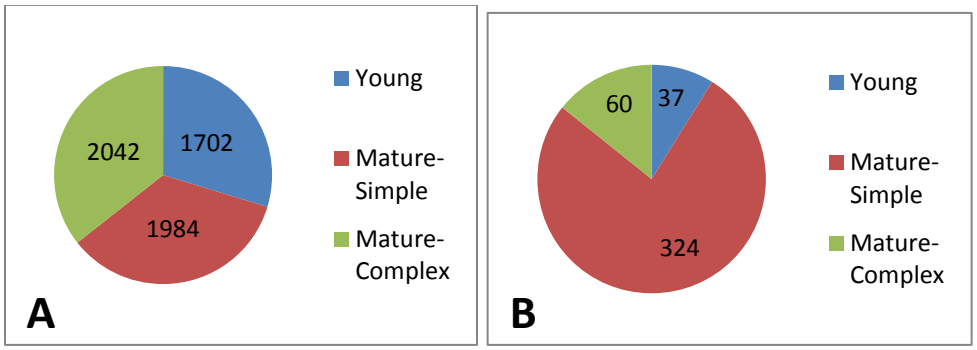
Alternative 3

According to Table 3-7, Alternative 3 is more comparable to the no action alternative (Alternative 1) than to either of the other action alternatives. This is reasonable because this treatment could only be performed once in the 100 year period. Therefore, density (BA and SDI) would be higher than the other action alternatives and remain at a higher than recommended

level. Tree size (QMD) would be slightly higher than the other action alternatives and volume would be similar.

Stand structure would shift, as shown in Figure 3-9. The M-S stands would increase by 301 acres that are proposed for thinning with a diameter limit in this alternative. The M-C stands would be reduced by the same 301 acres.

Figure 3-9. Acres in each stand structure group for the A. Analysis area and B. Project area for Alternative 3.



Alternative 3 limits harvesting to less than 20” DBH and does not include regeneration harvest. Thinning only trees less than 20” DBH to the recommended stocking levels described in the methodology section would harvest all trees between 8”and 20” DBH. This would eliminate the growing stock available to grow into the greater than 20” size class. The residual stand would be a stand of overstory trees with developing seedling and sapling size classes. This would leave a residual stand with less density and less variety of diameter classes.

The prescription proposed in Alternative 3 is not sustainable in the long term. Since the 8”-20” DBH class is eliminated in the first harvest, follow up harvests following the same prescription cannot occur or would not be marketable for the next 90 years.

In the long term, the 20” harvest diameter limit in this alternative would create stands that are primarily a single story of large trees rather than a multi storied, uneven-aged structure as would be maintained in Alternatives 1 or 4.

Mortality in the stands would be reduced following harvest and then would increase over time since there is no subsequent harvest scheduled in the 100 year period. Overall, mortality is second highest of the four alternatives (see Table 3-7). Average growth over the 100-year time period is also second highest of the four alternatives.

Alternative 3 includes understory thinning, which would lead to a reduction in ladder fuels and stand density. This would lower the mortality levels, as compared to Alternative 1, in the event of a fire.

The FVS model shows that stand density and volume increase over a 100-year period since subsequent harvests would not occur. Average stand diameter would be greater (by + 4”-6”) than the stands in Alternatives 2 or 4. This increase is due to the smaller trees being eliminated in the

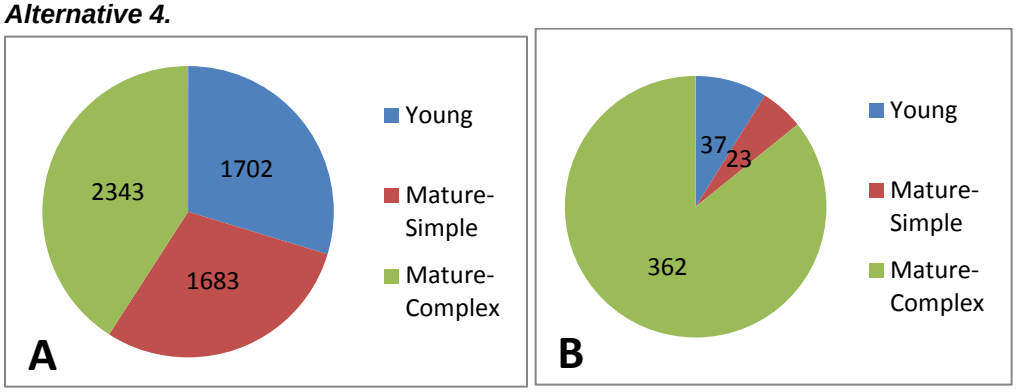
first harvest, leaving only the larger trees. Alternative 3 would produce less total volume per acre for the first entry when compared to Alternative 2 or 4. In addition, because there is only one entry, less volume would be removed over the 100-year period from Alternative 3 than would be in Alternatives 2 and 4.

In summary, this alternative would convert the most ground into single story, mature stands. This alternative would improve resiliency to drought, insects and disease, reduce fuel loading, restore fire-dependent processes, and utilize materials from treatments to produce forest commodities.

Alternative 4

Alternative 4 maintains basal area within what would be considered a healthy range for this forest (see Table 3-7). Alternatives 2 and 4 are comparable as far as average stand metrics over this time period.

Figure 3-10. Acres in each stand structure group for the A. Analysis area and B. Project area for Alternative 4.



Stand structure would not shift in this alternative, as it does in Alternative 2 or 3. As shown in Figure 3-10, the M-C stands would remain in the M-C class rather than shifting to the M-S class because the stand would not be simplified by removing trees less than 20” DBH as in Alternative 3 or regeneration harvested as in Alternative 2.

This would leave a residual stand with less density and a variety of diameter classes. In the long term, this alternative would restore historic stand structure. The effects of density management treatments on the stands in Alternative 4 would be the same as those described under Alternative 2 for density management treatments, however they would be spread over more acres.

In summary, this alternative would maintain as much ground in mature-complex stands as Alternative 1. Regular harvests reduce the risk of mortality within the stand and allow that mortality to be captured and used as forest products. According to the FVS model, stand density and volume would fluctuate with each harvest (every 30 years) over a 100-year period. These regular harvests keep the stands within recommended stocking and stand density ranges. This alternative would improve resiliency to drought, insects and disease, reduce fuel loading, restore fire-dependent processes, and utilize materials from treatments to produce forest commodities.

Cumulative Effects

Past and present actions in the analysis area are described in the Affected Environment section above. The effects of the proposed action are analyzed in the Environmental Consequences section above.

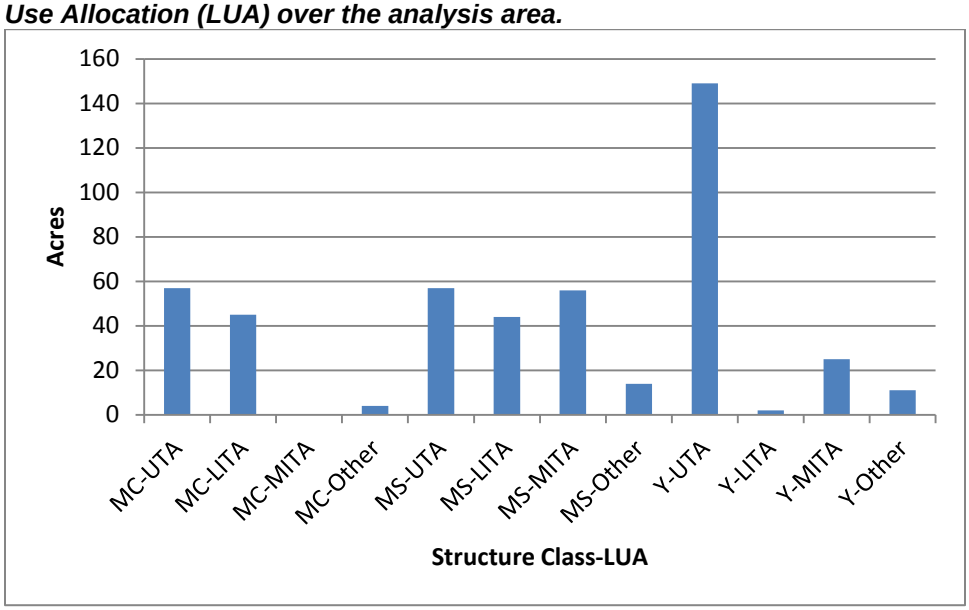
Reasonably foreseeable actions

- Continued harvest on private land
- State and USFS lands would remain in the same structural category as they are currently in. Even if they are harvested, the current structural class would be maintained for these stands.
- Continued harvest on BLM lands in the analysis area

Since we have already assumed continued harvest on private land, this would leave these lands in the Y category. Any further harvest would not change the amount of young forest we are currently estimating in the analysis area. The same is true of State and USFS land as we assume they would stay in the same category. Since all non-BLM land would stay in the same category, we will assume that those stay constant and only examine changes on BLM land for the rest of this analysis.

For the purposes of this analysis, we will assume that harvest on BLM lands in the future will comply with the 2016 RMP. The acres available for harvest per the 2016 PRMP/FEIS (Appendix X, pp. 2000-2002) for the first ten years have been estimated by KFRA staff specialists to be as shown below in Figure 3-11.

Figure 3-11. Estimated Available harvest acres by forest structure types in each 2016 RMP Land Use Allocation (LUA) over the analysis area.



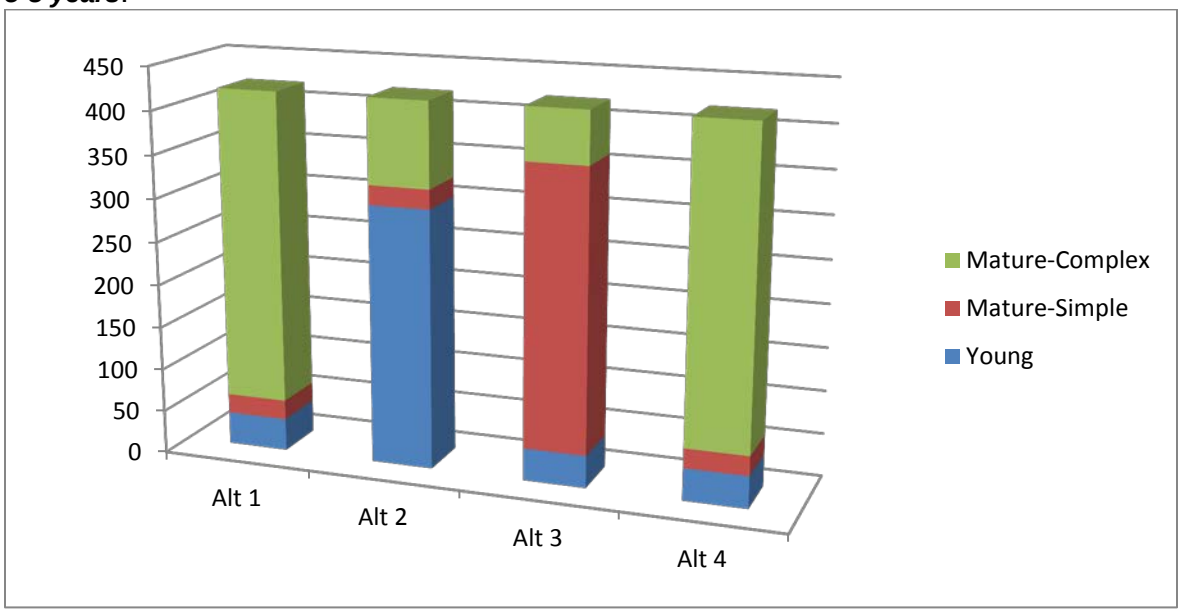
UTA=Uneven-aged Timber Area, LITA=Low Intensity Timber Area, MITA=Moderate Intensity Timber Area. Refer to Appendix B of the 2016 PRMP for management direction for each LUA.

UTA harvest would maintain the forests in the same structural classification that it is currently in, however the density of the stand would be reduced. MITA or LITA harvest would move stands into the Y category.

Incremental effects from future BLM timber sales may affect this structural distribution, however the only noticeable effect would come from regeneration harvest shifting mature forests to young forests. Although the quantity of future regeneration harvest is unknown, it would be the same for all alternatives, and therefore would not trigger a choice of one alternative over the others as the differences would be minor.

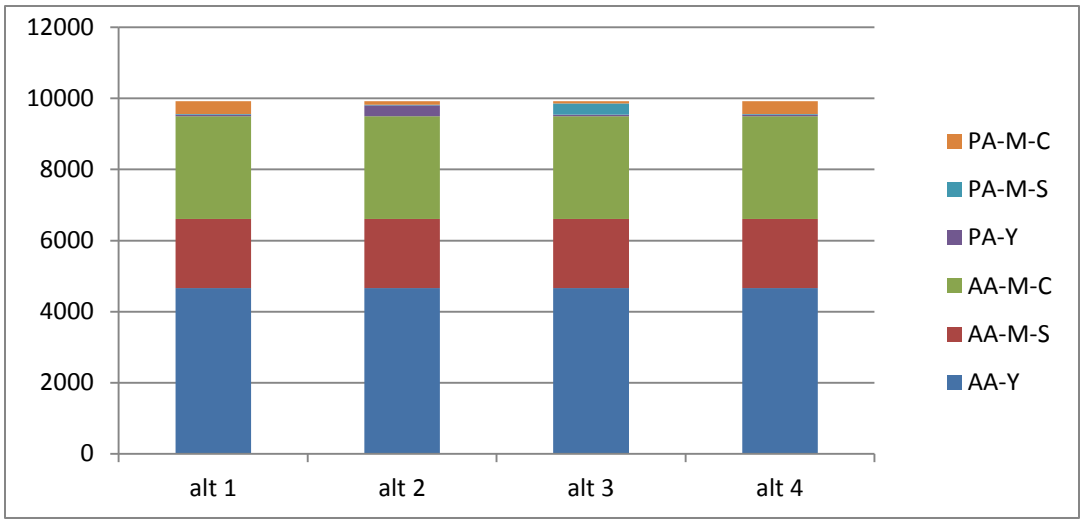
Within the project area, the three alternatives show more dramatic shifts in stand structure as is displayed in Figure 3-12. Alternatives 1 and 4 produce the most M-C acres, Alternative 2, the most Y acres, and Alternative 3 the most M-S acres.

Figure 3-12. Comparison of forest structure types over the project area for all four alternatives for 5-8 years.



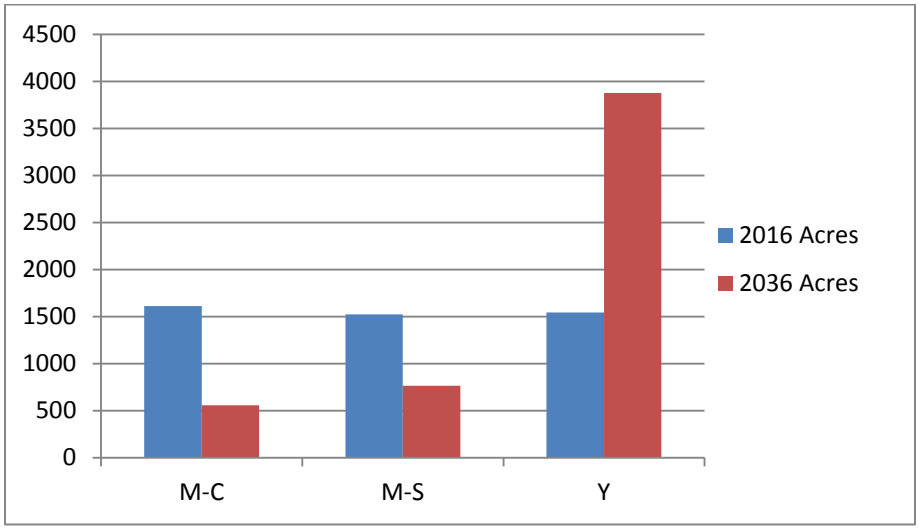
The 1995 RMP directs us to "Manage forests …so that over time, landscapes would trend towards a variety of structures… (RMP, p.E-9)." Within the analysis area it appears that all three alternatives would do this. There is a more dramatic change at the project level, however that is due to the fact that it is at a small scale. Over the entire analysis area, there is little variation in stand structure as a result of this project as is demonstrated in Figure 3-13. This graph shows the variation in structural class over the analysis area and allows comparison of how each of the four alternatives would affect the overall distribution of these structural classes within the analysis area for the next ten years.

Figure 3-13. Comparison of forest structure types over the analysis area for all four alternatives for 10 years. (PA= Project area, AA= Analysis area)



Over the life of the 2016 RMP, further changes would occur to structure classes in the analysis area. For the purposes of this analysis it is assumed that the RMP will be in place for 20 years and that all available harvest land base is harvested. It is also assumed (for the sake of comparison) that all land within the analysis area within an LUA that allows regeneration harvest is regeneration harvested. In this case, Figure 3-14 displays the changes in structure class in the analysis area over a 20-year period. As you can see, the 2016 RMP management shifts quite a few acres of mature forest into young stands.

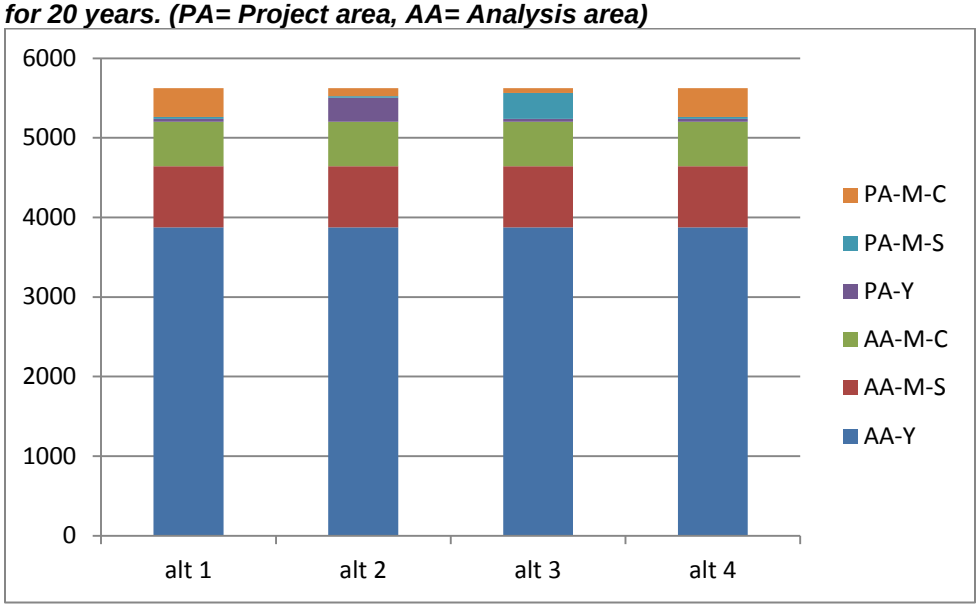
Figure 3-14. Comparison of forest structure types over the analysis area over 20 years under the 2016 RMP.



When this shift in structure types over the long term is compared with the individual effects of each of the alternatives, it is easy to see that the additive effects of the activities that take place within this project area are minor and insignificant within the analysis area as a whole. This is displayed in Figure 3-15. This graph shows the variation in structural class over the analysis area

and allows comparison of how each of the four alternatives would affect the overall distribution of these structural classes within the analysis area for the next 20 years.

Figure 3-15. Comparison of forest structure types over the analysis area for all four alternatives for 20 years. (PA= Project area, AA= Analysis area)



Any analysis after this point would be impossible as there is no way to know what future land use plans will prescribe. While the 2016 RMP does not specify how many acres should be in each of these structure classes, it does point out that each of the silvicultural approaches is meant to result in a variety of structural classes. The 2016 RMP states that "Even-aged management systems with clear-cutting would produce more uniform stands in a mix of age classes without structural legacies. Two-aged management systems with variable-retention regeneration harvesting would produce stands in a mix of age classes with legacy structures and multiple canopy layers. Uneven-aged management systems with selection harvesting regimes would produce mostly older, structurally-complex stands and mature forests with multiple canopy layers" (2016 PRMP/FEIS, p.307). Based on this analysis, both our future projects and the project proposed in this EA are within a range of structural classes that are consistent with both our current (1995) and future (2016) RMPs.

3.3 What are the effects of timber harvest and associated activities on northern spotted owls and designated critical habitat?

Affected Environment

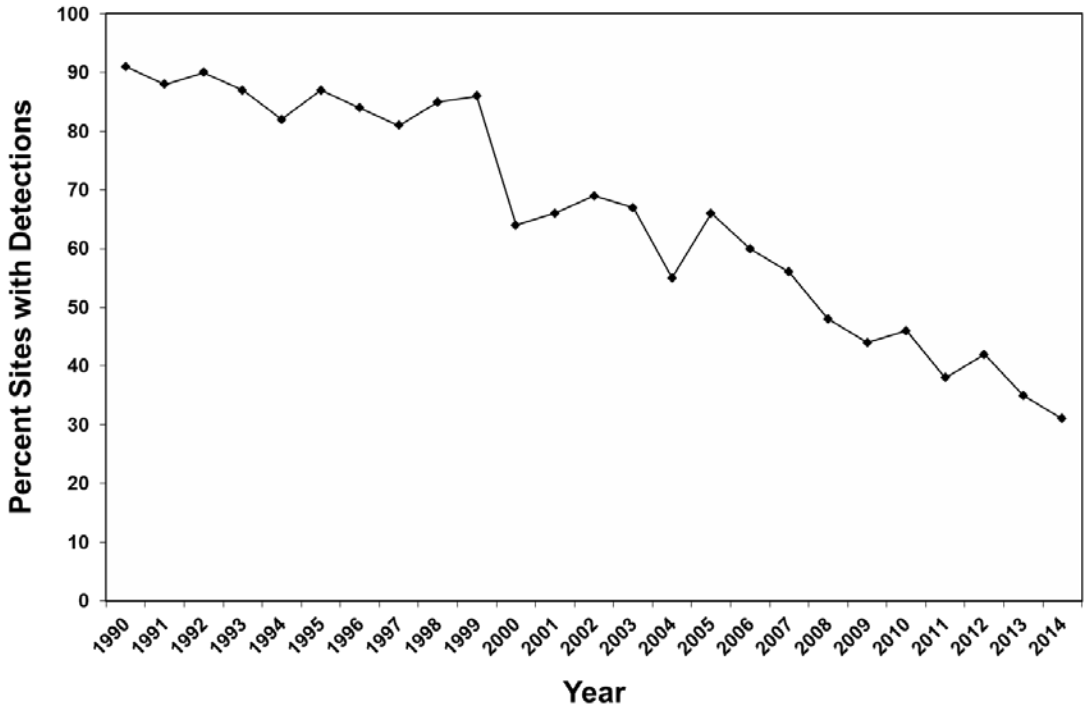
Northern Spotted Owl (NSO) (*Strix occidentalis caurina*) - Federally Threatened

Indicators and temporal and geographic extent for this analysis
The indicator used to measure impacts for this analysis will be the amount or acres of Nesting, Roosting, Foraging and Dispersal habitat (NRFD) available and affected by the proposed action as well as direct effects to individual spotted owls. The geographic extent for NSOs is the portion of their range within the Klamath Falls Resource Area. This extent was chosen because of its location on the eastside of the cascades, the land base within this extent is primarily Matrix lands available for timber harvest and there has been long-term monitoring of NSO sites within the KFRA. The temporal extent for this analysis will be for 30 years. That is the estimated time frame the NSO Recovery Plan determined it would take to delist the species.

NSO Status and Population Trends within the KFRA and the Southern Oregon Cascades Demography Study Area (CAS)
The Klamath Falls RA has conducted surveys and monitored its known spotted owl sites since 1990. There are currently no active sites south of Highway 66.Topsy, Hayden Creek, Edge Creek and Long Prairie Creek have been classified as abandoned by the FWS or ODF. There are 10 known sites north of Highway 66 that are still classified as current sites and are surveyed annually. Seven of those sites had NSOs detected in 2015 with three of those sites having pairs and one of those sites reproducing with three young.

The CAS was established in 1990 and incorporates approximately 2,400 km^2 of primarily Federal forest land. The area is geographically situated on lands administered by the Rogue River-Siskiyou National Forest (High Cascades Ranger District), the Fremont-Winema National Forest (Klamath Ranger District), and the Umpqua National Forest (Diamond Lake Ranger District). Although not part of the CAS study area, the data collected on the resource area is used as part of the range-wide demographic workshop conducted every five years to monitor population trends within the demographic study areas for the NSO. The CAS population trends would be representative of those on the KFRA. Spotted owls in the CAS were detected at 53 of the 171 sites visited in 2014 (Figure 3-16). Among the sites that were surveyed to protocol, pairs were detected at 36 sites, single owls were detected at 5 sites, and owls of unknown social status were detected at 12 sites. The percentage of sites where spotted owls were detected on the study area (31%) represented a 4.0% decrease from 2013 (Dugger *et al* 2014 unpublished report).

Figure 3-16. Percentage of all sites surveyed annually with ≥ 1 spotted owl detected on the Southern Cascades Study Area, Rogue River-Siskiyou and Fremont-Winema National Forests, Oregon, 1990-2014 (Dugger et al 2014 unpublished report).



The latest meta-analysis also indicates that population rates and occupancy rates for NSOs were continuing to decline in all parts of their range with the exception of the Green Diamond Resource lands where populations started increasing after barred owl removals were initiated in 2009 (Dugger *et al* 2016). In contrast to the meta-analysis, population modeling conducted for the PRMP/FEIS (pp. 962) indicates that the East–Cascades South Physiographic Province which includes the KFRA would contribute to a stable and increasing NSO population during the next 50 years even in the absence of a barred owl removal program. However the modeling parameters also indicate the population in this portion of the range is currently at risk from extirpation due to its low number (PRMP/FEIS pp. 962).

<u>Barred Owls</u>

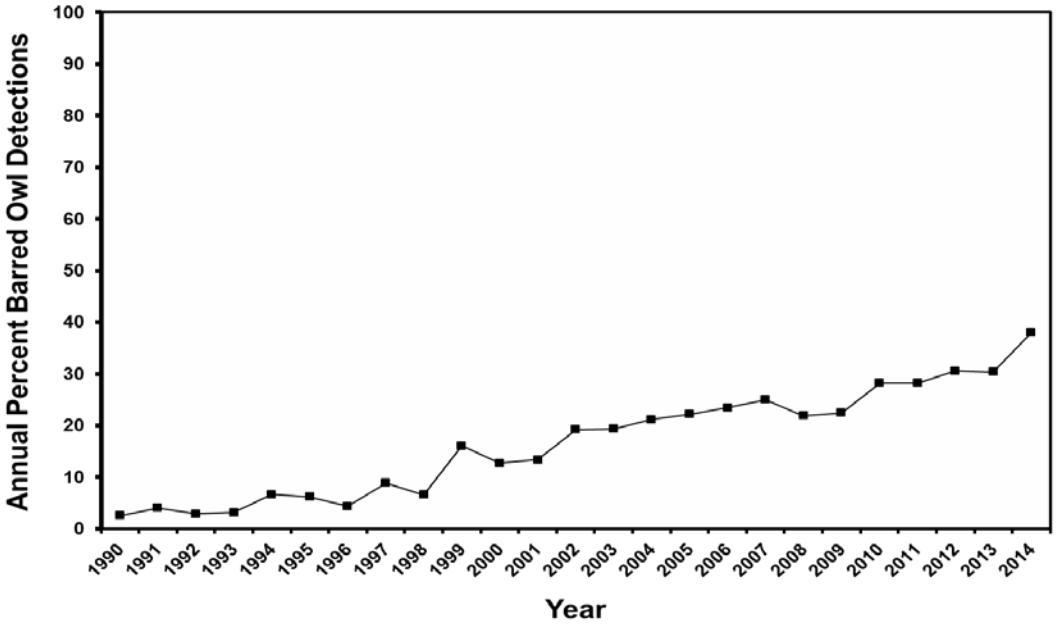
Until 2002, the barred owl was only rarely detected within the KFRA. Since that time, the barred owl has regularly been detected in the Resource Area. In 2015, there were five spotted owl territories where barred owls were detected plus two areas with detections outside known NSO territories. The CAS annual report from 2014 showed that the annual percentage of barred owl detections has increased from a low of 4.1% to a high of 38% in 2014. Cumulatively, barred owls have been detected at 80% of the spotted owl territories during at least one breeding season over the course of this study. Kelly *et al* (2003) reported that occupancy of spotted owls was significantly lower in the presence of barred owls. The latest publications continue to show the impacts that barred owls are having on occupancy rates of spotted owls found within the CAS Demographic Study Area (Dugger *et al* 2014). There is a strong association between barred owl detection rates and local spotted owl site extinction rates. These two species are competitors and the barred owl is currently displacing spotted owls from historical breeding territories. This study also showed the strong barred owl habitat effects on occupancy dynamics of spotted owls, and

provided evidence of interference competition between the species. Spotted owl occupancy rates decreased when barred owls were detected regardless of the habitat configuration of a territory. Loss of spotted owl territories was lowest in areas where old forests were most abundant and colonization was highest in forests of less fragmentation. These effects increase the importance of conserving large amounts of contiguous, old forest habitat to maintain northern spotted owls in the landscape (Dugger *et al* 2011).

There have been two detections of barred owls in the project area during the past four years and barred owls have been detected in four out of the five adjacent territories. The results in Dugger *et al* 2016 indicate that competition with the barred owl may be the primary cause of the NSO population decline across the range. "Barred Owl densities may now be high enough across the range of the Northern Spotted Owl that, despite the continued management and conservation of suitable owl habitat on federal lands, the long-term prognosis for the persistence of Northern Spotted Owls may be in question without additional management intervention. Based on our study, the removal of Barred Owls from the Green Diamond Resources (GDR) study area had rapid, positive effects on Northern Spotted Owl survival and the rate of population change, supporting the hypothesis that, along with habitat conservation and management, Barred Owl removal may be able to slow or reverse Northern Spotted Owl population declines on at least a localized scale" (Dugger *et al* 2016).

The detections of barred owls within the KFRA occurred during spotted owl surveys. It is likely that the full number and influence of barred owls within the KFRA has not been realized, since systematic surveys for barred owl has not occurred. Based on the current trends, it is likely that spotted owls will continue to be displaced or negatively affected by barred owls within the KFRA.

Figure 3-17. The annual percentages of historic spotted owl territories surveyed where barred owls were detected on the Southern Cascades Study Area, Rogue River-Siskiyou and Fremont-Winema National Forests, Oregon, 1990-2014 *(Dugger et al 2014 unpublished report).*



NSO Occupancy and spotted owl surveys within and adjacent to the Project Area

The project area overlaps a small portion (4 acres) of the Miner's Creek home range. One acre is classified as dispersal and the other three acres are classified as non-habitat. The remainder of the project area is outside any current NSO site, outside any priority sites, and has been surveyed and no NSOs were detected within the project area. During the development of the 1995 RMP, the KFRA underwent a survey effort to identify known sites and activity centers that met the criteria of a site as of January 1st 1994 to meet the Northwest Forest Plan Record of Decision (ROD 1994) in which all known activity centers received a 100 acre Late Successional Reserve (LSR).

The Surveyor Mountain (MSNO 0028) activity center is within the project area. This activity center was designated for an observation of a single owl in 1979. Cursory surveys were conducted in the 1980s with no detections and the area was thoroughly surveyed from 1990-1994. Subsequent the detection of a male and female (pair status unknown) in 1990 no detections of spotted owls were made. Surveyor Mountain did not receive a 100 acre LSR under the 1995 RMP or NWFP standards and guidelines because based on the survey efforts in the 1970s, 80s and 90s, the Surveyor Mountain NSO observation did not meet the criteria for a site based on the 1992 survey protocol for NSOs (FWS 1992). The project area was surveyed again in 2013-2015 (Table 3-18) with no spotted owls detected. Therefore, the project area currently does not support any owls considered resident or territorial owls. However based on a past radio telemetry study (2002-2006) within the resource area there could be some use by transient or "floaters" spotted owls that use the area outside the breeding season. During the telemetry study there was some non-breeding period (August- January) use within and adjacent to the project area.

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Table 3-18. Status of NSO Known Sites Within or Adjacent to Jigsaw Project Area

Site Name	MSNO	2013	2014	2015
Miners Creek	2265	NO	NO	NO
Surveyor North	0103	P	S	P
Hornbill	0066	NO	NO	NO
Kent Peak	2064	S	P	S
Buck Mountain	1306	S	NO	P

NO – none detected; S - single detected; P - pair detected

Spotted Owl NRF and Dispersal Habitat within the Project Area and Klamath Falls Resource Area

NSO habitat was originally classified in 1994 for the KFRA and that habitat tracked annually through project implementation. In 2012, the KFRA decided to update its habitat layer due to the changes in habitat definitions in the Recovery Plan for the NSO (2011). The amount of habitat is updated annually to reflect changes from project implementations and wildfire. Table 3-19 describes Nesting, Roosting, Foraging, and Dispersal (NRFD) habitat for the NSO within the KFRA and Jigsaw project area.

The project area is approximately 422 acres with proposed treatments on 354 of those acres. There is approximately 190 acres of Nesting/Roosting habitat, 63 acres of Foraging and 94 acres of Dispersal Habitat for the spotted owl within the project area. All but 56 acres of nesting/roosting habitat is proposed for treatments. There are approximately 4,477 acres of Nesting/Roosting habitat, 9,491 acres of Foraging and 17,977 acres of Dispersal Habitat available within the Klamath Falls Resource Area in 2016.

Table 3-19. Spotted Owl Habitat within the Project area and within the KFRA

Area	Nesting/Roosting	Foraging	Dispersal	Non-Habitat
Jigsaw	190*	63	94	75
KFRA	4,477	9,491	17,977	21,192

*56 Acres of N/R habitat not proposed for treatment

Table 3-20. Spotted Owl Habitat Descriptions

Nesting/Roosting Habitat (NR): Stands for nesting and roosting are generally characterized by: Moderate to high canopy closure (60 to over 80 percent), (ii) Multilayered, multispecies canopies with large (20–30 in (51–76 cm) or greater (dbh) overstory trees, (iii) High basal area (greater than 240 ft2/acre (55 m2/ha), (iv) High diversity of different diameters of trees, (v) High incidence of large live trees with various deformities (e.g., large cavities, broken tops, mistletoe infections, and other evidence of decadence), (vi) Large snags and large accumulations of fallen trees and other woody debris on the ground, and (vii) Sufficient open space below the canopy for northern spotted owls to fly (USDI FWS 2012).
Foraging Habitat (F): Stands for foraging habitat are generally characterized by: Stands of nesting and roosting habitat; (ii) Stands composed of Douglas-fir and white fir/Douglas-fir mix; (iii) Mean tree size greater than 16.5 in (42 cm) quadratic mean diameter; (iv) Increasing density of large trees (greater than 26 in (66 cm) and increasing basal area (the total area covered by trees measured at breast height) increases foraging habitat quality; (v) Large accumulations of fallen trees and other woody debris on the ground; and (vi) Sufficient open space below the canopy for northern spotted owls to fly (USDI FWS 2012).
Dispersal Habitat (D): Stands for dispersal habitat are generally characterized by: (a) Habitat supporting the transience phase of dispersal, which includes: (i) Stands with adequate tree size and canopy closure to provide protection from avian predators and minimal foraging opportunities; in general this may include, but is not limited to, trees with at least 11 in (28 cm) dbh and a minimum 40 percent canopy closure; and (ii) Younger and less diverse forest stands than foraging habitat, such as even-aged, pole-sized stands, if such stands contain some roosting structures and foraging habitat to allow for temporary resting and feeding during the transience phase. (b) Habitat supporting the colonization phase of dispersal, which is generally equivalent to nesting, roosting, and foraging habitat as described above, but may be smaller in area than that needed to support nesting pairs (USDI FWS 2012).
Home Range: Extent of area used by a pair of spotted owls for annual survival. This area is delineated for this analysis by a 1.2 mile radius circle (approx. 2,894 acres) around the last known nest site.

Northern Spotted Owl Critical Habitat

In 2012, the FWS issued a final rule for revised critical habitat for the northern spotted owl (USDI FWS 2012). Under the final rule, all of the Jigsaw project area is designated as critical habitat for the northern spotted owl. Regulations from Section 7(a) (2) of the Endangered Species Act (ESA) require consultation where a proposed discretionary action is likely to destroy or modify designated critical habitat.

The East Cascades South Critical Habitat Unit (ECS; unit 8) contains 526,815 acres and is divided into three subunits. The ECS-1 subunit consists of approximately 127,801 ac (51,719 ha) in Klamath, Jackson, and Douglas Counties, Oregon, and comprises lands managed by the BLM and the USFS. This subunit is expected to function primarily for demographic support to the overall population, as well as north-south and east-west connectivity between subunits and critical habitat units (USFWS 2012). The entire Jigsaw project area is within the ECS-1 totaling 422 acres and 354 acres are proposed for treatment

Table 3-21. Spotted Owl Critical Habitat on the KFRA and Jigsaw portion of ESC-1

KFRA	Acres	Jigsaw	Acres
Nesting/Roosting	4,189	Nesting/Roosting	190
Foraging	5,433	Foraging	63
Dispersal	6,839	Dispersal	94
Non-Habitat	4,034	Non-Habitat	75

Environmental Consequences

Methodology/Analytical Assumptions
For the spotted owl habitat analysis, several assumptions were made to determine the effects of the proposed actions on northern spotted owl (NSO) suitable and dispersal habitat. These assumptions are as follows:

- Density management prescriptions for Jigsaw will retain approximately 110-120 basal area of standing live trees. Regeneration will retain 16-25 large trees per acre.
- Timber harvest prescriptions on similar forest stands from previous sales would result in similar habitat qualities after harvest within the proposed project. Post-harvest stand exams (USDI BLM, 1999-2014) have supported this assumption with respect to canopy closure, tree density, snag density, and stand structure.
- Timber harvests that maintain snags, coarse woody debris, multi-age stands, greater than 160 basal area (BA) with the majority of the BA in the overstory would maintain canopy closure greater than 60% and would maintain spotted owl foraging habitat.
- Timber harvests that maintain snags, coarse woody debris, multi-age stands, greater than 200 basal area (BA) and retain trees > 20 inches with the majority of the BA in the overstory would maintain canopy closure from 60 to over 80% and would maintain spotted owl nesting habitat.
- If multiple treatments (i.e., commercial timber harvest, submerchantable thinning, and prescribed fire) were conducted within NRF habitat on the same acres, the loss of the structural components resulting from the additional treatments may reduce the quality of habitat and downgrade the habitat to dispersal habitat.
- On average, if a stand is thinned to 100 BA, the resulting canopy closure has exceeded 50% thereby meeting the definition of dispersal habitat. For density management treatments the habitat classified as dispersal pre-project would remain dispersal post-harvest. Post-harvest stand exams from previous timber harvest on similar habitat have supported this assumption.
- Private industrial forest lands adjacent to the KFRA have different management objectives and those lands provide minimal to no habitat for spotted owls and will into the future based on past and current harvest practices.
- Future density management and regeneration timber harvest on the KFRA outside of occupied spotted owl habitat will reduce spotted owl habitat to dispersal or non-habitat.
- No authorization of “Incidental Take” would occur on timber harvest for residential singles or territorial pairs until implementation of a barred owl management program has begun after the signing of, and that is consistent with, the Western Oregon RMP/ROD (PRMP/FEIS2016). The KFRA developed a 10 year timber sale plan with no anticipated “Incidental Take” based on this assumption.

Consistency with the 2011 Recovery Plan

2011 Revised Spotted Owl Recovery Plan
The 2011 Revised Spotted Owl Recovery Plan contains over 30 recovery actions, some of which are applicable to the KFRA and some which are not. Below is a discussion of the recovery actions pertinent to KFRA in general and the proposed project in specific.

Recovery Action 10 - Conserve spotted owl sites and high value spotted owl habitat to provide additional demographic support to the spotted owl population.

The Recovery Plan identified Interim Guidance on how to implement RA 10. When planning management activities, Federal and non-federal land managers should work with the Service to prioritize known and historic spotted owl sites for conservation and/or maintenance of existing levels of habitat. The prioritization factors to consider are reproductive status and site condition. The site conservation priorities for reproductive status are:

- Known sites with reproductive pairs;
- Known sites with pairs;
- Known sites with resident singles; and
- Historic sites with reproductive pairs, pairs, and resident singles, respectively.

The priority for site condition is sites currently with >40% in the provincial home range (*e.g.*, 1.3 mile radius) and >50% habitat within the core home range (*e.g.*, 0.5 mile radius). This prioritization provides a guide to evaluate the relative impacts of management actions, and conservation of sites that provide the most support to spotted owl demography (USDI FWS 2011).

In 2012, the KFRA identified NSO sites using this guidance for conservation priority and coordinated with the FWS. The project area is outside any current NSO site, outside any priority sites and has been surveyed and no NSOs were detected within the project area. Therefore the Jigsaw project is consistent with Recovery Action 10.

Recovery Action 32 - "Because spotted owl recovery requires well distributed, older and more structurally complex multi-layered conifer forests on Federal and non-federal lands across its range, land managers should work with the Service as described below to maintain and restore such habitat while allowing for other threats, such as fire and insects, to be addressed by restoration management actions. These high-quality spotted owl habitat stands are characterized as having large diameter trees, high amounts of canopy cover, and decadence components such as broken-topped live trees, mistletoe, cavities, large snags, and fallen trees."

In 2015, during the development of the new RMP for Western Oregon the KFRA identified and mapped RA 32 habitat for KFRA lands within the range of the spotted owl. These stands met the definition of RA 32 and would be managed as such under the new RMP. There is a 66-acre forest stand identified as an RA 32 stand within the project area. Ten acres of this stand are proposed for thinning under all action alternatives. The stand is currently at risk from insect and disease due to a high basal area of approximately 340 BA. The thinning would be designed to maintain the treatment unit classified as Nesting/Roosting habitat post-harvest and would retain a minimum of 200 BA with retention of all trees greater than 20 inches. This would reduce the risk from insect and disease outbreak but still maintain habitat. The remaining 56 acres of the RA 32 stand will be untreated. Therefore, the Jigsaw project would be consistent with RA 32.

Effects common for All Alternatives

Effects to the NSO Individuals and the KFRA Population

For all alternatives, including No Action, there would be no direct effects to territorial or resident spotted owls at any scale from proposed activities. None of the proposed actions will have any effect on the current spotted owl population due to the lack of resident or territorial spotted owls within the project area. Surveys conducted from 2012-2015 have not documented any owls during the breeding season. Nesting surveys would continue through the implementation of the project. There may be spotted owl use from non-territorial owls or owls dispersing outside the breeding season. During a past telemetry study (2002-2006) there was some use of the project area outside the breeding season (August –September) that would indicate that there still may be some use by non-territorial owls (i.e. floaters) during the fall and winter months. Since these individual owls are not tied to a nest site during that time period they would be able to move from any disturbances associated with harvest activities.

Alternative 1 (No Action)

Effects to Nesting/Roosting, Foraging, and Dispersal habitat within project area and KFRA

The No Action alternative would continue to maintain spotted owl habitat at its current levels in both the project level and the KFRA. Long-term the stands currently classified as foraging and dispersal habitat would likely develop into to nesting and foraging habitat and continue to provide for dispersing or "floater" spotted owls. Dugger *et al* 2016 found their results were consistent with other studies that have found links between habitat and demographic rates of Northern Spotted Owls (Franklin et al. 2000, Olson et al. 2004, Dugger *et al* 2005, 2011, Forsman *et al*. 2011, Yackulic *et al*. 2014), and provided support for previous recommendations to preserve as much high-quality habitat in late successional forests as possible across the range of the subspecies (Forsman *et al*. 2011). The No Action would provide the most suitable spotted owl habitat compared to the other action alternatives (Table 3-22).

Alternative 2

Effects to Nesting/Roosting, Foraging, and Dispersal habitat within project area and KFRA

Both regeneration harvest and the proposed basal area retention prescription under density management would reduce the quality and quantity of spotted owl habitat within the project area. The regeneration harvest proposed under Alternative 2 would reduce 94 acres of NRF habitat and 63 acres of dispersal habitat to non-habitat. The proposed density management harvest would reduce 38 acres of nesting habitat to dispersal habitat. Although both harvest types would reduce the amount of habitat available, the regeneration harvest method would remove habitat for a longer period of time before it is available for use by spotted owls. The units harvested through regeneration methods with jackpot burning would remove NRF habitat for approximately 100-120 years while the density management units are projected to recover to foraging habitat in approximately 30 years post thinning based on modeling and past timber harvest with similar prescriptions. The proposed combination of regeneration harvest with jackpot burning and density management harvest would reduce spotted owl nesting, roosting, and foraging habitat within the project area by 78%. The quantity and quality of habitat reduced would be the highest under Alternative 2. There would be approximately a 2% reduction of habitat within the KFRA from Alternative 2.

There are approximately 10 acres of dispersal habitat within the understory thinning units. The proposed understory thinning would continue to maintain those acres as dispersal habitat. The proposed riparian reserve treatment is within non-habitat for the spotted owl and would have no effect on habitat. The planting of trees within the proposed harvest units would have no short-term effect but would provide a basis for spotted owl habitat in the future.

Table 3-22. NSO Habitat Comparison within Jigsaw project area for all Alternatives

Alternative	Nesting/ Roosting	Foraging	Dispersal	Non-Habitat	% Reduction in NRF
Alt 1	190	63	94	75	0%
Alt 2	66	0	0	356	78%
Alt 3 & 4	66	0	281	75	78%

*56 Acres of N/R habitat not proposed for treatment

Alternative 3 and Alternative 4

Alternative 3 and 4 are the same timber harvest prescriptions with the exception of a diameter limit of less than 20 inches under Alternative 3. There is also no riparian treatment or prescribed burning proposed under these alternatives.

Both alternatives would reduce 134 acres of nesting/roosting habitat and 63 acres of foraging habitat to dispersal habitat. The proposed density management would reduce spotted owl NRF habitat within the project area by 78%. Both alternatives would reduce nesting, roosting and foraging habitat due to the reduction of basal area that would remove canopy closure below 60%. Although Alternative 3 does leave all trees greater than 20 inches the loss of canopy would still reduce the quality of habitat and these stands would be classified as dispersal habitat post-harvest. The retention of all trees > than 20 inches would provide a higher quality foraging and nesting/roosting habitat by retaining the larger structural diversity as the stand density recovered post-harvest and returned to foraging habitat. There would be approximately a 2% reduction of habitat within the KFRA from Alternative 3 and 4.

Compared to Alterative 2 the recovery time for spotted owl habitat to recover to suitable habitat will be measurably less under both these alternatives. The density management units are projected to recover to foraging habitat in approximately 30 years post-thinning based on forest stand modeling and past timber harvest with similar prescriptions.

Table 3-23. NSO Habitat Comparison within KFRA for all Alternatives

Alternative	Nesting/ Roosting	Foraging	Dispersal	Non-Habitat	% Reduction in NRF
Alt 1	4,477	9,491	17,977	21,192	0%
Alt 2	4,343	9,428	17,893	21,473	2%
Alt 3 & 4	4,343	9,428	18,090	21,192	2%

Northern Spotted Owl Critical Habitat

The Jigsaw project area is within critical habitat unit ECS-1. The ESC- 1 unit is 127,201 acres and the primary function of ESC-1 is to provide for primary demographic support and connectivity between the critical habitat units. As described in the habitat section above, the proposed action alternatives will negatively impact critical habitat by downgrading

nesting/roosting, foraging and dispersal habitat (primary constituent elements) within the project area. However, the critical habitat unit is large and the project area (422 acres) equates to well less than 1% (.003) of the overall critical habitat unit.

The project location as described in the critical habitat rule was designed to focus impacts to critical habitat outside of occupied or high quality NSO habitat and focus within matrix lands. By design the project area was focused outside of occupied NSO sites and high quality habitat to minimize impacts to NSOs. The proposed action alternatives would continue to maintain the primary function of demographic support and connectivity between critical habitat units.

Table 3-24. NSO CH Habitat Comparison within KFRA portion of CH Unit ECS 1.

Alternative	Nesting/ Roosting	Foraging	Dispersal	Non-Habitat	% Reduction in KFRA
Alt 1	4189	5433	6839	4034	0%
Alt 2	4055	5370	6755	4315	2%
Alt 3 & 4	4055	5370	7036	4034	2%

Cumulative Effects

The foreseeable actions that are considered under this section are those that may have an effect on spotted owls and their habitat. The primary foreseeable action within the KFRA and the adjacent forested lands that may affect spotted owls are timber harvest or vegetation management. The private industrial forest lands contribute minimal suitable habitat for the spotted owl and based on past management there would not be much contribution in the foreseeable future.

<u>Cumulative Effects to NSO Individuals and KFRA Population</u>
Based on the current trends of spotted owls and guidance in the PRMP/FEIS (2016) the KFRA has developed a timber harvest plan for the next ten years that doesn't anticipate "Incidental Take" on spotted owls. The Jigsaw project did not have any effect on a residential single or territorial pair of spotted owls. Therefore there would be no cumulative affects to the spotted owl population within the KFRA from the Jigsaw timber harvest.

<u>Cumulative Effects to NSO Habitat</u>
The proposed harvest in all three action alternatives would reduce NRF habitat (Table 3-24). Over the next 10 years the proposed timber harvest would further reduce habitat. Table 3-25 shows the anticipated change in NSO habitat over the next 10 years. Although this change in habitat will be outside the home ranges of any resident or territorial pairs of spotted owls based on the projected timber harvest plan it would still reduce habitat within the range of the spotted owl. Dugger *et al* 2016 and others (Franklin *et al*. 2000, Olson *et al*. 2004, Dugger *et al*. 2005, 2011, Forsman *et al*. 2011, Yackulic *et al*. 2014) did find a link between the quantity of NSO habitat and demographic rates. Under the 10 year timber sale plan there would be a mix of regeneration and density management harvest. As stated under the assumptions, because the harvest proposal is outside of occupied NSO sites, in the next 10 years these stands will likely be harvested to maximize timber volume while reducing direct impacts to NSOs. There would be approximately 1020 acres of NRF habitat that will be harvested through a density management prescription and downgraded to dispersal and approximately 534 acres of NRF that would be harvested through a regeneration prescription that will be downgraded to non-habitat.

Table 3-25. Cumulative Effects Comparison of NSO Habitat within the KFRA for all Alternatives.

Alternative	Nesting/ Roosting	Foraging	Dispersal	Non-Habitat	% Reduction in NRF
KFRA (Baseline)	4,477	9,491	17,977	21,192	N/A
10 TS (Pre)	485	1,069	1,363	371	N/A
KFRA NSO Cumulative Baseline	3,992	8,422	18,752	21,971	11%
10TS + Alt 1	3,992	8,422	18,752	21,971	11%
10TS + Alt 2	3,858	8,359	18,668	22,252	13%
10TS + Alt 3 & 4	3,858	8,359	18,949	21,971	13%

For all alternatives, the incremental effects of the Jigsaw proposed timber harvest would not substantially add to the effects of past management actions and the timber harvest over the next ten years. There would only be a 2% reduction in NSO habitat from the Jigsaw timber harvest. The modeling in the PRMP/FEIS (pp 962) does show that the East Cascades South Physiographic Province which includes the KFRA would increase in available spotted owl habitat over the next 30 years and provide for stable to increasing spotted owl populations. The Jigsaw project and the 10 year timber sale plan were designed to be consistent with the NSO recovery plan (2011) and the NSO critical habitat final rule (2012) by focusing timber harvest outside of active spotted owl sites or those sites considered priority for conservation. Despite the harvest from the proposed project and future timber harvest, in-growth of NSO habitat over the next 30 years is expected to outpace the harvest of NSO habitat within the East Cascades South province (PRMP/FEIS 2016).

3.4 What are the effects of timber harvest and associated activities on fisher (*Pekania pennanti*)?

Affected Environment

Geographic and Temporal Extent and Effects Indicators for this Analysis

The indicator used to measure impacts for this analysis will be the amount or acres of Denning and Foraging habitat available and affected by the proposed action as well as direct effects to individual fishers. The geographic extent for fisher is the portion of their range within the project area and Klamath Falls Resource Area. This extent was chosen because of its location on the eastside of the cascades, the land base within this extent is primarily Matrix lands available for timber harvest and the uncertainty of the current distribution of fisher on the landscape. Based on the latest survey information there is uncertainty on the distribution outside of the KFRA and across southern Oregon. This extent would address the past, present and foreseeable impacts to the known distribution of fisher within the KFRA. The temporal extent for this analysis is 30 years. This is the anticipated time frame for forest stands to recover from density management harvest.

Fisher ESA Listing Status and Occupancy within the Project Area and KFRA

The fisher was proposed for listing under the ESA and the proposed rule (FWS 2014) identified three distinct population segments that were considered for listing under ESA. The FWS published a withdrawal of the proposed rule to list the West Coast segment of the Fisher population on April 18th, 2016. This means that no portion of the west coast segment of the fisher

population is listed under the ESA and for the BLM the fisher remains classified as a sensitive species.

In 1998 through 2001, the Lakeview District BLM Klamath Falls Resource Area (KFRA) conducted surveys for fisher and other forest carnivores using baited camera stations following the Zielinski and Kucera methodology for detecting forest carnivores (Zielinski and Kucera 1995). Those survey efforts did not detect any fisher. From 2013 through 2015, a similar survey effort on the KFRA was conducted using baited camera stations with hair snares following the same methodology (Zielinski and Kucera 1995). The survey area is located southeast of the known fisher population in Southwest Oregon (Aubry K.B. and J.C. Lewis 2003) and includes the Jigsaw project area. Both digital photographs of fishers and fisher hair samples were collected over this time period. Hair samples collected were sent to USFS Rocky Mountain Research Station for DNA analysis.

Based on their analysis 9 individuals (5 males and 4 females) were identified with one male individual being a recapture previously detected on the Fremont-Winema National Forest (Pilgrim. K. and M. Schwartz 2014-2015). Of the 9 individuals, eight had a haplotype common to the introduced population from British Columbia and those populations in Southwestern Oregon (Pilgrim. K. and M. Schwartz 2014-2015) that received translocations in the 1960s, 1970s and 1980s (Aubry. K. and J. Lewis 2003). One individual female had one of two haplotypes observed previously in fishers from Northern California, the Mt. Ashland area and from BLM surveys west of Interstate 5 in Oregon. This female is consistent with being related to/descended from the native fisher population. This individual female was also located on the Klamath Falls and Medford BLM (Pilgrim. K. and M. Schwartz 2014-2015). This female was the second individual (along with a male collected near Hyatt Lake on the Medford BLM) located east of Interstate 5 that has a genetic signature consistent with the native population.

In October 2015, the KFRA and the Ashland RA, Medford BLM initiated a fisher telemetry project in partnership with USFS Pacific Northwest Research Station and Oregon State University. Five fishers (three female and two male) were collared using a combination of GPS and VHF radio collars. That project is currently ongoing and field work is planned to be completed in 2016. When you compare the current survey findings and the multiple unsolicited sightings of fisher in the past few years to the past survey efforts and no unsolicited sightings on the KFRA, it appears that there has been a recent expansion of fisher into the KFRA. The source populations would include the known translocated population to the northwest of the KFRA and at least one individual related to the native population west of Interstate 5.

Baited camera stations and hair snare surveys are continuing in 2016 within the Jigsaw project area during the denning season. Based on hair samples from these surveys three individual females were documented in the project area from February-April 2016 (Pilgrim. K. and M. Schwartz 2016). Plus two other detections have occurred within and directly adjacent to the project area in previous survey efforts.

Fisher Habitat within the Project Area and the KFRA

With the recent detection of fisher, the KFRA biologists identified fisher habitat within the KFRA to better assess the effects of land management actions on fishers and fisher habitat.

Denning and foraging habitat was identified based on the habitat descriptions in the Draft Species Report Fisher West Coast Population (FWS 2014) and the Conservation of Fishers in South Central British Columbia, Western Washington, Western Oregon, and California (Lofroth *et al* 2010). In general, fisher denning and resting habitat within the project area and the KFRA can be described as mosaic of mixed conifer forested habitat including mature structurally diverse (horizontal and vertical) forest with moderate to high canopy closure (Lofroth *et al* 2010). Structures such as live trees and snags with cavities, platforms such as mistletoe brooms and broken top trees are essential components of fisher denning and resting habitat. Foraging habitat is mixed conifer forest stands with moderate to high canopy closure that provides prey and security while foraging. According to Lofroth *et al* 2010, the mean home range for a male fisher is 20.8 square miles (13,329 acres) and 7.3 square miles (4,692 acres) for a female within western Oregon. Home range sizes vary in shape and size based on habitat quality, availability and configuration of habitat. Fisher home ranges typically include a diversity of forest successional stages and plant communities but reflect the forested plant communities (Lofroth *et al* 2010).

The Jigsaw project area contains approximately 133 acres of habitat classified as denning and 163 acres of foraging habitat. For this analysis the KFRA fisher habitat is limited to the contiguous BLM lands north of Highway 66 and west of Highway 97. The remote parcels and areas south of Highway 66 are currently considered unoccupied by fisher due to the checkerboard ownership, large areas of heavily thinned stands on private lands that lack structure (large green trees, snags, down wood, and canopy closure) and lack of available suitable habitat on both BLM and private lands. Fishers avoid open areas with low to no canopy closure likely from the increased risk of predation (Ruggerio *et al* 1994). The KFRA contains approximately 13,313 acres of foraging habitat and 4,237 acres of denning habitat.

Table 3-26. Fisher Habitat within the Project area and within the KFRA

Area	Denning	Foraging	Non-Habitat
Jigsaw	133	163	126
KFRA	4,237	13,313	5,108

Table 3-27. Description of Fisher Habitat

Denning Habitat	Mature mixed conifer forest stand with high canopy closure (>70%) with both vertical and horizontal structure an abundance of large diameter live and dead trees to support maternal and natal denning. Cavities in live or dead trees are a key characteristic of denning habitat.
Resting Habitat	Mixed conifer forest stand with microsite characteristics that include moderate to high canopy closure around rest structure (live tree or snags). The structures may include mistletoe broom, other platforms or cavities. Fisher will also use cull landing piles as rest areas (Aubry and Raley 2006). Rest structures are used by fisher when not hunting or traveling that probably serves multiple functions including a secure location for protection from potential predators, a secure location for consuming prey and thermal regulation (Aubry and Raley 2006). Live trees are used more frequently than snags for resting. In live trees fisher used mistletoe brooms more than any other microsite (Aubry and Raley 2006, Raley *et al* 2012).
Foraging Habitat	A mosaic of forested habitat types with moderate to high canopy closure (>40%) with both vertical and horizontal structure (CWD) to provide prey and security while foraging.

Environmental Consequences

Methodology

- For the KFRA, occupied fisher habitat is limited to the contiguous BLM lands north of Highway 66 and west of Highway 97. The remote parcels and areas south of Highway 66 are currently considered unoccupied by fisher due to the checkerboard ownership, large areas of heavily thinned stands on private industrial forest lands.
- Timber harvest that reduces the forest canopy closure below 70% or substantially remove denning structure would no longer be classified denning habitat.
- Timber harvest that maintain snags, coarse woody debris, multi-age stands, greater than 160 basal area (BA) with the majority of the BA in the overstory would maintain canopy closure greater than 60% and would maintain fisher denning habitat
- Timber harvest that reduces the forest canopy closure below 40% would no longer be classified foraging habitat.
- On average, if a stand is thinned to 100 BA, the resulting canopy closure has exceeded 50% thereby meeting the definition of foraging habitat. For density management treatments the habitat classified as foraging pre-project would remain foraging post-harvest. Post-harvest stand exams from previous timber harvest on similar habitat have supported this assumption.
- Based on surveys and DNA from hair samples both male and female fishers have used the project area. For this analysis it is assumed that the project area is within the home range of at least one male and one female fisher.
- For this analysis the mean home range for a male fisher is 20.8 square miles (13,329 acres) and 7.3 square miles (4,692 acres) for a female (Lofroth *et al* 2010).
- Based on habitat use by radioed fisher, post-harvest density management timber stands within the KFRA continue to provide foraging habitat for fishers. Fishers continue to use past density management units for forging on the KFRA based on the past three years of camera and hair snare stations in past density management stands plus preliminary data from the ongoing telemetry study. Past harvest prescriptions were similar over the past twenty years. A general description of past density management harvest include; retention of basal area ranging from 100-160, most down wood and snags retained within harvest units, and canopy closure in the 40-70% range. Therefore for this analysis fisher foraging habitat will be maintained based on the current prescriptions for density management.
- The majority of private industrial forest lands adjacent to the KFRA have conducted overstory removal harvest in the past two decades and therefore those lands provides minimal foraging or denning habitat for fisher. For this analysis we will assume that there is minimal contribution of fisher habitat from private lands due to the management objectives on those lands.
- Seasonal restrictions would be required if fisher den sites are found or suspected prior to or during the implementation of the project. Restrict activities that create noise or visual disturbance(s) above the ambient conditions within 0.5 miles of known fisher natal or maternal den sites from February 1st to June 30th. Based on camera surveys during the denning season within the project area denning may occur within or adjacent to the project area and therefore the seasonal restrictions for fisher den sites should be implemented.

Alternative 1 (No Action)

Effects to individual fisher and fisher populations within the KFRA
Under the No Action Alternative, there would be no effect to fisher individuals or the population within the KFRA. Both male and female fishers have been detected within or adjacent to the project area and habitat within the project is classified as denning and foraging habitat. As of the spring of 2016, there have been multiple fishers detected within the project area. No denning has been confirmed within the project area, only foraging and resting behavior, but due to the activity during the denning season denning may occur in or adjacent to the project area.

The No Action Alternative would continue to provide denning, resting and foraging habitat within the project area. The No Action Alternative would provide the maximum amount of habitat currently available within the project area for fisher between all alternatives.

Alternative 2

Effects to individual fisher and populations within the KFRA
Both male and female fishers have been documented within or adjacent to the project area. The male fisher has an estimated mean home range of approximately 13,329 acres and the female fisher has an approximate mean home range of 4,692 acres. These are estimates of home range and the current use of the KFRA by fishers and their home range size and configuration is unknown. However, these estimated mean home ranges by Lofoth *et al* 2010 can provide this analysis with a means to measure impacts (loss of habitat) to fishers from timber harvest. As described above, denning and resting activity may occur within the project area. Since denning is suspected within or adjacent to the project area the PDFs for seasonal restriction would prevent direct impacts to individuals and would protect the den site through the denning season. Fishers are quite mobile, have relatively large home ranges and outside the denning season fisher should be able to avoid timber harvest activity.

Vegetation management, primarily timber harvesting, can substantially modify the numbers and distribution of structural elements and overstory canopy. Once these components are removed it may take many decades to replace (USDI FWS 2014). Structure is a key component to fisher habitat and multiple rest sites (snags, mistletoe brooms, broken top trees, etc.) within stands to provide security from predation and thermoregulation in the summer and winter months. Fishers have not shown high site fidelity to rest sites or den sites. Fishers have large home ranges and rarely reuse rest structures (USDI FWS 2014, Zielinski *et al* 2004 pp 481-482, Lofroth *et al* 2010 pp. 57, 72, Aubry. K, and Raley 2006). Having den and rest structure distributed across the landscape is probably more important than focusing on individual rest and den structures. Regeneration harvest would have the greatest impact long-term to structures associated with fisher denning and resting habitat. Alternative 2 would have the greatest impact to fisher habitat of all the proposed alternatives. Regeneration harvest would downgrade approximately 94 acres of denning habitat and 146 acres of foraging habitat to non-habitat due to the loss of canopy closure and structural diversity (Lofroth *et al* 2010).

The proposed density management would downgrade denning habitat on 38 acres to foraging habitat. Under this alternative there would be an estimated 2% reduction in available habitat within a male fisher home range and an estimated 5% reduction in available habitat within a

female fisher home range. Both of these reductions are not anticipated to appreciably diminish foraging, denning or resting habitat for individual male and female fisher and therefore not affect the population within the KFRA. The proposed project area is surrounded by forested landscape of foraging and denning habitat and Alternative 2 post-harvest would not preclude connectivity.

Table 3-28. Comparison of Fisher Habitat by Alternative for Male and Female Fisher Home Range

Alternatives	Male	% Change	Female	% Change of Fisher Habitat
Alt 1	13,329	0%	4,692	0%
Alt 2	13,090	2%	4,453	5%
Alt 3 and 4	13,329	0%	4,692	0%

Alternatives 3 and 4

Effects to individual fisher and populations within the KFRA

Alternative 3 and 4 would downgrade approximately 132 acres of denning habitat to foraging habitat. Similar to Alternative 2, the reduction of denning habitat within the project area is not anticipated to appreciably diminish foraging, denning or resting habitat for individual male and female fisher within their respective home ranges and therefore not affect the population within the KFRA. Although Table 3-29 shows 0% change in fisher habitat there is a downgrade of denning habitat to foraging habitat due to the density management thinning. Those acres previously classified as denning were downgraded to foraging due to the reduction of overstory canopy closure, reduction of potential rest sites and reduction of potential den sites. These stands would still continue to provide foraging habitat.

Table 3-29. Comparison of Fisher Habitat within the KFRA for Alternatives

Alternatives	Denning Habitat	Foraging Habitat	Non-Habitat	% Change of Fisher Habitat
Alt 1	4,237	13,313	5,108	0%
Alt 2	4,105	13,205	5,348	1%
Alt 3 and 4	4,105	13,445	5,108	0%

Effects common to all action alternatives – Habitat within the KFRA

The loss of fisher habitat within the project area would minimally impact fisher within the KFRA. Under all Alternatives approximately one percent of habitat would be downgraded or removed from available habitat within the KFRA. There would be no effect on connectivity for fisher movement within the KFRA or dispersing fisher from the loss of habitat from the Jigsaw project.

Cumulative Effects

The foreseeable actions that are considered under this section are those that may have an effect on fishers and their habitat. The primary foreseeable action within the KFRA and the adjacent forested lands that may affect fishers are timber harvest or other vegetation management. The private industrial forest lands contribute minimal habitat for the fisher and based on past management there would be minimal contribution in the foreseeable future.

The ten year harvest plan which is based on minimizing impacts to spotted owls would benefit fishers and fisher habitat as well. The anticipated harvest in the next ten years would be outside what is considered the higher quality fisher habitat within the KFRA.

Table 3-30. Cumulative Effects Comparison of Fisher Habitat within the KFRA for all Alternatives.

Alternative	Denning	Foraging	Non-Habitat	% Reduction in Fisher Habitat
KFRA (Baseline)	4,237	13,313	5,108	N/A
10 TS (Pre)	400	2,308	371	N/A
KFRA Fisher Cumulative Baseline	3,837	13,124	5108	3%
10TS + Alt 1	3,837	13,124	5,108	3%
10TS + Alt 2	3,705	13,016	5,348	4%
10TS + Alt 3 & 4	3,705	13,256	5,108	3%

The proposed harvest in all three action alternatives would reduce Fisher habitat (Table 3-29). Over the next 10 years the proposed timber harvest would further reduce habitat. Table 3-30 shows the anticipated change in Fisher habitat over the next 10 years.

Under the 10 year timber sale plan, there would be a mix of regeneration and density management harvest. There would be approximately 218 acres of denning habitat harvested through a density management prescription and downgraded to foraging and approximately 1,902 acres of foraging that would be maintained as foraging. Approximately 181 acres of denning habitat and 406 acres of foraging habitat would be harvested through a regeneration prescription and removed as suitable habitat for fishers. For all Alternatives, the incremental effects of the Jigsaw proposed timber harvest would not substantially add to the effects of past management actions and the foreseeable timber harvest over the next ten years. There would be a maximum of a 1% reduction in fisher habitat loss from the Jigsaw timber harvest within the KFRA. The PRMP/FEIS 2016 analysis found similar results; that within the first two decades of implementation there would be a slight loss in fisher habitat but by the 3rd decade (30 years) and in subsequent decades, fisher habitat would increase over time within the KFRA. Based on the PRMP/FEIS (2016) land use allocations approximately 2,350 acres (55%) of the denning habitat in the KFRA baseline (Table 3-30) are in reserve acres.

3.5 What are the economic differences between proposed timber harvest alternatives?

Definitions

- Pond Value - The value of logs delivered to a mill.
- MBF represents thousands of board feet while MMBF represents millions of board feet.

Assumptions

For affected employment levels, this analysis used the same assumption used in the Northwest Forest Plan: 9.07 jobs per million board feet processed in the solid wood products industry (USDA and USDI 1994a, 3&4-293).

In choosing between alternatives, the relative economic effects are considered. Recognizing costs and product values may rise and fall over time, this analysis assumed economic values to remain static in order to simplify the comparative analysis between alternatives.

Harvested volume occurring on matrix lands will contribute to the Klamath Falls Resource area's (KFRA) fiscal year 2016 harvest volume target of 4.0 MMBF. It is anticipated that 6.0 MMBF would be needed to meet the 2017 harvest volume target. The Green Leftovers timber sale was previously sold and contributed 2.6 MMBF to fiscal year 2016 harvest volume target. 1.4 MMBF is still needed to meet fiscal year 2016's harvest volume target.

All volume estimates are based on stand exam plot data.

For purposes of estimating timber values, pond values are assumed to be $350.00 per MBF. Between the alternatives, harvesting cost (yarding trees from stump to truck), is the only cost that will fluctuate on a dollar per MBF basis. All other costs i.e. trucking, profit and risk, and road maintenance remain the same dollar per MBF cost across the alternatives.

Affected Environment

Economic Setting

A regional perspective of the economic setting is provided in the Northwest Forest Plan (USDA and USDI 1994a, 3&4 261-319). With implementation of the ROD in 1995, approximately 23,550 acres of Oregon and California (O&C) land are currently designated as lands allocated for timber production (Matrix lands) on the Klamath Falls Resource Area.

With the presence of merchantable forested land in the project area, there is potential for the forest products industry to contribute to the local economy using material from the project area. Processing facilities locally and in neighboring communities are dependent upon a stable, sustainable, and reliable supply of timber. There are three large wood products processing facilities in Klamath County. In addition local forest products frequently go to processing facilities in Jackson County and Siskiyou County, California.

All landowner types for Klamath, Jackson, and Siskiyou counties produced the following approximate timber volumes:

Table 3-31. Timber Volumes Produced by County

County	Timber Produced (MMBF)	Value at a Mill (pond value)
Klamath	103 (Oregon Timber Harvest Data, 2014)	$36,050,000
Jackson	115 (Oregon Timber Harvest Data, 2014)	$40,250,000
Siskiyou County, Ca	184 (California State B of E, 2014)	$66,150,000

In addition to the supply of wood to the local economies, provisions in the 1937 Oregon and California (O&C) Act provide for the dispersal of portions of timber receipts from O&C lands to the O&C counties. The general formula is that 50% of the timber receipts from Matrix lands on

O&C timber sales are distributed to the O&C counties (DOI, OCLA). Table 3-32 shows the effects of each alternative on payments to the O & C counties.

Since the late 1980s, litigation regarding the northern spotted owl has resulted in steep reductions in timber harvests in the Pacific Northwest and correspondingly steep reductions in income to counties that depend on revenues from timber harvests on public lands (DOI, OCLA). The Secure Rural Schools and Community Self Determination Act of 2000 provides for federal funds to flow to counties that traditionally have been supported by timber payments. From 2000-2015 the act has provided counties with funding in lieu of timber receipt payments. The most recent payment in 2015 provided 18 counties in Oregon with approximately $35.5 million (BLM, OR/WA).

Economic Factors

Economic factors which affect supplying forest commodities in an economically feasible manner are the amount, quality and distribution of material available for harvest, the harvest method, access to harvest areas, and the associated costs to mitigate the effects of harvest.

Common harvest methods (moving trees from stump to truck) are the primary factors affecting actual harvest costs. Ground based tractor logging is proposed under all action alternatives. This harvest method is based on management objectives in conjunction with site conditions such as access and topography. Ground based tractor yarding is the least costly method of removal and, depending on conditions, may range from $50 per MBF to $150 per MBF.

The main factor affecting harvest system costs between the alternatives is harvested volume per acre. As the harvested volume per acre declines so too does number of loads of logs produced each day. Since equipment and manpower costs remain relatively constant, as loads produced per day declines the cost per load or cost per MBF increases.

Access to harvest areas is a factor with respect to the miles of road being used and the condition of those roads. Cost factors include the level of road improvement needed for hauling logs, road surface condition with respect to operating season, use restrictions during wet conditions, and move in and move-out costs of equipment where multiple road systems are used for access. Economic feasibility and efficiency is reduced where road improvement costs and the number of road miles needed for harvest access increases.

Mitigation of harvest effects includes costs such as ripping compacted soils, decommissioning or closing roads, treating slash, and implementing seasonal operating restrictions. The cost and level of mitigation needed depends on the situation. Typically, the more mitigation measures applied, the greater the reduction in economic feasibility and efficiency.

Socioeconomics- Environmental Consequences

Alternative 1

Alternative 1 (No Action alternative) would result in the KFRA not offering a timber sale in this project area. It would also mean that KFRA would not meet the assigned harvested volume target for 2016 and potentially 2017. No timber volume would be produced and there would be no

money returned to the counties from the project area. Refer to Table-3-32 below for a comparison of the alternatives.

Alternative 2

Under Alternative 2, approximately 7.8 (MMBF) of timber is expected to be commercially harvested from approximately 301 acres. This corresponds to an average of approximately 25,983 board feet of harvested volume per acre. Under this alternative the assigned harvested volume target would be met for FY 2016. This alternative could potentially contribute volume to 2017 and 2018 harvest volume targets as well. Harvesting costs are approximately $121 per MBF for a total cost of $942,431. Volume harvested under this alternative could support approximately 13 forest products jobs in FY 2016 and 54 forest products jobs in FY 2017. Additionally this alternative could support approximately four forest products jobs in FY 2018. Alternative 2 disperses approximately $897,460 to the O & C counties if SRS is not in effect.

Alternative 3

Under Alternative 3, approximately 2.3 MMBF of timber is expected to be commercially harvested from approximately 301 acres. This corresponds to an average of approximately 7,681 board feet of harvested volume per acre. Under this alternative the assigned harvest volume target would be met for 2016. This alternative would also contribute 900 MBF to the 2017 harvest volume target. Harvesting costs are approximately $179 per MBF for a total cost of $412,692. Volume harvested under this alternative could support approximately 13 forest products jobs in FY 2016 and eight forest products jobs in FY 2017. Alternative 3 disperses approximately $206,346 to the O & C counties.

Alternative 4

Under alternative 4, approximately 3.7 (MMBF) of timber is expected to be commercially harvested from approximately 301 acres. This corresponds to an average of approximately 12,316 board feet of harvested volume per acre. Under this alternative the assigned harvest volume target would be met for 2016. This alternative would also contribute 2.3 MMBF to the 2017 harvest volume target. Harvesting costs are approximately $152 per MBF for a total cost of $561,611. Volume harvested under this alternative could support approximately 13 forest products jobs in FY 2016 and 21 forest products jobs in FY 2017. Alternative 4 disperses approximately $367,920 to the O & C counties.

Table 3-32 was developed to compare the timber values associated with each of the alternatives. All of the values are estimates and will change over time as timber markets change.

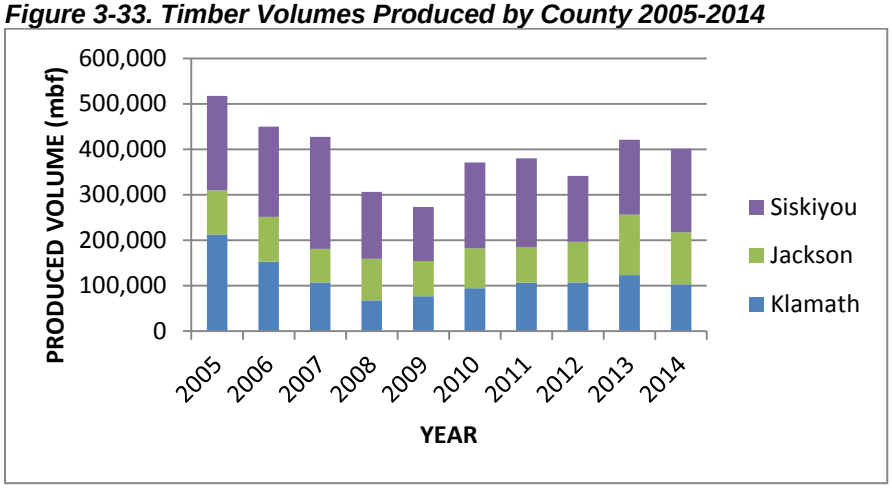
Table 3-32. Timber Values by Alternative

Alternative	Volume Harvested (MMBF)*	Estimated Pond Value delivered Logs	Costs	Total Revenue	Return to O&C Counties
Alternative 1	0	$0	$0	$0	$0
Alternative 2	7.8	$2,737,350	$942,431	$1,794,920	$897,460
Alternative 3	2.3	$809,200	$396,508	$412,692	$206,346
Alternative 4	3.7	$1,297,450	$561,611	$735,840	$367,920

Cumulative Effects

The following chart (Figure 3-33) shows the volume of timber produced in Klamath, Jackson and Siskiyou counties between all landowners public and private (Oregon Timber Harvest Data, 2005-2014) (California State Board of Equalization, 2005-2014).

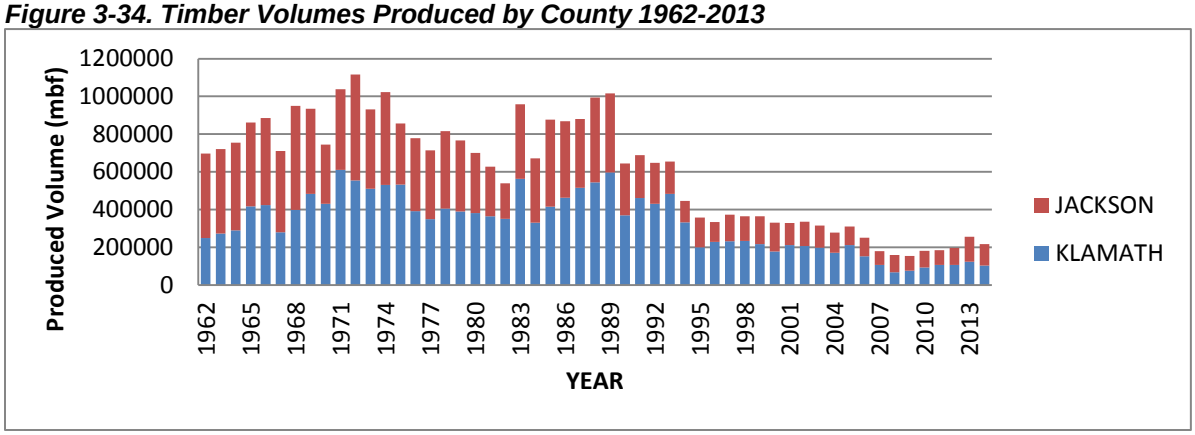
Figure 3-33. Timber Volumes Produced by County 2005-2014



Since the geographic area is so large, it is impracticable to find accurate data for present and future harvest. What we can see from the recent past is harvest trends are increasing from 2009 to 2013. Since the recession of 2008 and 2009, harvest levels have increased largely from private lands (Oregon Timber Harvest Data, 2005-2014). However, the following Figure 3-34 gives us a longer term view of the overall situation for timber production. In this graph long term data was only available for Klamath and Jackson counties. Based on data from 2005-2014 it's reasonable to surmise that harvest levels may stay the same or even increase, however, looking at the trend since 1962, timber production is much lower.

In addition to the trend mentioned above The Secure Rural Schools and Community Self Determination Act of 2000 was originally authorized to provide payments through 2006. Extensions of the SRS act have been supported through 2017. The latest extension was reauthorized in April 2015 and locks in allocation elections made by counties for Fiscal year 2013 for two fiscal years (2016-2017) (BLM, O/W). Even though extensions have been granted since 2006 there is no guarantee the administration and congress will continue to support them.

Figure 3-34. Timber Volumes Produced by County 1962-2013



From 1995-2015 KFRA has an average annual harvest of 5.8 MMBF (KFRA APS 2015 Table 19.6). Alternative 1 would lower the average annual harvest to 5.5 MMBF per year. Alternatives 2, 3, and 4 would lower the average annual harvest to 5.7 MMBF.

Alternative 1 would not provide enough volume to meet the assigned harvest volume target for FY 2016. Alternatives 2, 3, and 4 would provide enough volume to meet the 4.0 MMBF assigned harvest volume target for FY 2016. Each of the action alternatives would produce volume to at least contribute to the future assigned harvest volume target for FY 2017. Alternative 2 would produce approximately 400 MBF for 2018 as well. This is assuming the target for 2017 is 6 MMBF.

In April of 2016 the BLM introduced the finalized RMP's for Western Oregon RMP plan revision. With the revision and the selection of an alternative the BLM will reestablish the ASQ for KFRA. The proposed RMP (PRMP) alternative assigns KFRA an ASQ of 6 MMBF for the first decade (Table 3-58, PRMP, Vol. 1 p. 353). KFRA currently has a sale plan that meets ASQ under the new RMP for approximately the next 8.5 years (2017-2025).

3.6 What are the effects of proposed activities on soil compaction and displacement?

Soils – Affected Environment

The proposed project is located in the southeast region of the High Cascade Province. This area consists of nearly level to gentle slopes derived primarily from andesite, basalt, and ashy deposits. Geologically young parent material coupled with a cold climate has produced soils in early or intermediate stages of development (NRCS, 1993).

The 1993 *Soil Survey of Jackson County Area, Oregon* identified two soil map units within the project area. Both map units are composed primarily of Oatman soils, with a lesser degree of Otwin and other soil inclusions present. Typically, the very deep well drained Oatman soils feature loam over sandy loam and contain a high volume of rock fragments throughout the profile. These soils exhibit a high natural productivity.

When moist, both Oatman and Otwin soils display a low resistance to compaction and a severe rutting hazard. In their natural state, they allow water to move freely into and through the profile, creating a slow to medium potential for runoff when thoroughly wet. The hazard of erosion, from both roads and off-road areas following disturbance activities, trends from slight to moderate. Soils present on flat to gentle slopes are slightly susceptible for soil degradation to occur during disturbance. On the steeper slopes, the risk of site degradation susceptibility is moderate. All soil types within the project area have a high restoration potential. Also defined as soil resilience, this is a soil's inherent ability to recover from degradation. Restoration potential describes the ability of a site to restore soil functional and structural integrity after a disturbance.

Table 3-35 displays the two map units and a few select soil characteristics.

Table 3-35. Soil Map Units in the Jigsaw Environmental Assessment Project Area

Soil Map Unit	Erosion Hazard	Compaction Resistance	Rutting Hazard	Site Degradation Susceptibility	Soil Restoration Potential	Acres
136E Oatman cobbly loam, 12-35% south slopes	Moderate	Low	Severe	Moderately	High	34
138C Oatman-Otwin complex, 0-12% slopes	Slight	Low	Severe	Slightly	High	387

The project area straddles the Spencer and Jenny Creek Watersheds. The Spencer Creek Watershed Analysis concludes that some losses in soil productivity have likely occurred in the watershed due to timber harvest and recreational activities. The losses are mainly due to compaction and displacement. However, the extent to which soil productivity has been affected by management activities is unknown (BLM, 1995).

To quantify levels of soil disturbance resulting from timber harvest, BLM staff conducted soil monitoring in the Kakapoo Stew timber sale area. This project was adjacent to and contained the same soils as those found in the Jigsaw project area. The intent of the monitoring was to determine: (1) the areal extent of surface disturbance caused by timber harvest activities; (2) the magnitude of soil impacts; (3) the effectiveness of Best Management Practices (BMPs) and Project Design Features (PDFs); and (4) if Resource Management Plan standards and objectives for protecting soil resources were being met.

From 1998 through 2000 soil cores were collected and analyzed to detect changes in bulk density from that of pre-harvest soil cores. Increases in soil bulk density are an indicator of increasing compaction levels. The findings from the areal extent portion of the monitoring concluded that approximately 26 percent of the project area was disturbed during the Kakapoo Stew timber sale; of that, approximately 8 percent of the project area had soil damage that was considered detrimental (BLM APS Report, 2000).

The Klamath Falls Resource Area Resource Management Plan limits detrimental soil impacts due to management activities to no more than 20 percent of a project area. Quantitative post-harvest soil monitoring data collected and analyzed for the Kakapoo Stew timber sale suggested that BMPs for the degree of soil disturbance and soil compaction was in compliance with the KFRA RMP and regional standards and guidelines for detrimental soil impacts. Analysis of sampling results concluded that soil productivity requirements were being maintained and improved in timber sales and other projects. The results from soil monitoring on the Kakapoo Stew and other timber sales were considered in the layout of future resource area timber sales, including the Jigsaw project.

Soils – Environmental Consequences

The baseline used for the potential effects analysis was the existing conditions described previously. To identify the level of effects and compare the consequences between alternatives, prospective acres of disturbance and volume of timber removed were used as indicators for the soils impact analysis. Acres of disturbance reflect the extent of surface-disturbing activities and

treatments that could potentially affect soil productivity. Volume of timber harvested and removal strategies determine the magnitude of disturbance. Ground disturbing activity that could lead to loss of ground cover or vegetation, reduction of topsoil, or in any way decrease site productivity would be an indicator of adverse or detrimental effects to soils.

For the Jigsaw project analysis, the magnitude of potential impacts or effects ranges from negligible to moderate. Negligible effects on soil productivity would be at or below the level of detection, whereby moderate effects would be readily apparent, result in changes of soil character, and would likely require mitigating measures to minimize adverse impacts. On a temporal scale, effects are short- or long-term, which means anticipated impacts occur within or beyond 5 years of project implementation, respectively.

The quantity of acres harvested and the harvesting methods are similar under all three action alternatives. Approximately 300 acres are proposed for density management or regeneration harvest. Harvest would be accomplished utilizing ground-based mechanical whole tree yarding methods. The variations between alternatives of the potential impacts to soil resources would primarily result from differences in volume harvested and treatment types. Table 3-36 and the following analysis summarizes potential effects to soils if the alternatives as proposed are implemented.

Table 3-36. Proposed Treatments and Potential Effects on Soil Resources

Variables	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Treatments	None	-Timber sale -Thinning -Underburning in regen harvest area -Pile burning in RR	-Timber sale -Thinning	-Timber sale -Thinning
Volume removed	None	7.8 MMBF 25,983 bf/acre	2.3 MMBF 7,681 bf/acre	3.7 MMBF 12,316 bf/acre
Potential Effects-comparative between alternatives	No adverse impacts	Most adverse impacts	Least adverse impacts	Mid- adverse impacts

Alternative 1--No Action

Under Alternative 1 none of the proposed management treatments would be implemented, consequently no additional acres of ground would be disturbed. Detrimental soil conditions from timber harvest and fuels treatment activities would not increase above existing levels. Livestock grazing, dispersed recreation, wildfire suppression, and road maintenance would continue.

The No Action Alternative would have no direct adverse effects on soil productivity in the upland areas. Additional soil impacts such as compaction, rutting, or displacement would not occur. Areas of previous timber harvest and former road location would continue the recovery process towards improved productivity. Upward trends in soil and site productivity could be expected.

Actions and Effects Common to All Action Alternatives

Density management-commercial timber sales: Use of ground-based mechanized equipment for timber sales and thinning activities has the potential to cause isolated areas of compaction, topsoil displacement, and creation of adverse surface conditions. Soil compaction typically

occurs on skid trails and landings, whereby tractors and skidders make multiple passes over a designated area. The use of mechanical harvesters normally results in a greater area of ground disturbance, particularly soil displacement, since they are not confined to skid roads.

Project design features (PDFs) and application of Best Management Practices specific to ground-based operations would limit soil compaction and displacement. BMPs include, but are not limited to: utilizing existing roads, skid trails, and landings where practical; operating restrictions during periods of high soil moisture; and retention of dead and down woody material. Logging on frozen ground or over sufficient snow depth is encouraged. With effectively implemented BMPs, short-term minimal adverse effects are anticipated. Site restoration potential is likely to remain high. As documented by post-treatment soil monitoring efforts on adjacent timber sales, detrimental soil conditions are expected to remain below threshold limits established by the 1995 RMP. Though not anticipated, should the threshold limits be exceeded, additional treatments such as seeding, planting, or other appropriate measures would be required.

Small diameter thinning: Thinning of small diameter trees in plantations would be accomplished utilizing ground-based harvesting equipment. Thinning operations would conform to the same soil BMPs as required in density management and regeneration harvest units throughout the project. However, impacts on soil resources may be slightly greater than those of density management operations due to the cumulative effects of multiple treatments over the years. Adverse effects are expected to range from minimal to moderate. In the event that RMP threshold limits be exceeded based on one-year post-harvest monitoring, additional mitigations such as backblading or subsoiling would be required.

Planting conifers: Planting of conifer species is proposed in several units. Localized adverse soil impacts from planting activities are expected to be negligible due to the gentle slopes, deep loamy soils, and minimal ground disturbance from foot traffic and hand planting equipment. In the long-term, beneficial effects of replanting this unit can be anticipated as a result of increased nutrient cycling and improved soil surface stability.

Alternative 2

With respect to the magnitude of potential adverse soil effects, Alternative 2 would result in the most soil disturbance and potential for adverse effects of the three action alternatives.

Alternative 2 proposes harvest of 7.8 MMBF of timber. The treatments emphasize regeneration harvest, and to a lesser extent, density management and small diameter thinning. This equates to an average 25,983 board-feet of harvested volume per acre (see Socio-Economics Section). The harvest levels of Alternative 2 are about three times greater than Alternative 3 and more than twice that of Alternative 4. Although the disturbance footprint of Alternative 2 is the smallest of the three, it is likely that with implementation of Alternative 2 the degree of adverse impacts would be the highest of the three action alternatives. This is due to the fact that for this analysis, harvest volume is an indicator of the magnitude of ground disturbance and soil impacts. Harvest volumes proposed under Alternative 2 are the highest and treatments are concentrated on fewer acres than that of the three action alternatives.

Alternative 2 is the only action alternative that proposes manual cutting, piling and burning of small trees in the riparian reserve unit 7-4. Additionally, underburning is proposed in the regeneration harvest areas. Manual cutting is expected to have no measureable impact on the soil resource except when followed by pile burning. To alleviate potential long-term detrimental effects, burned areas will remain small and interspersed throughout the unit. Burning will only occur when the soil surface is very moist or wet. Applicable PDFs and BMPs that would be implemented are listed in Section 2.7. Low-intensity underburns would have minimal effects on soil properties. Typically, cool broadcast burns have a slight short-term positive effect of increasing available nutrients, with a slight negative effect three to five years post burning, due to decreases in nitrogen. Soil productivity is expected to improve due to the positive flush of post-treatment nutrients.

Under implementation of Alternative 2, detrimental soil conditions are expected to remain below threshold limits established by the 1995 RMP.

Alternative 3

With regards to the three action alternatives, Alternative 3 would result in the least adverse impacts on soil resources. Imposing a 20-inch diameter limit would reduce the harvest to 7,681 board-feet per acre. The diminished harvest volume would result in less soil disturbance and a lower potential for adverse soil impacts than Alternatives 2 or 4. Additionally, no treatments are proposed in the riparian reserves, nor will prescribed burning occur with implementation of this alternative. Fewer treatments and lower harvest volume indicates a lower degree of soil disturbance than the other action alternatives.

With the exception of localized soil disturbance (e.g., landings or skid trails), it is expected that detrimental soil impacts would not exceed 20 percent of the total acreage within individual treatment units.

Alternative 4

Alternative 4 proposes harvest of 3.7 MMBF of timber throughout all age and diameter classes. This equates to an average 12,316 board-feet per acre. Although the areal extent of soil disturbance would be more than that of Alternative 2, Alternative 4 would result in less adverse soil effects. This is because the treatments would be dispersed over a slightly larger area and the volume of trees removed would be less.

When comparing effects on soils with respect to Alternative 3, Alternative 4 would result in more adverse impacts. Here again, the proposed volume of trees removed under implementation of Alternative 4 is greater, and there are no diameter limits. Both of these factors influence the likelihood of higher levels of adverse soil impacts.

Under implementation of Alternative 4, detrimental soil conditions are expected to remain below threshold limits established by the 1995 RMP. With effectively implemented PDFs and BMPs, it is expected that detrimental soil impacts would not exceed 20 percent of the total acreage within individual treatment units.

Cumulative Effects

Cumulative effects include all past, present, and reasonably foreseeable actions that cause soil disturbance within the same activity areas. Past, present, and future activities in the project area include, but are not limited to: timber sales, vegetation and fuels treatments, grazing, road construction and maintenance, firewood gathering, dispersed recreation, and watershed improvement projects. Wildfires have occurred and continue to occur throughout the watershed.

It is recognized that former management treatments, human activities, and naturally occurring events have resulted in various degrees of soil disturbance within the project area. As a consequence, soil productivity has been impacted to various degrees. Where soil disturbance from previous timber management activities occurred, in most cases natural processes have gradually restored soil quality over the past 20+ years. The addition of organic matter residues, root penetration, rodent activity, and freeze-thaw cycles have improved soil productivity and advanced recovery. Localized presence of soil displacement as a result of former timber harvest activities exists on skid trails and landings scattered throughout the project area.

The precise extent and degree of impacts on the soil resource from past management activities are not known. Accordingly, current soil conditions were used as a proxy for past management activities. Soil disturbance monitoring in the area determined that soil conditions subsequent to timber harvest activities were in compliance with the KFRA RMP and regional standards and guidelines for detrimental soil impacts. Analysis of sampling results concluded that soil productivity requirements were being maintained and improved in timber sales and other projects.

The cumulative impacts that would result from project implementation are not anticipated to approach or exceed the RMP or regional standards for soil resources. If and where soil resource damage occurs, it would be in small isolated areas. Moreover, inherent soil features render the volcanic-derived soils resistant to the impacts of management activities that frequently cause compaction and rutting. The gentle slopes present minor risks for soil erosion. Soil characteristics coupled with the geographic setting of the project area would likely alleviate cumulative effects of past and future management activities.

Project Design Features were incorporated into the project plan to ensure BLM standards would be met. Best Management Practices would be employed during the implementation phase, not only to comply with standards and guides, but also to move the project area closer to desired future conditions. Units were designed to avoid steep slope ground-based harvest, and thus mitigate potential erosion hazards. The use of existing roads and skid trails is intended to minimize additional ground disturbances.

Effectively implemented BMPs would provide additional resource protection. BMPs such as restricting operations to dry conditions and retaining large woody debris on site would protect soil condition, improve soil functions, and increase soil productivity. In localities where detrimental conditions exceeding RMP standards are identified, additional BMPs would be implemented to mitigate adverse effects.

3.7 What are the effects of proposed project activities on hazardous fuels in the project area?

Affected Environment

The *analysis* area for this issue is the same as the area used in the Forest Vegetation section which is the red fir zone above 5,500 feet in elevation in which the project is located (see Forest Vegetation Section 3.2). This analysis area (8,611 acres) was chosen because the fuels and biophysical settings at this scale are relevant to the project boundary. The temporal scale used for this analysis is 0-10 years based on expected fuels treatment effectiveness. This analysis will also refer to the project area which is the 354-acres area encompassing only the treatments proposed.

Within the analysis area boundary, there have been 33 fires between 1967 and 2013. The primary cause of fires has been lightning and the majority of these fires were extinguished by initial attack firefighters while they were less than one acre in size.

The primary fuel types within the analysis area include the following standard fire behavior fuel models (Scott and Burgan 2005) (Landfire 2010):

40% TU5- Very High Load, Dry Climate Timber-Shrub
32% TL4- Small Downed Logs
16% GS2- Moderate Load, Dry Climate Grass-Shrub
12% Other (17 various fuel models)

Table 3-37 shows the predicted fire behavior for each primary fuel model, if a fire were to occur under 90th percentile weather conditions. The indicator used for this analysis and the comparison of alternatives is flame length.

Assumptions:

- 90th percentile weather conditions are based on weather observations collected from the Parker Mountain remote area weather station (RAWS) located approximately 6 miles southwest of the project area. The observations were collected from 1995-2012 between June 1st and October 1st (typical fire season) each year (Fire Family Plus).
- Fire behavior estimates are based on outputs from BehavePlus 5.0.5.

Table 3-37. Predicted Fire Behavior by Fuel Model

Fuel Model	Acres	Average Flame Length (feet)
TU5	3,444	14
TL4	2,756	3
GS2	1,378	12
Other, various	1,033	3-14

Biophysical settings (BPS) are the primary environmental descriptors used for determining a landscape's natural fire regimes, vegetation characteristics, and resultant fire regime condition class (FRCC) diagnoses (FRCC Guidebook 2010). Fire regime classes and their fire return

interval and severity description are shown in Table 3-38. The BPS (Landfire 2010) within the analysis area are described as:

67% Mediterranean California Red Fir Forest
22% Mediterranean California Mesic Mixed Conifer Forest and Woodland
11% Other (mix of numerous other BPS types)

The majority of the analysis area (95%) can be described as Fire Regime Class I.

Table 3-38. Fire regime classes expressed as fire return interval and severity

Fire Regime Class	Frequency (Fire Return Interval)	Severity Description
I	0-35 years	Generally low-severity fires replacing less than 25% of the dominant overstory vegetation; can include mixed-severity fires that replace up to 75% of the overstory.
II	0-35 years	High-severity fires replacing greater than 75% of the dominant overstory vegetation.
III	35-100 + years	Generally mixed-severity; can also include low severity fires.
IV	35-100 + years	High severity, stand replacing fires.
V	>200 years	Generally stand replacement severity; can include any severity type in this frequency range.

Fire regime current condition classes are a qualitative measure describing the degree of departure from historical fire regimes, possibly resulting in alterations of key ecosystem components such as species composition, structural stage, stand age, canopy closure, and fuel loadings. One or more of the following activities may have caused this departure: fire suppression, timber harvesting, livestock grazing, introduction and establishment of exotic plant species, introduced insects or disease, or other management activities (Schmidt et al. 2000). A description of fire regime condition classes are described in Table 3-39. Within the Jigsaw analysis area, the current condition class is 2 (based on 2008 Landfire data).

Table 3-39. Fire regime condition class descriptions

	Condition Class descriptions
Condition Class	Fire Regime
1	Fire regimes are within a historical range and the risk of losing key ecosystem components is low. Vegetation attributes (species composition and structure) are intact and functional within a historical range.
2	Fire regimes have been moderately altered from their historical range. The risk of losing key ecosystem components is moderate. Fire frequencies have departed from historical frequencies by one or more return intervals (either increased or decreased). This results in moderate changes to one or more of the following: fire size, intensity and severity, and landscape patterns. Vegetation attributes have been moderately altered from historical range.
3	Fire regimes have been significantly altered from their historical range. The risk of losing key ecosystem components is high. Fire frequencies have departed from historical frequencies by multiple return intervals. This results in dramatic changes to one or more of the following: fire size, intensity and severity, and landscape patterns. Vegetation attributes have been moderately altered from their historical range.

Environmental Consequences

Methodology

The BehavePlus5 modeling tool was used to estimate average flame length for each alternative within the Jigsaw *project* boundary (422 acres). Inputs included fire behavior fuel models (Scott and Burgan 2005) and 90th percentile weather condition (Fire Family Plus) which were used to estimate average flame length.

Small patch cuts are proposed in some alternatives, however since the model used to predict average flame length does not account for variability within the stand, the patch cuts were not considered in modeling potential flame length.

Alternative 1 (No Action)

Under Alternative 1, no treatments would occur. Over time (0-10 years), as vegetation continues to grow, hazardous fuels would increase. Stands that are currently exhibiting a fuel model of TU5 (40%) would tend towards a combination of TU5 and SB3 (High Load Activity Fuel or Moderate Load Blowdown). TL4 (32%) would tend towards TL5 (High Load Conifer Litter) and GS2 would tend towards a SH5 fuels model (High Load Dry Climate Shrub).

Table 3-40. Predicted Flame Length by Fuel Model, Alt. 1

Fuel Model	Acres	Average Flame Length (feet)
TU5 (50%) and SB3 (50%)	207	20
TL5	135	4
SH5	55	36
Other, various	25	4-36

Alternative 2

Alternative 2 proposes density management of 38 acres and 40 acres of small diameter thinning. These acres can be described as primarily TL4 (Small Down Logs) and the primary carrier of fire in this fuel type is moderate load of fine litter and course fuels, this includes small diameter downed logs. Although thinning would reduce ladder fuels, the treatment does not remove the existing surface fuels so after this treatment, the fuels model could still be described as TL4 with average flame lengths of three feet.

Alternative 2 also proposes regeneration harvest on 262 acres. After treatment, most ladder and overstory fuels will be removed, leaving 16-25 large green trees per acres. Most of the fuels contributing to fire spread would be on the surface and could be described as a GS2 with average flame lengths of 12 feet.

The 13 acre riparian reserve within the project area would be treated with hand cutting of small diameter trees (<12”). Downed trees would be limbed and limbs and slash piled and burned. After this treatment, the fuel model could be described as a GR2 (Low Load, Dry Climate Grass) with average flame lengths of 11 feet.

Average flame lengths for 69 acres that would not be treated would range from 4 to 36 feet as compared to Alternative 1, no action.

Table 3-41. Predicted Flame Length by Fuel Model, Alt. 2

Fuel Model	Acres	Average Flame Length (feet)
TL4	78	3
GS2	262	12
GR2	13	11
Other, various	69	4-36

Alternative 3

Alternative 3 proposes density management of 301 acres and 40 acres of small diameter thinning with a diameter limit of 20" DBH. These acres can be described as primarily TL4 (Small Down Logs) and the primary carrier of fire in this fuel type is moderate load of fine litter and course fuels, this includes small diameter downed logs. Although thinning would reduce ladder fuels, the treatment does not remove the existing surface fuels so after this treatment, the fuels model could be described as TL4 with average flame lengths of three feet.

Riparian reserve treatments and regeneration harvest is not proposed under this alternative. Average flame lengths for 74 acres that would not be treated would range from 4 to 36 feet as compared to Alternative 1, no action.

Table 3-42. Predicted Flame Length by Fuel Model, Alt. 3

Fuel Model	Acres	Average Flame Length (feet)
TL4	348	3
Other, various	74	4-36

Alternative 4

Alternative 4 is similar to alternative 3, however it does not have a 20" diameter limit. Fire spread potential is estimated by surface fuel loading and larger diameter trees do not significantly affect fire spread so the fuels model would be similar to alternative 3 which is TL4 with average flame lengths of three feet.

Average flame lengths for 74 acres that would not be treated would range from 4 to 36 feet as compared to alternative 1, no action.

Table 3-43. Predicted Flame Length by Fuel Model, Alt. 3

Fuel Model	Acres	Average Flame Length (feet)
TL4	348	3
Other, various	74	4-36

Cumulative Effects

The *analysis* area (8,611 acres) was used to estimate cumulative effects of the Jigsaw project. Past and present conditions were discussed in the Affected Environment section above and within the analysis area, Table 3-44 below shows the average flame length

Table 3-44. Predicted Fire Behavior by Fuel Model

Fuel Model	Acres	Average Flame Length (feet)
TU5	3,444	14
TL4	2,756	3
GS2	1,378	12
Other, various	1,033	3-14

The effects of the alternatives were analyzed in the Environmental Consequences sections above. Actions within the analysis area that are in the reasonably foreseeable future include continued harvest on private land (2,349 acres) and on BLM land (5,805 acres), and no harvest on State (80 acres) or US Forest Service lands (377 acres).

Historical fire regime and condition class were discussed in the Affected Environment section. Landfire data shows that the analysis area is historically in a Fire Regime I and currently in Condition Class 2 where fire regimes have been moderately altered from their historical range as described above. Due to fire suppression and extinguishing fires while they are small, fuels have been accumulating and are altered from their historical range and at risk of a fire that could result in a stand replacing fire. Cumulatively, Alternative 1 contributes to the increased risk by not treating the 422 acres proposed in this project. All action alternatives contribute to reducing fuels in the project area and would reduce the risk of a stand replacing fire across the analysis area.

3.8 What are the effects of small diameter tree thinning on meadow associated plant species?

Affected Environment

Thinning in Riparian Reserves

Indicators and temporal and geographic extent for this analysis

The indicator used to measure impacts for this analysis will be the amount or acres of meadow habitat available to support meadow associated plant species as well as direct effects to meadow associated (or obligate) species. The geographic extent for meadow habitat is the proposed project area. This extent was chosen because there is only one meadow within the project area that is isolated and not connected to any other meadows adjacent to the project area that would be impacted by the proposed project activities. This extent would best address the past, proposed actions and foreseeable actions on meadow habitat within the project area. The temporal scale for this analysis will be for 3-5 years for the short-term (time it would take for seedlings to become established) and 10-20 years for the long-term (for trees to return to 12” DBH).

Montane Meadow Habitat within the Project Area typically consists of openings within mixed conifer forests dominated by grasses, forbs and associated shrub species. This unique vegetation community provides habitat for numerous bird, wildlife, plant, and BLM Sensitive and Strategic species. Within the western half of the KFRA there are patches of scattered montane meadow habitat that provide suitable habitat for BLM Sensitive and Strategic species. The Klamath Falls RA has conducted surveys and monitored many of its known meadow habitat areas over time. Long-term fire suppression, grazing history and changes in climate are potential contributing factors to the loss of meadow habitat in this region (Thompson 2009).

Montane meadow habitat is unique and typically supports diverse communities of forbs and grasses interspersed with shrubs which provide suitable habitat to recruit meadow associated and BLM Sensitive and Strategic species of birds, wildlife, plant and invertebrates.

Meadows in the analysis area are being encroached upon by *Abies Magnifica* (Shasta red fir), *Abies concolor* (white fir) and *Pinus ponderosa* (ponderosa pine). White fir grows best in full sun however; saplings can endure decades of suppression under a closed canopy or in dense brush field. White fir dramatically increases in diameter and height growth when canopy openings are created, or when its height surpasses surrounding vegetation (Fiscke J. and DeBell, D. 1989 and Laacke, R. et.al. 1983) as is the case within the meadow of the project area.

White fir is a prolific seeder (produces up to 220,000 seeds per cone), reproduces abundantly under favorable conditions, and it is an aggressive pioneer species (Mauk et. al. 1984). A trend of conifer encroachment exists and is compromising the ecological site integrity within the meadow. Fire typically maintains the open structure of grasslands and meadows. Years of fire suppression in the region have led to a departure from the historic fire return intervals in this area which may be a contributing factor in this encroachment process (Jurena & Archer 2003; Heyerdahl et. al.2006; Coop & Givnish 2008).

Historically the meadow in the project area was more open with a few old growth trees within portions of the meadow. Lack of fire within the project area has allowed the meadow to become un-maintained naturally. Instead the meadow condition has deviated from a preferred open state to an increased competitive state between meadow associated plant species and encroaching white fir trees which are inconsistent with natural or historic processes and conditions.

A few legacy trees (≥ 20” DBH and larger and older than other trees in the stand) are scattered within the central portion of the meadow and serve as seed sources allowing encroachment within and on the edges of the meadow. Although follow up maintenance will be needed approximately every 8-10 years, legacy trees will be retained and the focus will be on treating young invading (≤12” DBH) conifers.

Meadow habitat assessments are currently being conducted within the western portion of the KFRA to determine the status of additional meadows outside the project area. Photos taken from the early 1950’s were georeferenced and are being used to compare past and present conditions of meadows along with fire history and other disturbance factors within the west side KFRA. Habitat assessment results will be used to prioritize meadows for future treatment needs and help

guide future management decisions regarding maintaining and increasing existing meadow habitat within the KFRA.

The Riparian Reserve (RR) are lands along streams, unstable and potentially unstable areas where special standards and guidelines direct land use. There are approximately 20 acres of RR along the southern boundary of the project area consisting of a 13 ac. meadow and two spring/seep areas that are both less than one acre in size. The meadow received a RR buffer of one site potential tree, 160 feet.

Environmental Consequences

Methodology/Analytical Assumptions

Meadow associated species and habitat analysis included several assumptions made to determine the effects of the proposed actions on meadow associated species within the project area. These assumptions include:

- Small diameter (≤ 12" DBH) thinning prescriptions on similar forest stands from previous projects would result in similar habitat qualities after treatment within the proposed project area. Post-thinning stand exams (USDI BLM, 1999-2014) have supported this assumption with respect to canopy closure, tree density, snag density, and stand structure.
- Similar thinning prescriptions in the Cascade Region have been effective at meadow associated species recruitment and persistence (Thompson 2007). The most effective strategy for maintaining or restoring meadows is targeting tree removal early in the encroachment process (Halpern 2009).

This proposed treatment is consistent with the Western Oregon PRMP (2016) with the anticipated ROD in the summer of 2016 which states that "The BLM would manage to contribute toward the recovery of ESA-listed plant species. The BLM would also manage for an array of natural communities including oak woodlands, shrublands, grasslands, cliffs, rock outcrops, talus slopes, meadows, and wetlands, and would support ecological processes and disturbance mechanisms to allow for a range of seral conditions" (2016 FEIS/PRMP Vol. I p.44). In addition meadows have the potential to provide 'Hot spots' which are areas of high Bureau Special Status Species richness and density (2016 FEIS/PRMP Vol. I p.523). Hot spots can occur at larger geographic scales or fine spatial scales, such as special habitat features including wetlands, rock outcrops, and other non-forested areas such as meadows.

Effects common for Alternatives 1, 3 and 4

<u>Effects to meadow associated plant species within the project area</u>

Alternatives 1, 3 and 4 would likely have negative long-term effects on meadow habitat and associated species within the project area due to lack of treatment of small diameter trees encroaching on the meadow.

Alternatives 1, 3 and 4 would allow conditions to persist at current levels in the analysis area including the project area within the KFRA. Long-term conifer encroachment would continue to degrade ecosystem integrity and species diversity within the meadow. Alternatives 1, 3 and 4 (no riparian/meadow treatment) would provide less suitable meadow associated species habitat

and no habitat improvement compared to alternative 2 which includes small diameter thinning in the meadow.

Alternative 2

Effects to meadow associated species and habitat within the project area
The quantity and quality of habitat improved would be the highest under Alternative 2 for meadow habitat and associated plant species. There would be approximately 13 ac. of improved meadow habitat within the project and analysis areas under Alternative 2.

Cumulative Effects

A cumulative effect is any other federal, state, local or tribal project within the analysis area. The analysis area (equivalent to the project area 354 acres) was used to estimate cumulative effects of the Jigsaw project. Past and present conditions were discussed in the Affected Environment section above and within the analysis area. Within the analysis area there are no other meadows being maintained by removal of small diameter trees, therefore there are no cumulative effects associated with this project. The 13 acres of meadow habitat proposed for future treatment within the analysis area is only proposed under alternative 2.

4- CONSULTATION AND COORDINATION

4.1 Endangered Species Act (ESA) Consultation

Consultation with the U.S. Fish and Wildlife Service as required under Section 7 (a) 2 of the Endangered Species Act (ESA) on the effects of the Jigsaw project for the NSO and NSO designated critical habitat has been initiated for the proposed action and will be completed prior to a decision being made. No residential or territorial spotted owls occur within the project area. For the Jigsaw project, a determination of "**May Affect, Not Likely to Adversely Affect**" was made by the BLM due to the downgrading of nesting/roosting, foraging and dispersal habitat to non-habitat and the downgrade of nesting/rooting and foraging habitat to dispersal habitat. The BLM has determined that the Jigsaw Project "**May Affect, Likely to Adversely Affect**" designated critical habitat due to the impacts to the primary constituent elements of nesting/roosting, foraging and dispersal habitat.

The NSO was the only listed species affected from proposed activities, and NSO critical habitat was the only designated critical habitat that would be affected from proposed activities. Therefore a "No Effect" determination was made by the BLM for all other proposed or listed species and designated critical habitat.

4.2 Tribal Consultation

Consultation on the Jigsaw Project has been ongoing with the Klamath Tribes since September of 2013 beginning with the Walter's Glade and Summit Projects and no concerns have arisen.

4.3 List of Preparers

Name	Position
Madeline Campbell	Project Lead/Silviculturist
Steve Hayner	Wildlife Biologist
James “Chris” Jensen	Forester
Kerry Johnston	Botanist/ Noxious Weeds
Chelsea Aquino	Hydrologist
Laird Naylor	Archaeologist
Julia Zoppetti	Fuels Management/Air Quality Specialist
Mike Limb, Tamiko Stone	GIS Specialists
Cindy Foster	Soil Scientist/Hazardous Materials
Rob Roninger	Aquatic Habitat/Fish Biologist
Terry Austin	Planning and Environmental Coordinator

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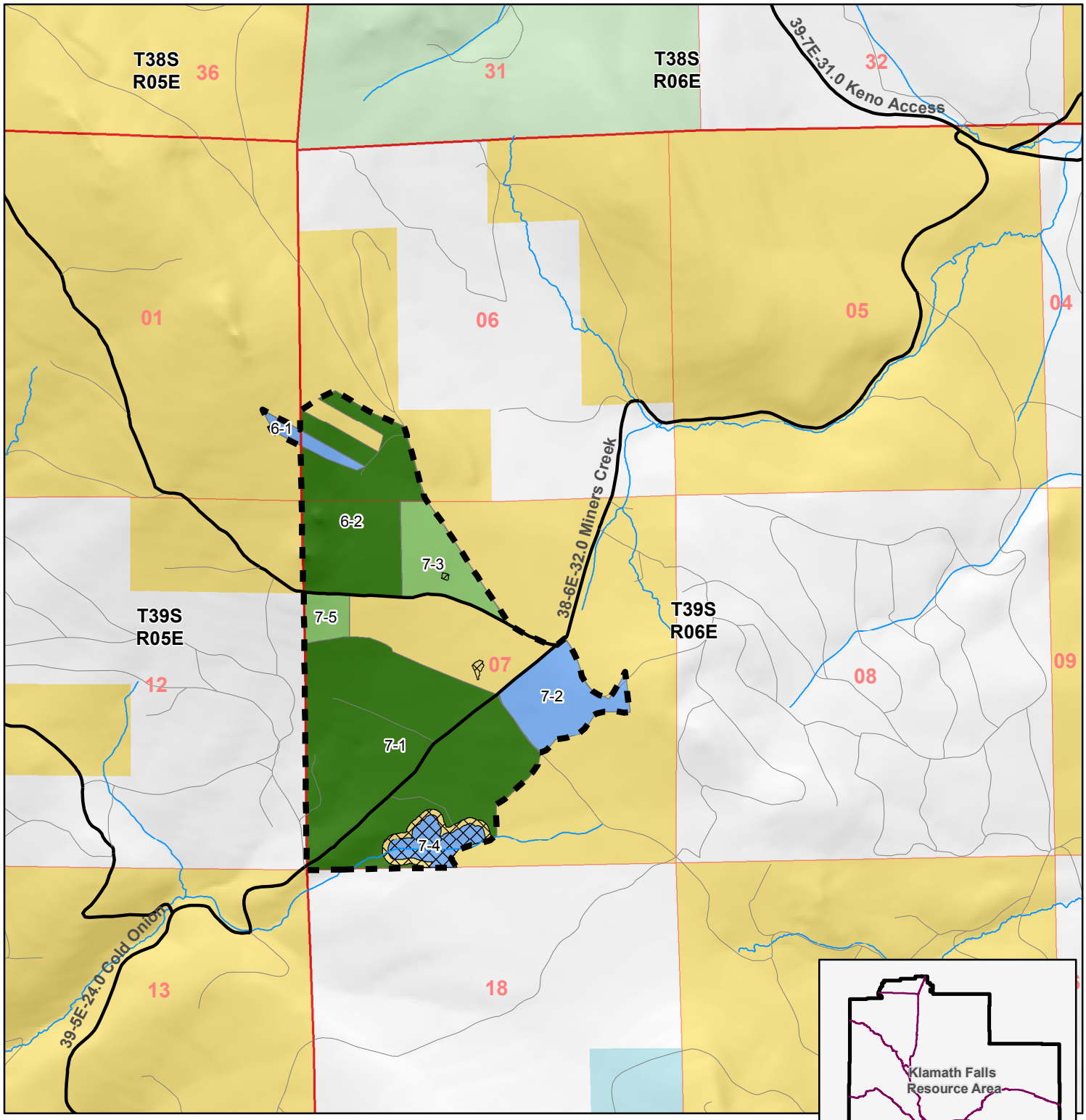
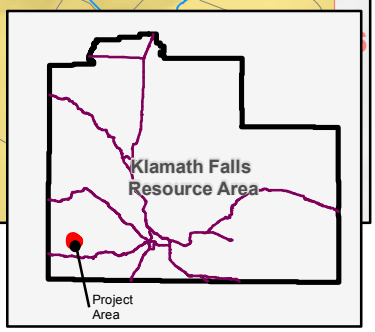
APPENDIX A - MAPS

Alternative 2 Map – Jigsaw Project
Alternatives 3 and 4 Map – Jigsaw Project

Alternative 2
Jigsaw Environmental Assesment





Project_Area
Riparian_Reserves
Timber Sale-Regeneration
Timber Sale-Thinning
Understory Thin
Bureau of Land Management
U.S. Forest Service
State
Private/Unknown

Jigsaw Environmental Assessment
Alternative 2

Klamath Falls Field Office
Lakeview District - Bureau of Land Management
2795 Anderson Ave. #25
Klamath Falls, Oregon 97603-7891
(541)883-6916

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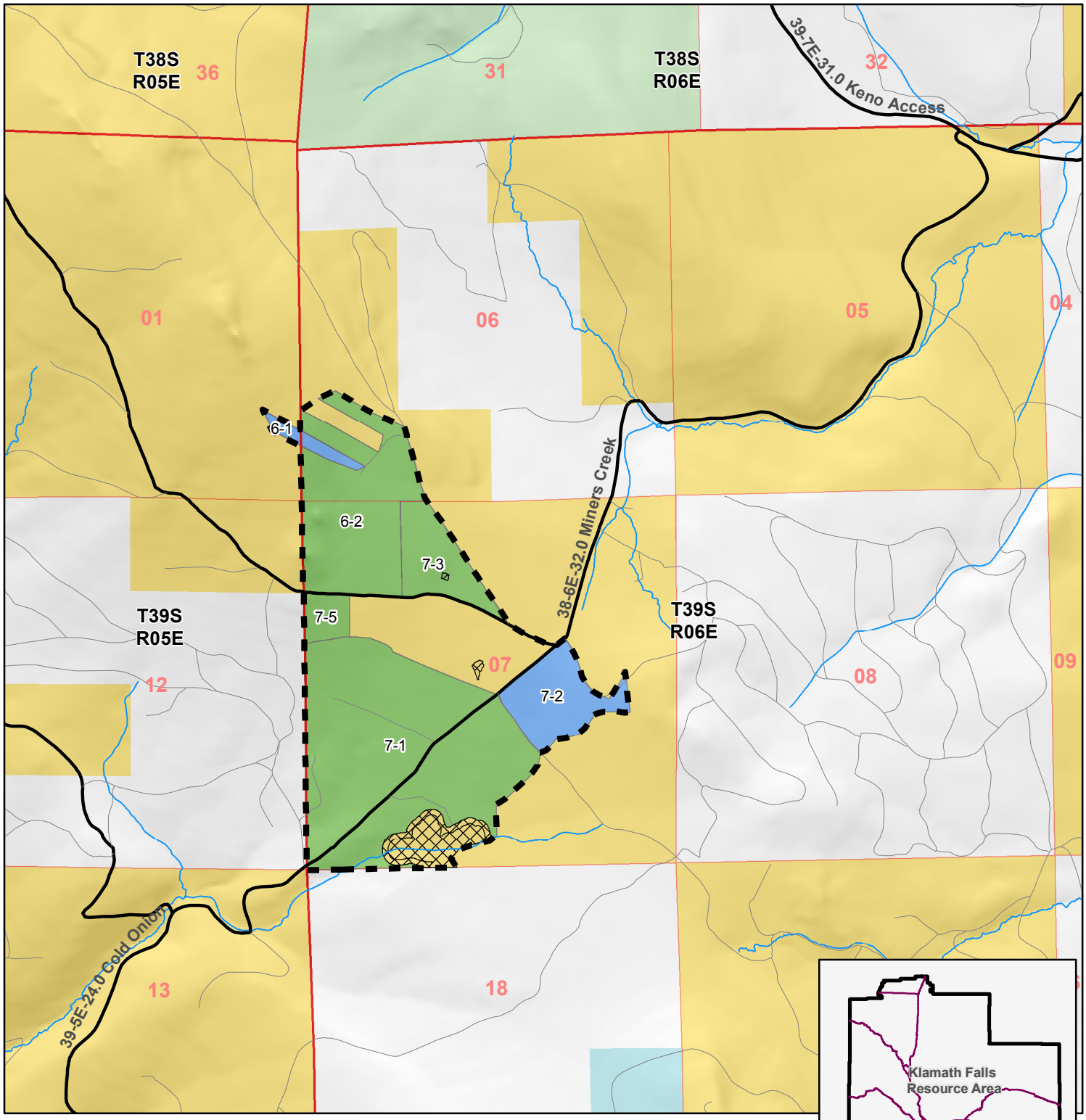
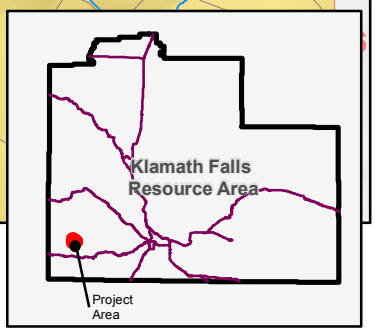
Alternatives 3 & 4
Jigsaw Environmental Assesment





Project_Area
Riparian_Reserves
Timber Sale-Thinning
Understory Thin
Bureau of Land Management
U.S. Forest Service
State
Private/Unknown

Jigsaw Environmental Assessment
Alternatives 3 & 4

Klamath Falls Field Office
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APPENDIX B - SURVEY AND MANAGE

2001 ROD Compliance Review: Survey & Manage Wildlife and Botany
Lakeview District BLM – Klamath Falls Field Office

Project Name: Jigsaw EA
Prepared By: Steve Hayner (wildlife biologist),
Kerry Johnston (botany/fungi/lichens/bryophytes)
Date: 05/13/2016
Project Type: Timber harvest; road maintenance, prescribed burning; mechanical and manual thinning, conifer planting.

Table B-1: Jigsaw Project Location by Township, Range, & Section

Township	Range	Section
T 39S	R 05E	01
T 39S	R 05E	06, 07

S&M List Date: April 2014:
Species listed below were compiled from the 2011 Settlement Agreement List of Survey and Manage Species and Category Assignment and include those vertebrate and non-vertebrate wildlife and non-vascular and vascular botanical species whose known or suspected range includes the Klamath Falls Resource Area according to the protocols listed below.

- Survey Protocols for Survey and Manage Strategy 2 Vascular Plants Version 2.0 (Dec1998)
- Management Recommendations for Survey and Manage Lichens Version 2.0 (March 2000)
- Natural History and Management Considerations for the Northwest Forest Plan Survey and Manage Lichens Based on Information as of the Year 2000 (USDA Forest Service R6-NR-S&M-TP-03-03 2003). Survey Protocols for Survey and Manage Category A & C Lichens in the Northwest Forest Plan Area Version 2.1 (2003)
- 2003 Amendment to the Survey Protocol for Survey and Manage Category A and C Lichens Version 2.1 (2003)
- Survey Protocols for Survey and Manage Component 2 Bryophytes Version 2.0 (1997)
- Survey and Manage Protocols Protection Buffer Bryophytes 2.0 (1999)
- Handbook to Strategy 1 Fungal Species in the Northwest Forest Plan (PNW-GTR-476 October 1999), and Handbook to Additional Fungal Species of Special Concern in the Northwest Forest Plan (PNW-GTR-572 January 2003)
- Survey Protocol for the Great Gray Owl within the Range of the Northwest Forest Plan v3.0 (Jan. 2004) as modified under the 2011 settlement agreement
- Survey Protocol Aquatic Mollusk Species From the Northwest Forest Plan Version 2.0 (Oct. 1997)
- Survey Protocol for S&M Terrestrial Mollusk Species v 3.0 (Feb. 2003).

Statement of Compliance

In December 2009, the District Court for the Western District of Washington issued an order on partial summary judgment in favor of the Plaintiffs finding inadequacies in the NEPA analysis supporting the Record of Decision to Remove the Survey and Manage Mitigation Measure Standards and Guidelines from Bureau of Land Management Resource Management Plans within the Range of the Northern Spotted Owl (BLM et al. 2007) (2007 ROD). The District Court did not issue a remedy or injunction at that time.

Plaintiffs and Defendants entered into settlement negotiations that resulted in the 2011 Survey and Manage Settlement Agreement, adopted by the District Court on July 6, 2011.
The Defendant-Intervenor subsequently appealed the 2011 Settlement Agreement to the Ninth Circuit Court of Appeals. The April 25, 2013, ruling in favor of Defendant-Intervener remanded the case back to the District Court.

On February 18, 2014, the District Court vacated the 2007 RODs. The District Court and all parties agreed that projects begun in reliance on the Settlement Agreement should not be halted. The District Court order allowed for the Forest Service and BLM to continue developing and implementing projects that met the 2011 Settlement Agreement exemptions or species list, as long as certain criteria were met. These criteria include:

> a. Projects in which any Survey and Manage pre-disturbance survey has been initiated (defined as at least one occurrence of actual, in-the-field surveying undertaken according to applicable protocol) in reliance upon the Settlement Agreement on or before April 25, 2013;
>
> b. Projects, at any stage of project planning, in which any known site (as defined by the 2001 Record of Decision) has been identified and has had known site-management recommendations for that particular species applied to the project in reliance upon the Settlement Agreement on or before April 25, 2013; and
>
> c. Projects, at any stage of project planning, that the agencies designed to be consistent with one or more of the new exemptions contained in the Settlement Agreement on or before April 25, 2013.

This project is consistent with Criteria A – Surveys for the great gray owls were conducted to meet the 2001 Survey and Manage Standards and Guidelines. Survey protocol used was “Survey protocol for the Great Gray Owl within the Range of the Northwest Forest Plan (2004)” as modified under the 2011 Settlement Agreement. Surveys were initiated in May of 2012. No great gray owls were detected within the Jigsaw Analysis area during survey efforts in 2012. Surveys were also conducted within the Jigsaw project area from 1996-2001 and no great gray owls were detected.

Table B-2. Survey & Manage Wildlife and Botany Species

Species	S&M Cate-gory	Survey Triggers			Survey Results			Site Management
		Within Range of Species?	Contains Suitable habitat?	Project may negatively affect species or habitat?	Surveys Required?	Survey Date Month/ year	Sites Known or Found?	
Vertebrates								
Great Gray Owl (Strix nebulosa) [1]	A	Yes	Yes	Yes	Yes	1996-2001 2012	0	N/A
Mollusks								
Chace Sideband (Monadenia chaceana) [2]	B4	Yes	Yes	Yes	Yes	Spring 2013 Fall 2013	0	N/A
Crater Lake Tightcoil (Pristiloma arcticum crateris) [3]	B4	Yes	No	No	No	N/A	0	N/A
Evening Fieldslug (Deroceras hesperium) [4]	B4	Yes	Yes	No	No	Spring 2013 Fall 2013	0	N/A
Fluminicola no. 3	A	Yes	No	No	No	N/A	0	N/A
Fluminicola no. 1	A	Yes	No	No	No	N/A	0	N/A
Vascular Plants*								
Cypripediium montanum[5]	C	Yes	Yes	Yes	Yes	2013-2014	0	N/A

[1]Pre-disturbance surveys for great gray owls are required since there is suitable nesting habitat within the project area. The required habitat characteristics of suitable habitat include: (1) large diameter nest trees, (2) forest for roosting cover, and (3) proximity [within 200m] to openings that could be used as foraging areas (Survey Protocol for the Great Gray Owl within the range of the Northwest Forest Plan v3.0, January 12, 2004). Surveys for the great gray owl were conducted designed to meet the 2001 Survey and Manage Standards and Guidelines. Survey protocol used was "Survey protocol for the Great Gray Owl within the Range of the Northwest Forest Plan (2004) as modified under the 2011 Settlement Agreement." No great gray owls were detected within the Jigsaw Analysis area during survey efforts in 1996-2001 or 2012.

[2] Equivalent-effort pre-disturbance surveys are required for the Chace Sideband (Survey Protocol for S&M Terrestrial Mollusk Species v 3.0, 2003). The Chace sideband is associated with open talus or rocky areas in forested habitat. Vegetation types include dry conifer/hardwood forest as well as oak communities (unpublished USDA/USDA 2005). The Oregon shoulderband was removed from the Resource Area survey list in 2002 under the Annual Species Review process due to the change in the known and suspected range. No Chace sideband snails were located in the Jigsaw project area.

[3]Suitable habitat for the Crater Lake tightcoil is "perennially wet situations in mature conifer forests, among rushes, mosses and other surface vegetation or under rocks and woody debris within 10 meters of open water in wetlands, springs, seeps and riparian areas…" (pg. 43, Survey Protocol for S&M Terrestrial Mollusk Species v 3.0, 2003). No habitat for the Crater Lake tightcoil snails occurs within any proposed treatment units.

[4]The evening field slug's range was extended to include the KFRA in March 2003 (pg. 2 and 3 2002 Annual Species Review and Appendix A pg32. Survey Protocol for S&M Terrestrial Mollusk Species v3.0, 2003). This species may be found in perennial moist situations in mature conifer forests or meadows amongst rushes, mosses and other surface vegetation or under rocks or woody debris within 10 m of open water in wetlands, springs, seeps, and streams. No evening field slugs were found during surveys.

[5] Botanical surveys for *Cypripedium montanum* were completed in the 2013 over 3880 acres in the Walters Glade EA treatment area (which includes the smaller Jigsaw Project Area) and in 2014 over 2120 additional acres. No sites were found within the Jigsaw Project Area.

* No habitat for any Survey and Manage Category A and C nonvascular plant species (lichen, bryophyte, liverwort) were included in the analysis area, therefore, the entire treatment area was not surveyed for these species. However, if an incidental sighting of a Survey and Manage Category A or C nonvascular species was discovered, it would have been reported at that time. No nonvascular species in categories A and C were found during 2013 and 2014 surveys. Details can be found in the Botanical Specialist's Report in the Jigsaw Project Record.

APPENDIX C – GLOSSARY

Anadromous: to ascend a river from the sea for breeding or spawning

Basal area: the cross-sectional area of all stems of a species or all stems in a stand measured at breast height and expressed per unit of land area (In this document = square feet/acre)

Biomass: woody biomass (as referred to in this EA) is plant matter used to generate electricity with steam turbines & gasifiers or produce heat, usually by direct combustion. Examples include forest residues (such as dead trees, branches and tree stumps).

Canopy Bulk density: The Forest Canopy Bulk Density (CBD) layer describes the density of available canopy fuel in a stand. It is defined as the mass of available canopy fuel per canopy volume unit.

Carbon Sequestration: Carbon sequestration describes long-term storage of carbon dioxide or other forms of carbon to either mitigate or defer global warming and avoid climate change. It has been proposed as a way to slow the atmospheric and marine accumulation of greenhouse gases.

Coarse Woody Debris (CWD): is a term used for fallen dead trees and the remains of large branches on the ground in forests.

Culturing: The process of harvesting trees from around a large, older tree in order to reduce competition for water and nutrients and maintain the large older tree for a longer period of time.

Diameter at breast height (DBH): The diameter of a tree measured 4.5 feet from the ground.

District Designated Reserve (DDR): Areas designated for the protection of specific resources, flora and fauna, and other values. These areas are not included in other land use allocations nor in the calculation of the PSQ.

District Designated Reserve Buffer (DDRB): An area adjacent to a DDR (see above) that remains in the timber base or Matrix but where timber harvest is generally less intensive than in the surrounding matrix.

Dripline: the widest part of the crown of an individual tree.

Evapotranspiration: a term used to describe the sum of evaporation and plant transpiration from the Earth's land surface to atmosphere.

Growth Basal Area (GBA): The basal area at which dominant trees grow at 1.0 inch in diameter per decade at age 100. This is a metric used to estimate site potential stockability using current stand growth.

Late Successional Reserve (LSR): Lands managed to maintain and restore old-growth forest conditions. (see also Un-Mapped Late Successional Reserve [UMLSR])

Late Successional Habitat: This term has a variety of definitions but is generally meant to refer to mature and old-growth forest. For the purposes of acreage calculation for the 15% standard and guide this term is defined on BLM land as stands 80 years old and greater.

Legacy Tree: a tree, usually mature or old-growth, that is retained on a site after harvesting or natural disturbance to provide a biological legacy

Macrophyte: an aquatic plant that grows in or near water and is emergent, submergent, or floating.

Matrix (General Forest Management Area): Federal land outside of reserves and special management areas that will be available for timber harvest at varying levels.

Nesting-Roosting-Foraging (NRF): forest stands that the USFWS considers "suitable" for spotted owls. See Table 3-20 on page 37 in the northern spotted owl section for habitat definitions.

Nonattainment zone/area: The Clean Air Act and Amendments of 1990 define a "nonattainment area" as a locality where air pollution levels persistently exceed National Ambient Air Quality Standards, or that contributes to ambient air quality in a nearby area that fails to meet standards.

Non-Vascular: a general term for plants without a vascular system.

Oligotrophic: deficient in plant nutrients, or having abundant dissolved oxygen, such as lichens, moss, bryophytes.

Quadratic Mean Diameter (QMD): an average diameter of all the trees in a stand based on the quadratic mean rather than the arithmetic mean. The quadratic mean gives greater weight to larger trees and is equal to or greater than the arithmetic mean by an amount that depends on the variance within the stand.

Stand Density Index (SDI): A measure of the stocking of a stand based on the number of trees per acre and diameter at breast height of the tree of average basal area. For modeling purposes, the max SDI for each species in this area is shown below. Stand SDI would be calculated as a weighted average based on the basal area of each species.

Species	Max SDI
White fir	560
Shasta red fir	560
Douglas-fir	380
Ponderosa pine	365
Sugar Pine	447
Western white pine	447

Seral Stage: The series of relatively transitory plant communities that develop during ecological succession from a community with no native plants (or possibly bare ground) to the potential natural community (PNC or climax) stage in rangeland communities and to old growth in forest communities.

Socioeconomics: The use of economics in the study of society.

Soil Bulk Density: The mass of dry soil per unit of bulk volume, including the air space. The bulk volume is determined before drying to constant weight at 105 degrees Celsius.

Uneven-age Timber Management Areas: A land use allocation designated under the 2008 RMP. Land placed under this LUA has the objective of achieving continuous timber production that could be sustained through a balance of growth and harvest.

Variable density thinning: a silvicultural technique intended to promote structural heterogeneity by developing of a mosaic of tree densities through thinning. A typical variable density thinning on the KFRA in involves harvesting trees throughout all size classes and leaving a residual stand of clumps and openings.

Unmapped Late Successional Reserve (UMLSR): a small block of forest approximately 100 acres in size designated around known spotted owl activity centers located on lands in the matrix. UMLSRs were established under the direction of the Northwest Forest Plan (NFP), but are not displayed on regional maps in the NFP. The objective for these areas is to protect and restore conditions for a variety of late successional and old growth dependent species. (See also Late Succession Reserve [LSR]):

Vascular: Plants that have specialized tissues for conducting water, minerals and photosynthetic products through the plant.

APPENDIX D – PROCEDURE FOR DETERMINING AGE ON UNEVEN-AGED STANDS IN KLAMATH FALLS

Procedure for Determining Age on Uneven-aged Stands in Klamath Falls

- Collect stand exam data as described in the BLM Ecosurvey Field User Guide. This will include separating the trees in each plot by layer based on height. The Ecosurvey handbook specifies that layer 2 be "on average less than 2/3 the average height of the top layer".
- Bore a representative tree of each layer at each plot to determine average layer age.
- When FOI unit has been completed determine the basal area made up by each layer in each plot and average them.

Plot 1	Plot 2	Plot 3
50 sq. ft. layer 1	20 sq. ft. layer 1	100 sq. ft. layer 1
70 sq. ft layer 2	100 sq. ft layer 2	20 sq. ft layer 2
10 sq. ft layer 3	10 sq. ft layer 3	0 sq ft layer 3

Average basal area/layer	
1	57
2	63
3	7

- The age of the stand will be assigned as the layer with the greatest BA for the stand. In this case the average age of layer 2 would be assigned to the entire FOI unit.