Biological Opinion

Westside Fire Recovery Project
Klamath National Forest, California

Northern Spotted Owl

08EYRE00-2015-F-0023:

Agency:

U.S. Fish and Wildlife Service
Region 8
Sacramento, CA

Biological Opinion Written by:

Yreka Fish and Wildlife Office
U.S. Fish and Wildlife Service
Region 8, Pacific Southwest Region
February 19, 2016

Jenny Ericson, Acting Project Leader
Yreka Fish and Wildlife Office
Table of Contents

Introduction........................................................................................................................................... 4
Consultation History............................................................................................................................... 5

1. Description of the Proposed Action.................................................................................................. 7
   1.1. Location of Proposed Action ......................................................................................................... 7
   1.2. Proposed Action............................................................................................................................. 8
   1.3. Project Design Features Related to Wildlife.................................................................................. 13
2. Purpose and Organization of this Biological Opinion......................................................................... 13
   2.1 Action Area.................................................................................................................................. 13
   2.2 Analytical Framework for the Jeopardy Determination .................................................................. 14
   2.3 Analytical Framework for the Adverse Modification Determination............................................ 15
3. NSO Ecology and Resource Use ......................................................................................................... 17
   3.1 Habitat and Habitat Use by NSO Unique to Post-Fire Environmental Conditions ....................... 18
   3.2 Barred Owls ................................................................................................................................ 20
   3.3 Northwest Forest Plan and Revised Recovery Plan for NSO ......................................................... 21
4. Range and Province Wide Status of NSO and Its Habitat ................................................................. 27
   4.1 Rangewide Status of the Species .................................................................................................. 27
   4.2 NSOs in the California Klamath Province ..................................................................................... 29
   4.3 NSO Habitat in the Klamath Ecological Province ......................................................................... 30

5. Environmental Baseline .................................................................................................................... 33
   5.1 NSO Habitat in the Westside Fire Recovery Action Area................................................................. 33
      5.1.1 General fire effects in the action area ....................................................................................... 34
      5.1.2 Current NSO Habitat Baseline for the Westside Recovery Action Area ................................. 37
      5.1.3 Previous and Current Federal Activities in the Action Area .................................................. 41
      5.1.4 Previous and Current Private Actions in the Action Area ...................................................... 41
      5.1.5 Westside Recovery Action Area Contribution to NSO Conservation ..................................... 42
      5.2 NSO in the Westside Recovery Action Area .............................................................................. 42
         5.2.1 Approach to determining post-fire NSO occupancy and demographic support (RA 10 value) ............................................................................................................................................ 42
         5.2.2 Post-fire Occupancy of Known NSO Sites ........................................................................... 43
6. Direct and Indirect Effects of the Westside Project on Northern Spotted Owls and their Habitat in the Action Area .................................................................................................................. 46
   6.1 NSO Habitat and NSO sites ............................................................................................................ 46
      6.1.1 Analytical Approach ............................................................................................................... 46
      6.1.2 Effects of the Proposed Action to NSO Habitat ...................................................................... 47
         6.2 Disturbance (Visual, auditory, or smoke related) or Habitat Modification in the Breeding Season .................................................................................................................................................. 58
      6.2.1 Analytical Approach ............................................................................................................... 58
      6.2.2 Effects to NSO from Disturbance (smoke, heat, or noise) or Habitat Modification in the Breeding Season .................................................................................................................................................. 61
      6.3 Effects to Individual NSO Sites .................................................................................................... 63
      6.3.1 Analytical Approach for Effects to Individual NSO Sites ......................................................... 63
      6.3.2 Effects to NSO sites in the action area from the proposed action .......................................... 65
      6.4 NSO Prey Species ....................................................................................................................... 103
      6.5 Proposed Action Impacts on NSO/Barred Owl Competition .................................................... 104
      6.6 Conclusion ..................................................................................................................................... 105
7. Cumulative Effects to the NSO ........................................................................................................... 105
8. Northern Spotted Owl Critical Habitat ................................................................................................. 112
   8.1 Status of Northern Spotted Owl Critical Habitat ............................................................................ 112
   8.2 Analytical Framework for the Adverse Modification Determination .............................................. 114
   8.3 Current Condition of Northern Spotted Owl Critical Habitat ......................................................... 114
   8.3.1 Environmental Baseline for Spotted Owl Critical Habitat in the Action Area ......................... 115
   8.4 Effects of the Westside Recovery Project to Spotted Owl Critical Habitat .................................. 123
   8.5 Cumulative Effects on Spotted Owl Critical Habitat ................................................................... 130
   8.6 Effects of the Action on Rangewide Critical Habitat .................................................................. 134
9.0 Conclusion ........................................................................................................................................ 134
Incidental Take Statement ......................................................................................................................... 138
Reasonable and Prudent Measures ......................................................................................................... 139
   Terms and Conditions ......................................................................................................................... 141
   Reporting Requirements ....................................................................................................................... 142
   Disposition of Sick, Injured, or Dead Specimens .............................................................................. 143
Conservation Recommendations ............................................................................................................ 143
Reinitiation – Closing Statement .............................................................................................................. 144
LITERATURE CITED ................................................................................................................................. 145

Appendix A. Supplemental information to the BA, Tables and Figures
Appendix B. Considerations for Evaluating Effects of Wildfire to NSOs and NSO Habitat
Appendix C. Status of the Species
Appendix D. Northern Spotted Owl Critical Habitat
Appendix E. Methods to Determine Baseline for Affected NSO Critical Habitat Units
INTRODUCTION
This document transmits the U.S. Fish and Wildlife Service’s (FWS) Biological Opinion (BO) based on our review of the Westside Fire Recovery Project (proposed action) and its effects on the threatened northern spotted owl (Strix occidentalis caurina; NSO) and its designated critical habitat in accordance with Section 7 of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531 et seq.).

The Klamath National Forest (KNF) determined that this proposed action may affect, and is likely to adversely affect the NSO and its designated critical habitat. Based on the analyses presented in the biological assessment (BA) dated July 23, 2015 (USDA FS 2015a), as well as key information to supplement the BA provided on August 18, 2015, and supporting documents and data provided through September 2015, in addition to our own review and independent analysis, FWS has also concluded that implementation of the proposed action would adversely affect NSOs and their critical habitat but not to such an extent that it would jeopardize the species or adversely modify its designated critical habitat.

This proposed action was developed under an abbreviated timeframe with an Emergency Situation Determination made by the Chief of the Forest Service and alternative arrangements, which shorten National Environmental Policy Act timeframes approved by the California Council on Environmental Quality (CEQ) (USDA FS 2015b; p. ix, xiii), although the alternative arrangements were ultimately not used. Due to the initial expectation of abbreviated time frames, there were limitations to the interagency consultation process as described within the 2013 Streamlining Memorandum of Understanding and local Level One Consultation Team working Charter. The abbreviated timeframe precluded close interagency collaboration in the development of the proposed action. FWS was first informed of details of the proposed action upon receiving the scoping notice on October 8, 2014. From that date forward, FWS participated in meetings as described in the consultation history section below.

This BO is based primarily on the following three sources of information: 1) The July 23, 2015, Westside Fire Recovery Project Biological Assessment and supplemental information; 2) the August 4, 2015 Final Environmental Impact Statement for the Westside Fire Recovery Project (FEIS; USDA FS 2015b) (US, specifically modified Alternative 3; and, 3) the final draft specialist resource reports. Clarifications or interpretations to versions of these documents occurred during interagency meetings, telephone conversations, and email correspondence involving staff biologists and managers of both KNF and Yreka Fish and Wildlife Office (YFWO). Some site visits were made to the action area. Additionally, this BO references information contained in the Record of Decision (ROD) for Amendments to Forest Service and Bureau of Land Management (BLM) planning documents within the Range of the Northern Spotted Owl (USDA Forest Service and USDI Bureau of Land Management 1994), and A Range-wide Baseline Summary and Evaluation of Data Collected Through Section 7 Consultation for the Northern Spotted Owl and Its Critical Habitat: from 2006 to November 9, 2015 (see appendix C).

The 2011 Revised Recovery Plan (Recovery Plan) for the Northern Spotted Owl became
effective on July 1, 2011 (76 FR 38575-38576; USDI FWS 2011a). The Recovery Plan describes management concerns and threats, (e.g. the barred owl and wildfire), that were not identified as key concerns in previous recovery plans. The 2012 Revised Designation of Critical Habitat for the Northern Spotted Owl was published in the Federal Register on December 4, 2012 (77 FR 71876-72068; USDI FWS 2012).

CONSULTATION HISTORY
This is not intended to be a comprehensive accounting of all meetings, phone calls, field trips, etc., but rather to give a general overview of key events in the consultation process.

September to November 2014

1) On September 28, 2014, a phone conversation took place between FWS and KNF wherein KNF provided an overview of the proposed action they were beginning to develop. FWS was informed of an upcoming field review.

2) On October 8, 2014, KNF issued a scoping letter notifying the public of their intent to develop the proposed action. And, on October 15, 2014, KNF published their intent to develop an Environmental Impact Statement (EIS) for the Westside Fire Recovery Project in the Federal Register.

3) On October 23, 2014, a meeting took place between FWS and KNF regarding treatment units and timing of operations.

4) On November 19, 2014, FWS attended a field tour in which objectives for salvage, roadside hazard, and wildland-urban interface (WUI), and fuels management zone treatments were introduced.

November 2014 to January 2015

1) KNF and FWS biologists generally met weekly or bi-weekly. These meetings focused on review of data to help determine NSO site placement and initial recommendations on salvage or fuels treatment units that were of the greatest concern.

2) At a meeting in the YFWO offices on January 13, 2015, FWS provided information pertaining to NSO use of burned landscapes and, following up on discussions held during the field tour, restated the FWS’s interests in providing input to the process and working closely with KNF to develop project design features that would minimize impacts to NSOs, designated critical habitat, and the fisher, which is proposed for Federal listing.

January 2015 to December 2015

1) FWS biologists attended meetings and corresponded with KNF frequently via email and phone to ensure open communication and a clear understanding of the proposed action and its analysis. FWS’s understanding of the proposed action is based on the following
elements: Final proposed action, fire severity mapping, review of other ongoing salvage projects on private land, and review of available KNF and state NSO databases. These sources of information were used to develop the framework for evaluating effects of varying fire severities on NSO habitat and designated critical habitat combined with impacts from fires, identification of habitat as NSO post-fire foraging habitat, prioritizing NSO and activity center placement, measures designed to minimize effects on NSOs, effects to NSO habitat of proposed down wood and snag retention, and fuels treatments, and the potential effectiveness of the proposed NSO survey strategy within the action area.

2) As agreed between FWS and KNF (approximately April 22\textsuperscript{nd}, 2015), consultation took place outside the bounds of Streamlined Consultation as described in the interagency Memorandum of Understanding (USDI, USDA, NOAA 2013). The parties jointly decided not to pursue an “agreed upon” BA. Instead, they decided it was more important to strive to meet the desired time frames for consultation.

3) FWS received a draft BA and description of the modified Alternative 3 on April 2, 2015.

4) FWS reviewed the draft BA and provided comments on April 12, 2015, outlining information needed to initiate consultation.

5) On April 22, 2015, FWS received a second BA dated April 16, 2015, but this BA still lacked key information necessary to initiate consultation. Due to the scope and scale of effects from the proposed action described in the draft BAs, FWS engaged in further discussions about refining the proposed action and minimizing impacts to NSOs and critical habitat.

6) The KNF obtained an Information, Planning, and Consultation System (IPAC) trust resource report species list for Siskiyou County from the FWS website on July 8, 2015. An updated list was obtained for completion of this consultation on January 7, 2015 (CF33C-BP42J-AVPFB-AWUTR-6CC4CU). There were no changes in occurrences of Federally-proposed or listed species between July and December, 2015, that could be affected by the proposed action.

7) A final BA was dated and received by FWS on July 23, 2015. The FEIS was published August 4, 2015.

8) On August 7, 2015, FWS sent a letter to KNF confirming that sufficient information had been received to initiate consultation with the understanding that there may be subsequent needs for clarification regarding the details of that information.

9) On August 18, 2015 FWS received key supplemental information to the BA from KNF via email. This supplemental information is included in appendix A of this BO.

10) Discussions continued from August through December 2015 to further clarify the proposed action and its effects and help FWS better understand the modified Alternative
3, the revised project design features (PDFs), and other information needed to complete consultation.

January 2016

1) On January 14, 2016, FWS and KNF met and discussed the draft Reasonable and Prudent Measures and the draft Terms and Conditions.

2) On January 22, 2016, FWS provided a draft BO to KNF.

3) On January 28, 2016, FWS and KNF met to discuss specifics of draft Terms and Conditions.

4) On February 3 and 4, 2016, FWS and KNF met and discussed Term and Condition 2. Subsequent emails and discussions pertaining to Term and Condition 2 occurred via email February 11-17th, 2016.

5) On February 9, 2016, FWS met with and received comments from KNF on the draft BO. An electronic version of the comments with signed cover page was received by email on February 11, 2016.

6) On February 17, 2016, FWS provided a final draft BO to KNF. Final comments were received on February 18, 2016.

7) On February 19, 2016, FWS signed and submitted the final BO to KNF.

A complete administrative record of this consultation can be made available upon request by contacting the YFWO in Yreka, California.

1. DESCRIPTION OF THE PROPOSED ACTION

1.1. Location of Proposed Action

The proposed action is located within the Salmon/Scott and Oak Knoll/Happy Camp districts of KNF. In late July and early August of 2014, numerous fires on the west side of KNF were ignited by lightning and fueled by dry and windy weather conditions. Three of the original 19 fires near the town of Happy Camp and immediately south of the Klamath River escaped containment growing together into one large complex that spread south and west of the Scott River and eventually into the Marble Mountain Wilderness. In this document, these fires are collectively referred to as the Happy Camp complex. The Beaver fire occurred on the north side of the Klamath River about 30 miles east of Happy Camp. The Whites fires, which occurred southeast of Fort Jones, California, spread into drainages of the north fork of the Salmon River. The three distinct and separate fire areas totaled about 183,000 acres. Approximately 21,000 of these acres occurred on private property (FEIS, Table S-1). Of the Federal ownership, about 81,000 acres burned within Late Successional Reserve (LSR) land allocations (FEIS, appendix E table 2).
The proposed action lies entirely within the California Klamath Physiographic Province as identified in the Recovery Plan and within portions of the 2012 Designated Critical Habitat Unit 9 (Klamath West) subunits K LW7 and K LW8, and Unit 10 (Klamath East) subunits K LE6 and K LE7 (USDI FWS 2012).

1.2. Proposed Action
This analysis is based on the information described in the BA and FEIS modified Alternative 3. As described in the FEIS, the purpose of the proposed action is to reduce the risk to the public and forest workers, to improve safety to firefighters performing fire suppression and community protection, to facilitate the development of future forested areas, and to provide revenue from commercial salvage of fire killed trees. Proposed treatments include, 1) commercial salvage; 2) roadside hazard tree removal (two treatment types concentrated and diffuse); 3) hazardous fuel treatments; 4) hazardous fuels plus roadside hazard treatments; 5) prescribed fire (underburning); and 6) site preparation, reforestation, and release (table 1). The overall footprint of the proposed action is 42,760 acres. Note that in some cases multiple treatments overlap each other. For example, roadside fuels treatment overlaps hazard tree removal, and prescribed burning overlaps site preparation and fuels management zones (FMZs). Additionally, roads and landings will be used to implement the proposed action requiring construction of new temporary roads, use of existing temporary roads, and re-opening and reconstruction of decommissioned roads. Some roads will be decommissioned following implementation of the proposed action.

Detailed descriptions of the activities are found in the BA (pp. 14-18), and the FEIS, chapter 2. Project design features (PDFs) are incorporated into the proposed action to further minimize negative effects to resources such as high value habitat within and outside of NSO core areas (see appendix A: summary 1.1 supplemental information to the BA; table 1.2 revised PDFs; table 1.3 for the definitions of NSO site, NSO core area, and NSO home range).

The description of the proposed action in the FEIS indicates that commercial salvage, some roadside hazard treatments, site preparation, and the majority of fuels treatments will begin immediately following the signing of the Record of Decision (ROD) (FEIS p. 34). The BA states the vast majority of the salvage harvest and hazard tree removal will be completed in the first two years (see summary 1.1 in appendix A); fuels treatments and site preparation and reforestation activities may continue for multiple years as funding allows (FEIS p. 21).
Table 1. Summary of proposed action in modified preferred Alternative 3\( ^1 \). Acres are rounded to the nearest ten.

<table>
<thead>
<tr>
<th>Activity Type</th>
<th>Total area and/or distance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commercial salvage( ^2 )</td>
<td>5,760 net acres</td>
</tr>
<tr>
<td>Roadside hazard in high and moderate severity (‘Concentrated RSH’)</td>
<td>2,040 acres / 46 miles</td>
</tr>
<tr>
<td>Roadside hazard treatments in low severity (‘Scattered RSH’)</td>
<td>12,280 acres / 274 miles</td>
</tr>
<tr>
<td>Hazardous fuels treatments including prescribed underburning</td>
<td>24,450 acres</td>
</tr>
<tr>
<td>Site preparation, reforestation, and release in existing plantations</td>
<td>7,130 acres</td>
</tr>
<tr>
<td>New Landing Construction( ^3 )</td>
<td>Up to 130 acres</td>
</tr>
<tr>
<td>Construction of new temporary roads</td>
<td>3.3 miles</td>
</tr>
<tr>
<td>Use of existing temporary roads</td>
<td>4.6 miles</td>
</tr>
<tr>
<td>Re-opening of decommissioned roads</td>
<td>4.8 miles</td>
</tr>
</tbody>
</table>

\( ^1 \) Derived from BA, pp. 14-17 unless otherwise noted. See footnote 2 and 3 below.  
\( ^2 \) This is net treatment acreage excludes about 495 acres of snag retention patches and 640 acres of riparian reserves. Acreage estimate in BA differs from FEIS page 174 (5,200 net acres).  
\( ^3 \) Up to 34 new helicopter landings (two acres each), 26 skyline landings (1.5 acre each) and 15 ground-based landings (1.5 acres each) are proposed for construction (table 7 Fish BA addendum (USDA FS 2015c), Wildlife BA pp. 10-11).

1. **Commercial Salvage** (5,760 acres harvested within 6,890 acres of salvage units)

Commercial salvage is not proposed within the Beaver fire area. Within the Whites fire and Happy Camp complex, salvage units were identified using Rapid Assessment of Vegetative Condition after Wildfire (RAVG) data and field reviews. Salvage units were then designated in areas determined to be feasible in terms of logging systems, accessibility, and economics. Treatments were designed to avoid hydrologic riparian reserves (643 acres, BA p. 15). Snag retention areas (495 acres, BA p. 15) were also delineated generally around legacy features or green tree inclusions and have been subtracted from the total acres listed below in table 2.

Areas of moderate to high severity tree mortality, with more than ten contiguous acres of medium to high severity mortality and with less than 40 percent remaining tree canopy were targeted for commercial salvage (BA, p. 15). When salvage units contain inclusions of NSO habitat that burned at low severity (RAVG grid code 1 and 2), the areas that burned at low severity will not be harvested but will instead be delineated as retention clumps. These clumps will be excluded from treatment unless specific circumstances occur where implementation is hampered and these areas must be entered or crossed in order to access a road. When this occurs, all efforts will be made to retain trees that do not meet the set probability of mortality (70 percent chance of dying in the next three to five years) (BA p. 24).

The vast majority of this treatment type occurs in the Happy Camp complex. Commercial salvage units range in size from 2-571 acres (average 80 acres in size) (BA Table 6, p. 36). Based on clarification and maps provided in person February 9, 2015, from KNF staff, larger units (over 100 acres in size) generally have well distributed snag and green tree retention areas in addition to riparian reserves, meeting the KNF land and resource management plan standards.
for snags. The large units are located where large patches of high severity fire occurred. The BA speaks generally to design features related to retention areas (pp. 71-75), but no data was available for specific units other than that listed in the table 6 of the BA (p. 36).

Additional clarification provided in a meeting between FWS and KNF staff on February 9, 2015, indicates all units less than 20 acres have been dropped. Based on GIS spatial layers that accompanied the BA several of the larger units have been divided into multiple smaller units (e.g. unit 23). It is unclear exactly how retention is distributed throughout these subunits as no update to table 6 has been provided. From a visual review of data (maps, GIS layers, information supplemental to the BA) it appears there are still some salvage units between 30 and 100 acres in size that have little to no retention.

Table 2 below shows the distribution of commercial salvage by each of the three logging systems.

Table 2. Acres of commercial salvage by logging system within the three fire areas

<table>
<thead>
<tr>
<th>Logging System</th>
<th>Happy Camp Complex</th>
<th>Whites Fire</th>
<th>Grand Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Acres of Treatment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ground-based</td>
<td>480</td>
<td>40</td>
<td>520</td>
</tr>
<tr>
<td>Skyline</td>
<td>2,800</td>
<td>170</td>
<td>2,970</td>
</tr>
<tr>
<td>Helicopter</td>
<td>1,930</td>
<td>340</td>
<td>2,270</td>
</tr>
<tr>
<td><strong>Total Treatment</strong></td>
<td><strong>5,200</strong></td>
<td><strong>550</strong></td>
<td><strong>5,750</strong></td>
</tr>
</tbody>
</table>

1. Treatment areas are less than entire delineated unit because hydrologic riparian reserves and areas where less than 50 percent mortality occurred will not be harvested.
2. Estimates based on GIS and field data. Values are rounded to the nearest ten acres.

The proposed action will retain legacy trees and snags within commercial salvage units. Legacy trees are representative of larger trees and contain important structural components, such as cavities, large branches or irregular branching, mistletoe brooms, or other signs of decay and defects (appendix A, table 1.2).

Based on data presented in the BA (table 6, p. 36):
- It is unknown how many legacy trees exist, and legacy trees may not occur in all commercial salvage units;
- Approximately half of the commercial salvage units (totaling 903 acres) do not have riparian reserves or snags grouped into patches. These units average 24 acres in size;
- Approximately half of the units contain a combination of riparian reserve and delineated snag retention patches (units average 129 acres in size). The proportion retained in these units average 22 percent (range 3 to 50 percent).

2. **Roadside Hazard Tree Removal** (320 miles / 14,320 acres)
Roadside hazard tree removal is defined as removing dead or fire-affected trees that meet the threshold of “high risk” (60 percent or greater probability of mortality) as defined in Marking
Guidelines for Fire Injured Trees, Smith and Cluck 2011) within 200 feet of the roadside. Limited operating periods (LOPs) will not apply to roadside hazard tree removal along roads designated as maintenance level 3-5, and select high clearance roads used for ingress/egress (further detail provided in section 6.2). Within riparian reserves, hazard tree removal will occur only if coarse woody debris requirements are met (FEIS, table 1-5, p.12). Estimating the mileage and acres where hazard trees will be removed is difficult; therefore, the values given represent the maximum acres and miles possible and may overestimate the number of acres and miles where roadside hazard tree removal will occur. About 215 (68 percent) of the proposed miles are along roads closed to the public or are designated for high clearance vehicles only. The remaining 32 percent (about 101 miles) of roadside hazard tree removal is proposed on all other maintenance level roads (FEIS table 2-23, p. 68).

There are two different types of roadside hazard tree removal, “concentrated” and “scattered”. The differences between concentrated and scattered roadside hazard tree removal are described in the FEIS (p. 69) and the BA (p. 15), although the BA does not use these terms. Scattered roadside hazard tree removal is utilized within areas dominated by low severity fire. Concentrated roadside hazard tree removal is utilized within areas dominated by moderate to high severity fire or mixed severity fire interspersed with pockets of high severity. The vast majority of roadside hazard trees proposed for removal in the proposed action are found within areas characterized as concentrated. Within the 320 miles of roadways being evaluated, it is estimated that logging within roadside hazard treatments is proposed within approximately 4,168 acres, including 1,330 acres of concentrated treatment and 2,838 acres of scattered treatment.

The BA provides three assumptions or criteria related to roadside hazard tree removal treatments:

- The majority of trees will be removed within areas burned at moderate to high severity containing trees that have over 50 percent mortality. See the BA (p. 22) or http://www.fs.fed.us/postfirevegcondition/index.shtml for detailed definitions of how fire severity is estimated.
- Areas that show no sign of having been burned will not be targeted for hazard tree removal.
- Roads that are not currently drivable and that would require substantial work to open will not be considered for hazard tree removal.

3) Hazardous Fuel Treatments (24,450 acres)

Reduction of hazardous fuels such as ladder fuels (understory trees and shrubs that facilitate ground fire becoming a crown fire) and concentrations of shrubs, small conifer and hardwood trees (up to 12 inches diameter breast high (dbh)), along with pruning of retained trees will occur within strategic areas such as ridges and roads. Hazardous fuels treatments will vary depending on importance of roads for ingress/egress purposes, slope position, aspect, degree of solar radiation, and occurrence within NSO core areas. “Complete” or “modified” prescriptions refer to the degree to which the understory shrub and small tree component is removed. “Roadside complete” prescriptions are proposed for areas with high solar radiation, generally in warm, dry areas, such as south and southwest facing slopes or the upper third of the slope. The treatments are more intense, proposing the removal of the majority of the understory trees and shrubs (all trees up to 12 inches and snags up to 16 inches). These warm, dry areas generally do not contain...
high quality NSO habitat. “Roadside modified” prescriptions are proposed in areas of low solar radiation that generally occur on lower slope positions and contain the cool, moist NSO habitat. These cool, moist areas typically occur on north or east facing slopes or near drainage bottoms and generally contain nesting, roosting, and foraging (NRF) habitat. There is some overlap between different fuels treatments e.g. prescribed fire and FMZ or wildland urban interface (WUI) hand treatment. Hazardous fuels treatments will occur within hydrologic and geologic riparian reserves and may overlap commercial salvage, roadside hazard tree removal, and site preparation and planting treatment units. Acres for each fuels treatment category provided in the BA are summarized below.

Acres of Hazardous Fuels Treatment

- Roadside modified (3,140 acres)
- Roadside complete (2,570 acres)
- WUI (2,630 acres)
- FMZ (4,930 acres)
- Prescribed fire (11,180 ac.):

4). Hazardous Fuels Plus Roadside Hazard Treatments (5,710 acres)
In strategic areas, hazardous fuels treatments will overlap roadside hazard treatment operations. Treatment prescriptions will be similar to the hazardous fuels treatments described above, but will remove conifer trees up to 16 inches dbh.

5). Prescribed Fire (Underburning) (11,180 acres)
The majority of prescribed fire will take place within the Whites fire area. Underburning may occur in spring or fall depending on its proximity to NSOs. PDFs that minimize effects to NSOs from these burns are described in appendix A table 1.2. Many of the prescribed burning locations will use existing control lines established in recent large fires within the action area. Line construction activities will occur around the perimeter of the fire and will include using dozers to re-scrape control lines to mineral soil. Where control lines are inaccessible for equipment, hand-line construction to mineral soil will occur. KNF has indicated that prescribed fire will occur later in time, roughly 5-10 years from the signing of the ROD.

6). Site Preparation, Reforestation, and Release (7,130 acres)
Reforestation needs in all fire areas were stratified into three categories: 1) burned conifer plantations; 2) conifer units proposed for salvage harvest; and 3) conifer units not proposed for salvage harvest for which there is a need to reforest with conifer species (BA pp. 17-18). Manual and mechanical (only in salvage units) site preparation will remove dead trees ≤16 inches dbh to facilitate tree planting. Riparian reserves will only be site prepped and planted in former plantations, not natural stands. Activity fuels will be removed if greater than 7 tons per acre exist post-treatment.

7). Roads and Landings (Up to 75 new landings, or approximately or 130 acres)
Existing landings will be used where possible (about 40). New skyline landings off the road system and ground-based landings will average one acre in size but will not exceed 1.5 acres and
will use roads wherever possible. Helicopter landings will not exceed two acres. All landings will be implemented according to the PDFs in chapter 2 of the FEIS.

There will be no roads added to the KNF transportation system as a result of this proposed action. Approximately three miles of new temporary roads will be constructed and about 4.6 miles of temporary roads on existing roadbeds will be used for access. Of the temporary roads being constructed, 4.8 miles were previously decommissioned roads (FEIS, table 2-26, p. 71).

The roads and landings listed below are associated with salvage units where KNF will not implement the three visit survey or LOP restriction applied elsewhere. The BA indicates this information is in appendix XI; however, for FWS data analysis purposes, information describing these landings and roads is included in supplemental information to the BA (appendix A summary 1.1).

- New temporary roads: 11, 15, 19, 21, 26, and 27
- Temporary road with existing roadbed: 26 and 34
- Reopen decommissioned road: 45N90Y

1.3 Project Design Features Related to Wildlife

The PDFs are an integral part of the proposed action. FWS considers these as measures that will minimize the adverse effects of the proposed action, and/or will benefit or promote the recovery of NSOs. Clarifications to PDFs and other key pieces of information in the BA were provided to FWS after the receipt of the final BA. The effects determination is based upon full implementation of the PDFs as described in appendix A (summary 1.1 and table 1.2).

2. PURPOSE AND ORGANIZATION OF THIS BIOLOGICAL OPINION

Because KNF determined that its proposed action may affect, and is likely to adversely affect the NSO and its critical habitat, KNF requested formal consultation with FWS. A description of the formal consultation process can be found at 50 CFR 402.14. Formal consultation results in FWS issuing a BO that evaluates the effects of the proposed action and determines whether the proposed action is likely to jeopardize the continued existence of the NSO and destroy or adversely modify its designated critical habitat. The requirement for all Federal actions to avoid jeopardy and destruction or adverse modification is described in Section 7(a)(2) of the ESA. The regulatory definition of jeopardy and a description of the formal consultation process can be found at 50 CFR 402.02 and 402.14, respectively. In the following sections, the jeopardy analysis for the NSO is presented first (section 6), followed by the adverse modification analysis for NSO critical habitat (section 8). The conclusion section provides the section 7(a) (2) determinations based on each of these analyses (section 9).

2.1 Action Area

The implementing regulations for Section 7(a)(2) of the ESA define action area as all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR 402.02). Referred to as the “analysis area” in the BA, the action area for
the proposed action buffers all treatments by 1.3 miles to represent the area where direct and indirect effects of the proposed action would likely occur. This buffer represents the estimated median annual home range size for NSOs in the Klamath Ecological Province in California and Oregon based on radio-telemetry data (Thomas et al. 1990; USDI FWS 2009). Suitable habitat within the 1.3 mile home range would likely be utilized to some extent within any given year by territorial NSOs (see definitions of home range in appendix A table 1.3). The action area would capture any known or unknown NSO home ranges within the perimeter of the treatment areas that could be affected by proposed action activities. In addition, the area potentially affected by noise disturbance (up to ¼ mile from the source of noise above ambient levels), and the area potentially affected by smoke (up to ¼ mile from burn units or within the drainage feature) would be captured within this spatial bounding for the analysis, in order to assess potential effects related to disturbance. For analyses of direct and indirect effects to NSO critical habitat, KNF evaluated a 1.3 mile buffer of treatment units that overlap critical habitat. The action area buffers proposed treatments within the three different fire areas referred to as the Beaver, Happy Camp complex, and Whites fire areas.

2.2 Analytical Framework for the Jeopardy Determination

The purpose of this BO is to examine whether the proposed action would result in jeopardy to threatened or endangered species as described in Section 7(a)(2) of the ESA.

This BO focuses on effects to NSOs. In accordance with policy and regulation, the jeopardy analysis in this BO relies on four components: 1) the status of the species, which evaluates the NSO’s rangewide condition, the factors responsible for that condition, and its survival and recovery needs (appendix C); 2) the environmental baseline, which evaluates the condition of the NSOs in the action area, the factors responsible for that condition, and the relationship of the action area to the survival and recovery of the NSO; 3) the effects of the action, which determine the direct and indirect effects of the proposed Federal action and the effects of any interrelated or interdependent activities on the species and its designated critical habitat in the action area; and (4) cumulative effects, which evaluate the effects of future, non-Federal activities, not involving Federal activities, that are reasonably certain to occur in the action area.

In accordance with the implementing regulations for section 7 and FWS policy the jeopardy determination is made in the following manner. The effects of the proposed Federal action are evaluated in the context of the aggregate effects of all factors that have contributed to the NSO’s current status along with the effect of Federal actions already consulted on, and, for the non-Federal activities in the action area, those actions likely to affect the NSO in the future. These factors are used to determine if implementation of the proposed action is likely to cause an appreciable reduction in the likelihood of both the survival and recovery of the NSO in the wild.

The Recovery Plan determined that 12 existing physiographic provinces meet the criteria for use as recovery units (USDI FWS 2011a). As described, the recovery units are useful for the purpose of managing the species and applying the jeopardy standard when evaluating effects of the proposed action. When a proposed Federal action is likely to impair or preclude the capacity of a recovery unit to provide for both the survival and recovery function it is intended to provide, that action may represent jeopardy to the species, if the analysis describes not only how the action affects the recovery unit’s capability but also the relationship of the recovery unit to both the
survival and recovery of the listed species as a whole. If an action is determined to jeopardize the continued existence of a species, the analysis must describe how the action would reasonably be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species.

2.3 Analytical Framework for the Adverse Modification Determination
This BO relies on the regulatory definition of “destruction or adverse modification” of critical habitat at 50 CFR §402.02 which was published on February 1, 2016 and becomes effective on March 1, 2016.

FWS and the National Marine Fisheries Service (NMFS), revised the regulatory definition of “destruction or adverse modification” that is integral to our implementation of the Endangered ESA. The ESA requires Federal agencies, in consultation with and with the assistance of FWS, to insure that their actions are not likely to result in the destruction or adverse modification of critical habitat of listed species. On May 12, 2014, FWS and NMFS proposed to revise the definition in our regulations to make it more consistent with the ESA, its legislative history, and two circuit court opinions which had found the previous definition to be invalid. In response to public comments received on our proposed rule, we have made minor revisions to the definition. This rule responds to section 6 of Executive Order 13563 (January 18, 2011), which directs agencies to analyze their existing regulations and, among other things, modify or streamline them in accordance with what has been learned.

As published (USDI USDC 2016), the revised definition of destruction or adverse modification is a direct or indirect alteration that appreciably diminishes the value of critical habitat for the conservation of a listed species. Such alterations may include, but are not limited to, those that alter the physical or biological features essential to the conservation of a species or that preclude or significantly delay development of such features. The finalized definition focuses FWS’s review of Federal actions on how they would affect the designated critical habitat’s ability to support recovery of species protected by the ESA.

The first sentence captured the role that critical habitat should play for the recovery of listed species. The second sentence acknowledged that some physical or biological features may not be present or may be present in suboptimal quantity or quality at the time of designation. The term “value” refers to critical habitat’s utility or importance. Many commenters on the 2014 proposed rule suggested that we replace two terms, “conservation value” and “life history needs,” with simpler language more clearly conveying their intended meanings. We agreed that use of these terms was unnecessary and led to unintended confusion and modified the proposed definition accordingly. Specifically, we replaced “conservation value of critical habitat for listed species” with “the value of critical habitat for the conservation of a listed species.” We also replaced “physical or biological features that support life-history needs of the species for recovery” in the second sentence with “physical or biological features essential to the conservation of a listed species.” These revisions avoid introducing previously undefined terms without changing the meaning of the proposed definition. Furthermore, these revisions better align with the conservation purposes of the Act, by using language from the statutory definition of “critical habitat”.
Though we made minor changes to clarify our intent, these changes do not alter the overall meaning of the proposed definition. We do not expect this final rule to alter the section 7(a)(2) consultation process from our current practice. to avoid unnecessary confusion and more closely track the statutory definition of critical habitat, we replaced two “terms of art” introduced in the proposed definition with language that explained the intended meanings (“conservation value” and “life history needs”). In addition, we modified the second sentence of the definition to avoid unintentionally giving the impression that the proposed definition had a narrower focus than the 1986 definition.

This analysis incorporates the refined definitions of the terms described above as well as the term “appreciably diminish” (Ibid, p. 27063-27064) as it applies to the function of the critical habitat as a whole, not just the action area, subunit, or units. A keypart of the critical habitat analysis process is how might the proposed action affect recovery, i.e., will it be delayed or will it be less likely to occur.

The following analysis relies on four components to support the adverse modification determination: 1) the Status of Critical Habitat, which evaluates the rangewide and provincial condition of designated critical habitat for the NSO in terms of primary constituent elements (PCEs), the factors responsible for that condition, and the intended recovery function of the critical habitat overall, as well as the intended recovery function of critical habitat at the provincial and critical habitat unit (CHU) scales (appendix D); 2) the Environmental Baseline, which evaluates the condition of the critical habitat in the action area, the factors responsible for that condition, and the recovery role of the critical habitat in the action area based on considering the intended recovery function of critical habitat at the relevant provincial and CHU scales (appendix E); 3) the Effects of the Action, which determines the direct and indirect impacts of the proposed Federal action and the effects of any interrelated or interdependent activities on the PCEs and how that will influence the recovery role of affected CHUs; and 4) Cumulative Effects, which evaluates the effects of future, non-Federal activities, that are reasonably certain to occur in the action area on the PCEs and how that will influence the recovery role of affected CHUs.

The adverse modification determination is made in the following manner. The effects of the proposed Federal action on NSO critical habitat are evaluated in the context of the aggregate effects of all factors that have contributed to the current status of the critical habitat at the provincial and rangewide scales and, for non-Federal activities in the action area, those actions likely to affect the critical habitat in the future, to determine if critical habitat at the rangewide scale would be appreciably diminished in its ability to serve its intended recovery role for the NSO with implementation of the proposed Federal action.

The critical habitat analysis places an emphasis on using the intended rangewide and provincial scale recovery functions of NSO critical habitat and the role of the action area relative to those intended functions as the context for evaluating the significance of the effects of the proposed Federal action, taken together with cumulative effects, for purposes of making the adverse modification determination. A “may affect, likely to adversely affect” determination for NSO critical habitat that triggers the need for completing an adverse modification analysis under
formal consultation is warranted in cases where a proposed Federal action will: 1) reduce the quantity or quality of existing NSO nesting, roosting, foraging, or dispersal (NRFD) habitat at the stand level to an extent that it would be likely to adversely affect the breeding, feeding, or sheltering behavior of an individual NSO; 2) result in the removal or degradation of a known NSO nest tree when that removal reduces the likelihood of owls nesting within the stand; or 3) prevent or appreciably slow the development of NSO habitat at the stand scale in areas of critical habitat that currently do not contain all of the essential features, but have the capability to do so in the future. Such actions adversely affect NSO critical habitat because older forested stands are more capable of supporting NSOs than younger stands. Adverse effects to an individual tree within NSO critical habitat will not trigger the need to complete an adverse modification analysis under formal consultation if those effects are not measurable at the stand level.

For purposes of the adverse modification determination, the effects of the proposed Federal action on critical habitat are evaluated in the context of the rangewide condition of the critical habitat, taking into account any cumulative effects, to determine if the rangewide critical habitat would remain functional to serve its intended recovery goal for the NSO. Text in the final rule indicates that the destruction or adverse modification determination is made at the scale of the entire critical habitat network, but:

“…a proposed action that compromises the capability of a subunit or unit to fulfill its intended conservation function or purpose could represent an appreciable reduction in the conservation value of the entire designated critical habitat. Therefore, the BO should describe the relationship between the conservation role of the action area, affected subunits, units, and the entire designated critical habitat. The analysis should not incorporate the effect of the proposed action on individual NSOs but, instead, on the life-history functions supplied by the primary constituent elements (PCEs) and the physical [or] biological features.”

“A proposed action that compromises the capability of a subunit or unit to fulfill its intended conservation function or purpose (e.g., demographic, genetic, or distributional support for NSO recovery) could represent an appreciable reduction in the conservation value of the entire designated critical habitat” (USDI FWS 2012).

An action may destroy or adversely modify critical habitat if it adversely affects the essential physical or biological features to an extent that the intended conservation function or purpose of critical habitat for the NSO is appreciably reduced”.

3. NSO Ecology and Resource Use
The discussion contained in this section provides contextual information unique to NSOs and how NSOs use forested landscapes. NSOs are central place foragers. Central place foragers occupy discrete home ranges and in the case of NSO regularly return to a central place during the day, either a nest or preferred roost location, after a period of nighttime foraging (see appendix C for more general information on NSO life history). Understanding the terms used in this document to describe the spatial use of a landscape by NSOs, because they are central place foragers, is essential to our evaluation of the baseline conditions in the action area for NSOs as well as the potential effects of the proposed action on NSOs. (See appendix A table 1.3 for full
definitions of NSO site, NSO core, and NSO home range).

- **NSO site**: Generally an area of concentrated activity by an NSO pair (male and female), occasionally a single territorial NSO, represented by a mapped location at the most biologically relevant point available.

- **NSO core**: The term NSO core as used in this document refers to the area around the nest tree, or day time roosting location if no nest has been found, that receives disproportionate use by NSOs (Bingham and Noon 1997).

- **NSO home range**: NSO home range refers to the approximation of the median annual home range size used by NSOs in the California Klamath Province represented by a circle with a radius of 1.3 miles. The circle provides a coarse but useful analogue of the median home range for NSOs (Lehmkuhl and Raphael, 1993, Raphael et al 1996).

This section addresses the current understanding of NSO habitat use in the Klamath Province, focusing on burned landscapes, the factors responsible for habitat use, including availability of prey species and the presence of barred owls (*Strix varia*). This section also briefly summarizes key components of the Recovery Plan and the role the California Klamath Province and the action area plays in the survival and recovery of the NSO. The current condition of NSO habitat in the California Klamath Province and rangewide is presented in appendix C. In combination with appendix B, this information provides a context for interpreting the significance of any adverse or beneficial effects of the proposed action considered herein, as well as for interpreting the significance of any adverse or beneficial cumulative effects reasonably certain to occur in the action area.

### 3.1 Habitat and Habitat Use by NSO Unique to Post-Fire Environmental Conditions

**Post-Fire Habitat Use by NSOs**

Based on the scientific literature and evaluation techniques summarized in appendix B, FWS generally assumes that NSOs will, to some degree, utilize burned areas that were previously suitable, for nesting, roosting, and/or foraging, depending on the complex interaction of factors such as habitat quality pre-and post-fire, location of the burns in relation to NSO core use areas, and the size, severity, and patterns of the burn.

Fires that burn at mixed severity may impact key features of higher quality NSO habitat, such as high canopy cover, number or quality of large trees, and forest stand complexity. The short and long term impacts to the habitat are strongly related to the scope and scale of fire intensity. A fire which burns at low severity typically does not entirely consume or largely alter snags and coarse woody debris used by NSO prey, but a fire classified as moderate severity can be highly variable. High-severity burned areas are generally not used by NSOs for nesting or roosting (Bond et al. 2009, Clark 2007, Clark et al. 2011 and 2013, King 1998, Eyes 2014) presumably because the protective multi-layered canopy cover is essentially consumed by the fire. Areas selected for nesting and roosting in post-fire landscapes generally reflect either no fire impacts or reflect low to limited moderate severity fire impacts (Bond et al. 2009, Clark 2007, Clark et al. 2011 and 2013, King 1998). The use of burned landscapes by NSOs may depend both on fire severity and the distance of fire effects from the NSO core use area and nest (Bond 2009, Clark 2007, Clark et al. 2011 and 2013). Because NSOs exhibit site fidelity and are central-place foragers, (Rosenberg
and McKelvey 1999) they may continue to use the post-fire landscape depending on remaining post-fire habitat conditions (i.e., sufficient habitat) (Bond 2009, Clark 2007, Clark et al. 2011 and 2013, Gaines et al. 1997, King et al. 1998, Lee and Bond 2015, a and b). Fires close to the nest or in heavily used foraging areas probably have greater negative effects than fires in less used portions of the home range (Jenness et al. 2004). Long term habitat use, the interplay of NSO ecology, prey diversity, and long term individual NSO fitness in burned landscapes is not well understood. In the short term, data suggest that the relationship between burn severity and post-fire habitat value is inverse, so the more severely burned an area, the less likely it is to be of use to NSOs, especially as the distance to the nearest unburned or moderately burned area increases and the patch size of the high severity burn increases (Gaines et al. 1995, King et al. 1998, Bond et al. 2002, 2009, Jenness et al. 2004, Clark 2007, Clark et al. 2013, Lee et al. 2012, Roberts et al. 2011, Comfort 2014).

Use of Habitat Edge
The role fire plays in retaining ecological diversity at stand and landscape scales is well described in the literature. Fire influences structural heterogeneity and vegetation diversity in mixed conifer forests depending on burn severities and patterns (Agee 1993, Skinner 1995, Arno et al. 2000, Knapp and Keeley 2006, Odion and Hanson 2006, Spies et al. 2012, Comfort 2014, and others). The edges between vegetation or forest age types, often caused by fire, are ecologically important. Diffuse edges (areas with burned and unburned trees) have been found to support NSO prey species (Bond 2009, Clark 2007, Sakai and Noon 1993). Although severely burned areas are known to be used by NSOs to a limited extent for foraging, observations indicate that, under these circumstances, they have been found to select the edges near less severely burned areas and avoid large, contiguous patches that have been disturbed by high severity fire. Factors such as distance to nest patches and intact NRF habitat are also likely to influence NSO use in post-fire landscapes (Clark 2007). It has been reported that NSOs may use small patches of habitat subject to high severity fire that are surrounded by suitable habitat subject to low to moderate severity fire impacts (Clark 2007 and Comfort 2014). Eyes (2014 found that there was a higher probability of use of high contrast edges (abrupt transitions in vegetation structure) the further the location from roost sites.

NSO Prey Response to Fire
Burned forests can influence small mammal populations and distribution, the degree to which is influenced by patch size and burn severities. Zwolak and Forsman (2007) found small mammal communities differed between burned and unburned forest habitat. Generally, burned areas had a higher proportion of deer mice (Peromyscus spp.) when compared to other species captured in the study area, but species diversity increased the year following the fire. Red-backed voles (Clethrionomys rutilus), bushy-tailed wood-rats (Neotoma cinerea), and northern flying squirrels (Glaucomys sabrinus) temporarily avoided burned areas. This avoidance of burned areas was attributed to the possible reduction in food resources, predation, and distance from cover.

Comfort (2014) found that where high severity fire edges that occur as small patches are dispersed in larger low severity fire patches, habitat for small mammal prey may be improved due to openings created by fire that allow for regeneration of brush and conifers, thereby increasing NSO use at these edges. However, edges that occur adjacent to large openings created by high severity fire may have improved prey habitat, but are farther from mature forest.
conditions and are likely to have a reduced level of NSO use (Comfort 2014). KNF considered the importance of these edges in modified Alternative 3 by reducing some treatments in areas of higher potential use in the Happy Camp Complex fire area as well as adjusting the hazard tree prescription originally proposed in Alternative 2.

The relationship between burned landscapes, NSO prey responses, and NSO foraging is unclear. The variability in prey response, and therefore NSO foraging behavior, is influenced by a variety of interacting factors. The best available information suggests that complex forests are more likely than other vegetation classes to provide NSOs with suitable structures for perching and nesting, retain a moderate microclimate at nest and roost sites, as well as visual screening from both predators and prey. When forests burn, the snags, coarse woody debris, hardwood mast, arboreal lichens, and mycorrhizal fungi used by NSO prey, are consumed, altered, and created, all depending on the complex interaction of the fire’s location, patch size, pattern and severity (Waters et al. 1994, Lehmkuhl et al. 2004, Meyer et al. 2005, Stephens and Moghaddas 2005). Early successional habitats may provide sources of prey for NSOs. As brush and conifers regenerate, species such as woodrats can become established (Raphael 1988, Sakai and Noon 1993 and 1997), although NSO use is likely dependent upon the adjacent forested stands for cover and perching. The potential impacts to NSO prey from fire must therefore also be considered when assessing the response of NSOs to these complex interacting forest processes.

**Summary**

In conclusion, the amount, arrangement and connectivity of NRF habitat remaining post-fire influences how NSOs use that habitat. Forested stands that have burned may have lost important habitat attributes but these areas may still provide opportunities for foraging post fire depending on pre-fire habitat qualities, patch size, edge type, and proximity to unburned habitats and NSO sites. While the role of moderate and high severity burned habitat is unclear in overall NSO population maintenance, available information suggests that at least in the short term, habitat quality, amount, and distribution are reduced. Depending on the amount and type of habitat affected, these stressors likely contribute to reductions in local NSO survival and occupancy.

### 3.2 Barred Owls

While there is some uncertainty about the barred owl’s pattern of range expansion, its interaction with NSOs, and the consequences of those interactions, the available data suggest that there are demographic effects to NSOs or negative inter-specific interactions between the two species (Courtney et al. 2004, Forsman et al 2011, Gutiérrez et al. 2007, Hamer et al. 2007, Livezy and Fleming 2007, Monahan and Hijamans 2007, Van Lanen et al. 2011, and Weins et al. 2010). The most recent NSO meta-analysis (Dugger et. al 2015a) reported: 1) barred owl presence was associated with increased adult extinction rates of NSOs for all 11 long term study areas across the range of the NSO and the effect was strong on 10 of the 11 study areas; and, 2) negative effects of barred owl presence on NSO colonization rates were observed on five of 11 study areas. By comparing Dugger et. al (2015a) with Forsman et. al (2011), FWS noted that barred owl encounter rates are much higher than previously reported, in some instances more than doubling between 2008 and 2013. Given this observation, it is apparent that barred owls are contributing to the decline of NSOs and are a significant threat to the recovery of NSOs across the range (USDI FWS 2011b). See appendix C, section 1.3.2.1 for more information.
Barred owl observations in the action area have generally been incidental to NSO surveys. The data are neither consistently collected nor consistently reported, so an accurate assessment of the current distribution of barred owls is unknown. Within the action area, data from KNF, private landowners, and the California Natural Diversity Database (CNDDB, https://www.dfg.ca.gov/biogeodata/cnddb/mapsanddata.asp) includes about 30 individual observations. FWS estimates that these observations represent approximately 12 territories. The existing influence of barred owls on NSOs in the action area is unknown. Because barred owls are documented as occurring within all three fire areas, we assume that the barred owls’ presence would have similar demographic effects to NSO as described by Forsman et al. (2011) and Dugger et al. (2015) (e.g., reduced NSO detectability, reduced NSO site occupancy, increased NSO extinction rates, and reduced adult NSO survival).

3.3 Northwest Forest Plan and Revised Recovery Plan for NSO
Early conservation efforts under the Northwest Forest Plan (NWFP) laid a framework for a rangewide conservation strategy that included allocations of large blocks of Federal land dedicated to protection and maintenance of late successional habitats. The Recovery Plan utilized concepts of that framework in describing specific recovery actions that address contemporary threats and promotes long-term recovery for the species (USDI FWS 2011a). Recovery units defined in the Recovery Plan are based on physiographic regions with varying ecological factors influencing of NSO survival. The 2012 critical habitat rule (USDI FWS 2012) built upon those same concepts by designating blocks of high quality NRF habitat that are capable of supporting successful NSO breeding and survival to facilitate stable to increasing NSO populations within designated Provinces throughout its range. These habitat blocks are expected to be interconnected to facilitate NSO dispersal and gene flow that maintain or enhance the resiliency of the NSO meta-population to persist in the long-term.

In the effects analysis of a BO, FWS considers the degree to which a proposed action contributes to the overall goals of the Recovery Plan and how the action will contribute to the recovery of the species. The Recovery Plan describes objectives for forest management that would develop and maintain adequate habitat in the near term to allow NSOs to persist. In addition, it encourages actions that restore and maintain ecological processes and landscapes that are resilient to disturbances such as fire, as well as ongoing and future climate-based changes. Balancing the concepts of forest management and wildfire, while successfully achieving the sought-after benefits of survival and recovery for NSOs, is a challenging endeavor.

Impacts to individual NSOs in the action area are not yet fully understood. After extensive fires like the one on KNF, there is a complex interaction of prey population response and displacement and relocation of NSOs. Barred owls in the landscape are also likely to add additional stress to the NSOs. On that basis, given recent effects and future threats, maintaining the current level of NRF habitat within the action area and the capability of this area to support NRF habitat is important to conserving the NSO.

Dry Forest Management in the Klamath Province
The proposed action is located within a portion of the NSO’s range which includes both moist and disturbance-prone ‘dry forests’. The Recovery Plan recommends that Federal land management in dry forests should consider and integrate the relationship between forest
vegetation and disturbance regimes. This can be a complicated task given changing climatic conditions, past management practices, and the diversity of ecological processes and topography associated with landscapes found in this region. Management should apply landscape-scale science-based adaptive treatments that incorporate temporal and spatial variability in forest conditions, including variability in natural processes (USDI FWS 2011a).

The Recovery Plan outlines a general approach to these disturbance-prone forests stating:

They should be “…actively managed in a way that reconciles the overlapping goals of spotted owl conservation, responding to climate change and restoring dry forest ecological structure, composition and processes, including wildfire and other disturbances.”

“Vegetation management of fire-prone forests can retain spotted owl habitat on the landscape by altering fire behavior and severity, and if carefully and strategically applied, it could be a part of a larger disturbance regime for landscapes that attempts to reintegrate the relationship between forest vegetation and disturbance regimes…” (USDI FWS 2011a).

Specifically, the Recovery Plan recommends that restoration-focused treatments include seven primary principals:

- Emphasize vegetation management that retains NSO habitat function within home ranges or implement vegetation management outside of NSO home ranges or high value habitat where consistent with overall landscape goals;
- Design restoration treatments in the context of the surrounding landscape so that disturbance regimes are accommodated;
- Retain and restore key structural components to conserve habitat, legacy trees, seed stock, and genetic values;
- Retain and restore heterogeneity within stands;
- Retain and restore heterogeneity among stands, retaining patches forests where habitat is of higher quality and where fires may be less severe;
- Manage roads to address fire risk;
- Use wildfires to meet vegetation management objectives where appropriate; and,
- Strategically locate and design projects to reduce fire severity with specific objectives and a clear understanding of how the local landscape responds to the many variables that influence fire severity (i.e., slope, aspect, topography, fuel condition, weather).

**Post-Fire Management [Recovery Action 12]**

Recovery Action 12 (RA12) in the Recovery Plan discusses moderating fuel conditions to temper future losses from high severity fire while retaining important structures of NSO habitat that take long periods of time to develop. One of the primary objectives of post-fire salvage harvest cited in the literature and in the BA is of reduction of fuel concentrations that contribute to extreme fire intensity and behavior.

As cited in the Recovery Plan, the following paragraphs summarize available literature on post fire harvest (USDI FWS 2011a):
Decisions to harvest timber after wildfires are often based on financial considerations, human safety, a desire to modify the composition and resource production of forests, and a desire to “clean up the forest” (Foster and Orwig 2006, Noss and Lindenmayer 2006, Lindenmayer et al. 2008). Possible beneficial ecological effects of post-fire timber harvest include: decreased erosion; decreased buildup of insect pests; decreased magnitude and extent of lethal soil temperatures around burning coarse woody debris; and decreased fire risk due to removal of snags if slash is also treated (McIver and Starr 2000, Lindenmayer et al. 2008, Monsanto and Agee 2008, Peterson et al. 2009).

Support is lacking for the contention that reduction of fuels from post-fire harvest reduces the intensity of subsequent fires (McIver and Starr 2000), and planting of trees after post-fire harvest can have the opposite effect. For example, forests in southwest Oregon that were logged and planted after a 1987 fire burned more severely in a 2002 fire than areas that were not logged or planted due, evidently, to high fuel conditions in conifer plantations (Thompson et al. 2007).

Detrimental ecological effects of post-fire timber harvest include increased erosion and sedimentation, especially due to construction of new roads. Detrimental effects also occur from the removal of snags and, decreased regeneration of trees; shortening in duration of early-successional ecosystems; increased spread of weeds from vehicles; damage to recolonizing vegetation; reduction in hiding cover and downed woody material used by NSO prey; altered composition of plant species; increased short-term fire risk when harvest generated slash is not treated and medium-term fire risk due to creation of conifer plantations; and alterations of patterns of landscape heterogeneity (Perry et al. 1989, McIver and Starr 2000, Beschta et al. 2004, Karr et al. 2004, Donato et al. 2006, Lindenmayer and Noss 2006, Reeves et al. 2006, Russell et al. 2006, Thompson et al. 2007, Lindenmayer et al. 2008, Johnson and Franklin 2009, Swanson et al. 2010).

Moreover, post-fire timber harvest activities “undermine many of the ecosystem benefits of major disturbances” (Lindenmayer et al. 2004 p. 1303) and frequently ignore important ecological lessons, especially the role of disturbances in diversifying and rejuvenating landscapes” (DellaSala et al. 2006).

To avoid crisis-mode decision-making and to minimize these detrimental effects, ecologically-informed policies based on pre-fire management directions should be developed before fires occur (Lindenmayer et al. 2008, Johnson and Franklin 2009) (USDI FWS 2011a).

Specifically RA12 states, “In lands where management is focused on development of spotted owl habitat, post-fire silvicultural activities should concentrate on conserving and restoring habitat elements that take a long time to develop (e.g., large trees, medium and large snags, downed wood). Examples of areas where we believe this recovery action would greatly benefit future spotted owl habitat development include such fire-affected areas as the Biscuit fire, the Davis fire and the B&B complex” (USDI FWS 2011a).
Guidance from the Recovery Plan for managing dry forests may also be applicable:

- Management of NSO habitat in these drier areas is an extremely complex undertaking. Changing climate conditions, dynamic ecological processes, and a variety of past and current management practices render broad management generalizations impractical. Recommendations for NSO recovery in this area also need to be considered alongside other land management goals – sometimes competing, sometimes complimentary. In some cases, failure to intervene or restore forest conditions may lead to dense stands heavy with fuels and in danger of stand-replacing fires and insect and disease outbreaks.


- Vegetation management of fire-prone forests can retain NSO habitat on the landscape by altering fire behavior and severity (Reinhardt et al. 2008, Haugo et al. 2010, Wiedinmyer and Hurteau 2010) and, if carefully and strategically applied, it could be part of a larger disturbance management regime for landscapes that attempts to reintegrate the relationship between forest vegetation and disturbance regimes, while also anticipating likely shifts in future ecosystem processes due to climate (Gartner et al. 2008, Noss et al. 2006, Lawler 2009, Mitchell et al. 2009, Littell et al. 2010, Swanson et al. 2010, Moritz et al. 2011).

- Portions of the Klamath Province have unique localized fire ecology and may not be subject to the same generalizations (Odion et al. 2004, 2010, Skinner et al. 2006, Hanson et al. 2009, 2010).

- Specific silvicultural practices that promote forest resilience and that can be applied to various forest types are given by Franklin et al. (2002, 2006, 2007), Hessburg et al. (2004, 2005, 2007), and Drever et al. (2006) (USDI FWS 2011a).

Recent research since the publication of the Recovery Plan relevant for consideration of post-fire management includes Halofsky et al. (2011), which addresses fire ecology of the Klamath-Siskiyou region. Additionally, Marlon et al. (2012) and Parks et al. (2015) speak to limitations of fire scar data in determining “historical range of variation” in fire size and severity and explore the concept of fire surplus and fire deficit in different regions of western forest based on sedimentary charcoal accumulation rates over thousands of years.

An evaluation of the effects of the post-fire management actions must balance a number of factors. The scope and scale of changes to forest structure should be measured along with the short and long term effects of these changes on NSO habitat and NSO, and the potential for long-term reduction in extreme fire behavior of future fires. Removal of large snags can influence the future development of late successional habitat and can negatively affect the long-term availability of key habitat structures associated with late successional habitat. There is
considerable uncertainty when weighing the potential benefit of salvage logging (described above) with the potential negatives. Concerns included replanted stands being less ecologically rich for wildlife due to lower tree species diversity as well as less hardwoods and shrubs (Hagar et al. 2007) and potential increased risk to adjacent forested stands from fire (Odion et al. 2004, Thompson et al. 2007). The proposed action incorporates some measures to offset some of the potential negative effects of post-fire management described above. The proposed action will retain all large legacy trees except for safety purposes, patches of burned trees in riparian areas, and regenerate conifer plantations using a variety of species and variable spacing. These efforts will assist in the creation of future stand variability and structural diversity.

Available literature describes the short term fuel accumulation following fires. Fuels are the primary factor that management can change (as opposed to climate, weather, wind, and topography). However, conclusions are variable regarding the efficacy of salvage logging on reducing future fire severity and the role of snags in future fire behavior (McIver and Starr 2000, Donato et al. 2006, Skinner et al. 2006, Cluck and Smith 2007, Thompson et al. 2007, Thompson and Spies 2010, Fraver et al. 2011, Long et al. 2014, Knapp 2015, Peterson et al. 2015). It is important to note that stocking levels of plantations in the Biscuit fire and Thompson et al. (2007) study were much higher than what is proposed in the Westside fire recovery project (over 200 trees per acre versus 75-225 trees per acre with treated activity fuels).

KNF completed a literature review of studies in the Klamath or other areas with similar fire regimes which may have particular relevance to the action area. Skinner et al. (2006) (USDA Forest Service 2015, p. 147) cautioned that a management emphasis on meeting or exceeding standards and guidelines for dead woody material has and will increase fire hazard over time and threatens the very habitat these guidelines were intended to improve. Peterson et al. (2015) (USDA Forest Service 2015, p. 147) conclude that post-fire logging can serve as an effective tool for managing fuel loading in forests regenerating after high severity fires, as well as reduce threats to human health, property, and ecosystem services if applied with consideration for possible negative impacts and meeting other management objectives. Salvage logging can contribute to restoring more natural fire regimes in dry, fire-prone coniferous forests of western North America when used over the long term in conjunction with thinning, prescribed fire, and management for low to mixed severity wildfire. Knapp et al. (2015) (USDA Forest Service 2015, p. 239) cautioned consumption of both standing snags and course woody debris contribute to extreme fire behavior and more severe fire effects (Page et al., 2013). However there is undeniable importance of woody detritus to the ecological health of many forested ecosystems which must be balanced to avoid excessive fire hazards in seasonally dry forests (Brown and See 1981, Brown et al. 2003, and Lemkuhl et al. 2007).

Ultimately, KNF determined that not reducing fuels by removing some of the fire killed trees will negatively affect the availability of key habitat structure and may actually result in a long term loss of late seral habitat by perpetuating a cycle of high intensity and high severity fire (USDA Forest Service 2015: Silviculture Report in appendix A, also discussed in appendices B, E, and I). This in due in part to very large high severity patches (up to 3,000 acres) observed in the 2014 fires, due to elevated fuel levels combined with severe drought and three years of record setting high temperatures (USDA Forest Service 2015, p. 5, pp. 142-147, p. 162, and p. 180) and overall proportions of moderate to high severity fire (USDA 2015 p.144 and appendix
The fire and fuels portion of the FEIS (chapter 3, p. 164), states:

“Planted stands are more likely to survive than the young trees that become established in large areas where fuels remain untreated” and “are expected to provide “islands” of coniferous forest in a sea of brushfields, perpetuated by re-burns, where fuels have not been reduced. This would provide a measure of vegetative diversity that would not otherwise be present on the landscape. These planted stands also have a much higher probability of achieving the desired late- successional stand condition for the Late Successional Reserve than unplanted areas” (USDA Forest Service 2015).

It is important to note the assumption of accelerated development of NSO habitat is based primarily on reaching a quadratic mean diameter (QMD) of 10 inches and 40 percent canopy cover (indicators of D habitat) and percentage of conifer composition (FEIS, p. 160).

The section above is intended to speak more generally to post-fire management principles and best available data. For specific analysis of the effects of the proposed action, please see section 6.1 of this document which includes a summary from BA (pp. 74-75) on snag dynamics as they relate to NSO habitat and uncertainty of changes in future fire burn severity in salvage logged areas.

Conserving NSO Sites and High Value Habitat (Recovery Actions 10 and 32)

Because the three main threats to the NSOs are competition with barred owls, past habitat loss, and current habitat loss, the recovery plan recommends conserving occupied NSO sites and retaining structurally complex or high-quality habitat to provide demographic support and to provide refugia from competition with barred owls. These recommendations are described under Recovery Action 10 (RA10), conservation of spotted owl sites, and RA32, maintaining high-quality habitat refugia.

The intent of RA10 is to protect, enhance, and develop habitat in the quantity and distribution necessary to provide for the long term recovery of NSOs (USDI FWS 2011a), specifically by retaining long-term occupancy and reproduction at established NSO sites. Priorities for conservation and/or maintenance of existing levels of habitat at known NSO sites are based on occupancy and reproductive status.

FWS and KNF staff biologists developed a data-based process to analyze the current post fire conservation value of known NSO sites. In determining the likelihood of NSO site occupancy during implementation of the proposed action, habitat availability was emphasized more than the known status for sites due to the limited and/or outdated survey history data. Available recent data was assessed and was used to update site locations that occurred in the KNF NSO location database. The assessment process is described in greater detail in section 5.2 of this document and the list of sites and their priority ranking can be found in table 6.1 of appendix A. The sites were ranked as follows:

- **High RA10 value**: The NSO site is relatively intact post fire with no shift or home range expansion of the NSO site anticipated. These sites are reasonably likely to be occupied and are expected to provide short-and long-term demographic support to the NSO
population in the action area.

- **Moderate RA10 value:** The NSO site was subjected to fire that reduced the quality, availability and, or, distribution of habitat such that a shift of the NSO core use area or home range expansion could occur. We assume that these sites are reasonably likely to be occupied and would continue to provide short-and long-term demographic support to the NSO population in the action area.

- **Low RA10 value:** The “reasonable likelihood” of occupancy for some of the sites identified as “low” may be difficult to determine. Based on the available information, for some sites, we can conclude a site is unlikely to support occupancy at the historical NSO site during proposed action implementation due to insufficient amounts of habitat to support a resident pair. In those cases NRF habitat has been reduced from past actions, the amount, extent and severity of the 2014 fires, or a combination of fire and recent salvage harvest on private land. Due to limited amounts of NRF habitat these sites are not likely to provide demographic support to the NSO population in the action area. In other cases, adverse effects determinations were made if there was insufficient information to conclude that impacts were insignificant or discountable, or if there was more uncertainty whether “low” sites could be occupied in the short term.

Based on our ranking of NSO sites according to their RA10 value, our analysis of priority status of NSO sites for conservation in the action area indicates that 35 sites can be characterized as high priority sites, while 38 are moderate priority sites, and 12 are low priority sites.

RA32 emphasizes the need for retention and restoration of well-distributed, older and more structurally complex multi-layered conifer forests for recovery of the NSO. In dry forest areas, such as those found in the action area, the Recovery Plan recommends actively managing habitat to meet the overlapping goals of NSO recovery, restoration of dry forest structure and composition and allowing operation of natural processes such as fire, insects, and disease to provide the ecological conditions that support NSOs at a landscape scale. The KNF did not outline specific measures identifying RA32 stands, or measures to minimize impacts to them from proposed treatments other than commercial salvage (BA table 2, page 11).

### 4.0 Range and Province Wide Status of NSO and Its Habitat

The preamble to the implementing regulations for Section 7 of the ESA provides good context for understanding the meaning of the term “Environmental Baseline.” On page 19932 of the regulations (51 FR 19926), it states, “In determining the “effects of the action,” the Director first will evaluate the [rangewide] status of the species or critical habitat at issue. This will involve consideration of the present environment in which the species or critical habitat exists, as well as the environment that will exist when the action is completed, in terms of the totality of factors affecting the species or critical habitat. The evaluation will serve as the baseline [emphasis added] for determining the effects of the action on the species or critical habitat.”

#### 4.1 Rangewide Status of the Species

There is little information regarding the total number of NSOs existing throughout their range. However, Dunk et al. (2012) conducted model simulations of NSO numbers over time in response to various habitat scenarios. While the purpose of the modeling was not intended to predict actual population size or trend in the future, it does provide general insights into
population size through the lens of habitat carrying capacity and other factors. Without an empirical study on total population size, Dunk et al. (2012) represents the best available data to inform total NSO numbers. This modeling effort was started for the Recovery Plan and finalized during development of the critical habitat rule (USDI FWS 2012). The modeling scenario (composite 11) that resulted in the estimate for the critical habitat rule was selected for because it: 1) had a pessimistic habitat change scenario; and, 2) reflected the final critical habitat network as reserve areas. All composites and simulations were based on estimates of a reasonable middle ground on implementation of barred owl control (midpoint between no barred owl control and complete barred owl eradication). Model simulations associated with composite 11 concluded with an estimate of 6,662 NSOs rangewide if the assumption is made that all females are part of a pair of NSOs.

While the above modeling framework represented state-of-the-art science, it was not intended to be a perfect reflection of reality. As with any model, the outcomes are contingent upon the inputs and assumptions made. The estimate resulting from this scenario may overestimate present day NSO numbers rangewide because it was based on NSO and barred owl data through 2008 (Forsman et. al 2011), used a constant rate of reproduction, and did not consider variables such as connectivity, demographic stochasticity, and competition. In addition, female-only models, as this was, are unable to consider potentially important ecological impacts that may occur in modeling regions with small populations (e.g. difficulty finding a mate).

The modeling to develop the relative habitat suitability (RHS) layer in step one of the three step modeling process was based on 2007 or earlier vegetation and does not reflect all habitat loss due to fire or harvest. Present day barred owl control efforts and subsequent changes in barred owl encounter rates may not match what was used in composite 11. While we recognize the limitations of using this modeling result as an estimate of the present day NSO population rangewide, we consider it to be the best available information to inform us about rangewide NSO numbers for the purposes of the analysis in this BO. For a complete description of model inputs, assumptions, and limitations see appendix C of the Recovery Plan (USDI FWS 2011a) and the final modeling supplement to support the critical habitat rule (Dunk et al. 2012).

For more detailed information on the rangewide status of the species in regards to the legal status, physical description, biology, and threats to the NSO please refer to appendix C.

In summary, the rangewide NSO population is in decline as a result of decades of habitat loss and degradation and the recent expansion of barred owl populations throughout its range. The majority of NSO habitat in the northern third of its range and within the Oregon Coast Province is assumed to be unoccupied due to significant population declines documented in 2009 and 2013 (Dugger et al. 2015a). In published meta-analyses, the average annual rate of decline in the rangewide population of the NSO has increased from 2.8 in 2011 to 3.8 percent in 2015 (Forsman et al. 2011, Dugger et al. 2015a). Given these documented declines, NSO populations rangewide have a reduced ability to withstand additional impacts.

The current meta-analysis for the NSO was published in December 2015 (Dugger et al. 2015a) and the results were considered in the analysis for this BO. Data from individual study areas’ annual reports evaluated in this meta-analysis have found continued and sharper declines from
those reported in 2011, further prompting concern for the species. Some of the key findings are:

- All NSO demographic parameters showed significant declines.
- Realized NSO population change is significant: California 32 to 55 percent, Washington 55 to 77 percent, Oregon 31 to 64 percent.
- Rate of 3.8 percent average annual decline (from 2.8 percent in 2011).
- There is strong evidence that barred owls negatively affect NSO populations primarily by decreasing survival and increasing extinction rates.
- Weather influenced demographics in some areas.
- NSO populations were declining throughout the range from 2008 to 2013 and the annual rates of decline were accelerating in many areas.
- Barred owl densities may now be high enough across the NSO range that the long term persistence of NSO may be in question without additional management intervention to reduce barred owl densities.

4.2 NSOs in the California Klamath Province

The proposed action lies within the NSO Recovery Plan California Klamath Province. The California Klamath Province covers about six million acres and extends from the Oregon border with California, south to the Clear Lake Basin within the Inner Coast Range. It lies between the California Coast and California Cascades provinces and is bordered in the north by the Oregon Klamath province (section 8, figure 2). The following information focuses on the California Klamath Province. Most lands in past and current large-scale NSO conservation plans within the California Klamath Province have been considered essential to NSO conservation because they help maintain habitat linkages, provide demographic support among NSO populations, support NSO dispersal, maintain the potential for genetic interchange between NSO populations, and temper (to a certain extent) the adverse effects caused by competition with barred owls (USDI 2012a). Where the data is available for the purpose of this analysis, we focus on the California Klamath Province.

The Oregon and California Klamath Provinces have long been recognized as providing an important contribution to NSO conservation. This contribution has been attributed to the positive influences of ownership patterns, past management and regulations, and the distribution and connectivity of high quality older forest habitats (Thomas et al. 1990, USDI 1990, USDI 1992). A recent study concluded that both of these provinces, which contain portions of the Klamath East and Klamath West modeling regions (as evaluated in the 2012 final critical habitat analysis), are principal zones of NSO productivity that appear to play a critical role in maintaining population stability overall (Schumaker et al. 2014). These authors describe both the Oregon and California Klamath provinces as containing a “source” population. They also emphasize the importance of targeting habitat protection and restoration for the NSO in key areas to avoid further adverse changes in landscape connectivity necessary for NSO conservation (Shumaker et al. 2014). FWS considers the large LSRs in the action area to be such key areas.

Actual population data for the California Klamath Province is not available. Across the Klamath east and west modeling region modeling regions population simulations indicated up to 2,680 NSO may be present [if each female is assumed to be part of a pair] (Composite 11, Dunk et al. 2012). Klamath east and Klamath west modeling regions largely overlap Oregon and California
Klamath Provinces, encompass a small proportion of the Oregon South Cascades Province, and accounted for about 40 percent of the rangewide simulated population. Using known NSO sites in CNDDB that occur within the California Klamath Province and assuming pair occupancy (2,932 NSOs), and applying the median rate of 44 percent population decline in California, (range of 33 to 55)(Dugger et al. 2015) FWS estimates the current population to be 1,642 NSOs.

There is no long term demographic study area within the California Klamath Province. Demographic trends on the three closest adjacent study areas are generally downward (Dugger et al. 2015a; Franklin et al. 2015);

- For one of the three study areas (Oregon Klamath Mountains) the confidence interval for realized population change widely overlapped 1.0 indicating uncertainty about annual rates of change in NSO populations and that this population may be stable. Northwest California (Willow Creek) and Oregon South Cascades had clear declines in NSO populations.
- Decreases in nearly all NSO demographic parameters (occupancy, nesting pairs, survival, fecundity, number of sub-adults) were observed 2008 to 2013;
- Barred owls continue to increase resulting in negative effects on NSO survival beyond normal stressors such as climate and habitat variation.

In sum, these findings cause concern for recruitment, genetic diversity and vigor, as well as overall long-term population stability of NSOs within the province.

4.3 NSO Habitat in the Klamath Ecological Province

The forest landscapes of the Klamath Mountains are unique due to the complex interactions among topography, land surface forms, forest and vegetation types, and the regional climate. Steep, dissected topography dominates much of this landscape, generally resulting in more flammable fuels on southwest aspects and in upper slope positions, where more severe fires occur (Weatherspoon and Skinner 1995, Taylor and Skinner 1998). Climate is characterized by cool wet winters and dry Mediterranean-type summers, with frequent thunderstorms. This situation results in productive forests that support a fire regime characterized by historically frequent fires which can be quite large events, and span a spectrum of fire severity. These variations in frequency and severity have contributed to the development of mosaics of vegetation types that vary in age and structural composition and are uniquely resilient to these mixed severity fire conditions (Halofsky et al. 2011, Williams and Baker. 2012). Over the last century, fire patterns have changed where suppression efforts have been conducted, resulting in denser forests with smaller openings than occurred historically (Skinner 2005). Pre-settlement fire-return rates averaged 11 to 20 years at lower elevations and 37 years at higher elevations. At that time most fires were characterized as low to moderate severity, resulting in mortality to trees in the understory but survival of large overstory trees (Agee 1993). Fire is a naturally occurring disturbance factor that contributes to changes in forest composition and diversity in the Klamath region, it is also recognized as a significant driver in maintaining or increasing current levels of late successional and old-growth forests in the west (Agee 1993, Agee and Skinner 2005, Davis and Lint 2005, Davis et al. 2011, USDI FWS 2011a, Davis et al., 2015). The effectiveness of fire suppression over the past hundred years has affected the overall acreage burned in much of these landscapes, though the more remote and inaccessible areas continue to burn as they have historically.
Wildfires in recent decades have strongly influenced the amount and distribution of habitat in the California and Oregon Klamath Provinces (Davis et al., 2015). Davis et al. (2015) determined that the physiographic provinces that experienced the greatest loss of habitat since 1993 were the California Klamath province (over 200,000 acres) and the Oregon Klamath Province (about 150,000 acres), representing about 10.7 and 13.2 percent of habitat (respectively). Most of these wildfire related habitat losses occurred in the federally reserved land use allocations (Davis et al. 2015). Other physiographic provinces that experienced significant amounts of habitat loss to wildfire include the Oregon Western Cascades (63,000 acres) and the Washington Eastern Cascades (52,100 acres).

In total, approximately 17 percent (about 266,400 acres) of the total Federal and non-Federal rangewide loss of NSO habitat has occurred in the California Klamath Province in the past 20 years, including about 20,000 acres from wildfires and 50,000 acres from harvest (Davis et al. 2015). Wildfire-related loss represents about 41 percent of the acres in the entire NSO range and 4 percent of NSO habitat on Federal and non-Federal lands rangewide (Davis et al. 2015). Most of these reductions were within reserved land allocations where conservation for NSOs (and other late successional species) was to be emphasized (Davis et al. 2015). Climate projections indicate this region may experience a continuation of current weather and precipitation patterns leading to lower fuel moisture and dryer summertime. A continuation of this scenario will contribute to the risk of larger scale wildfires with greater potential to further reduce NSO habitat in the province.

In 2015, there were no large wildfires on the KNF, but about 200,000 acres burned in portions of the NSO range in northern California on the Shasta Trinity and Six Rivers National Forests. The Fork Complex had the highest proportion of moderate and high severity fire of all the fire perimeters (about 25 percent) based on draft 30 day post fire RAVG (USDA Forest Service 2015d). Changes to the NSO habitat baseline from 2015 fires has been approximated within critical habitat but is not currently available for the Klamath province as a whole. Preliminary data from the Shasta-Trinity National Forest estimates within the fire complexes that burned in 2015, low severity fires dominated (range of 73-83 percent of the fire perimeters). Our review of fire severity and habitat maps indicate that the patterns of these 2015 fires was likely more similar to historical patterns exhibited in the Happy Camp and Beaver fires and may not have profoundly affected NSO habitat overall.

NSOs are associated with structurally complex late successional or mid-and late successional mixed conifer forests. Habitat attributes usually associated with these forests typically do not develop until 150-200 years of age (Thomas et al. 1990). In the Klamath Province, NSOs utilize a broad range of habitat types for foraging, including forest composed of smaller trees or forests with lower canopy cover (USDI 2012). In a sample of NSO “intensive use” and roosting sites on the KNF, forest stands were determined to contain trees with the mean age ranging from 73-367 years (Thomas et al. 1990).
**Nesting and Roosting Habitat**
Across the range, NSOs generally rely on late successional forested habitats because such forests contain the structures and characteristics required for nesting, roosting, and foraging (appendix C). In the Klamath Province, NSO exhibit strong patterns of selection for specific habitat conditions and resources. These conditions, however, occur along a broad gradient of vegetation structure that is strongly influenced by abiotic features (slope, elevation) and spatial arrangement of habitat patches. Stands selected for nesting and roosting are typical of those found throughout the range. They are dominated by large trees, structural complexity, and overall contain a multitude of canopy layers, contain high densities of coarse wood, are characterized by a mixed age class, are typically close to seasonal watercourses, and are found in the lower slope positions. Douglas fir mistletoe is a common feature associated with nests and nesting habitat (Dunk et al. 2012).

The FWS describes values for selected stand structural parameters used to classify nesting/roosting habitat for NSOs in the Northern Interior Region as containing a mix of basal area ranging from 150 to ≥210+ ft² per acre, a quadratic mean diameter of ≥ 15 inches dbh, canopy closure of ≥ 60 percent, and ≥ 8 trees per acre which are ≥ 24 inches dbh (USDI FWS 2009).

**Foraging Habitat**
Within the California Klamath Province, foraging habitat is variable and spatially extensive, encompassing a broader array of stand conditions than those associated with nesting/roosting (USDI FWS 2009, 2011a). NSO forage in both nesting/roosting and foraging habitats. Forest structural features typically used to describe NSO foraging habitat include canopy cover, tree size, and basal area; other attributes such as tree species composition, canopy layering, presence of edges and small openings, and landscape position have been influential in several studies (Irwin et al. 2007, 2011, Solis and Gutierrez 1990, Ward et al. 1998, Zabel et al. 1995). These studies provide the basis of the FWS’s definitions of suitable foraging habitat for NSO in the Northern Interior Region. Consistent with the high degree of variability described in research publications, our criteria for evaluating foraging habitat for NSO consists of a range of stand conditions frequently used by owls rather than a single threshold value. Values for selected stand structural parameters used to classify foraging habitat for northern spotted owls in the Northern Interior Region are described as containing a mix of basal area ranging from 80 to ≥180+ ft² per acre, a quadratic mean diameter of ≥11 inches dbh, a mix of canopy closure of ≥ 40 percent, and ≥ 5 trees per acre which are ≥ 24 inches dbh (USDI FWS 2009).

Snags, downed wood, and decaying live trees are key resources for NSO prey. Several important prey species, including northern flying squirrels, dusky-footed woodrats, Douglas’ squirrels, and some deer mouse and chipmunk species use cavities in snags and decaying live trees for nesting, denning, and food storage (Maser et al. 1981, Carey 1991, McComb 2003, Martin et al. 2004, Innes 2007). Other “defects” on live trees also provide important resources for prey; for example, “witches’ brooms” provide foraging, nesting, and resting structures for northern flying squirrels, bushy-tailed woodrats, chipmunks, and birds (Parks et al. 1999). Down wood provides small mammals, such as woodrats, western red-backed voles, Douglas’ squirrels, and chipmunks, with cover, under-snow and food-storage spaces, runways for
moving above the forest floor, and material for dens (Maser et al. 1981, Carey 1991, McComb 2003). Down wood is also an important resource for truffles and mushrooms, which are primary foods for northern flying squirrels, western red-backed voles, and many other small mammals.

The two primary prey species for NSO in the action area are likely northern flying squirrels (which prefer denser stands of mature trees) and dusky-footed woodrats, which occupy diverse habitats including shrubby openings and late successional habitats. Relationships of northern flying squirrels with seral stages and forest structure have been a topic of considerable research and debate. Some studies have found that densities of flying squirrels are highest in old forests, or old forests of mixed conifer-deciduous composition (Carey et al. 1992, Carey 1995, Smith 2007, Richie et al. 2009, and others), while others have suggested that the flying squirrel is a generalist species with respect to seral stage or stand age and canopy cover and distance between trees may be more important than seral stage or species composition (Rosenberg and Anthony 1992, Waters and Zabel et al. 1995, Ransome and Sullivan 1997). Richie et al. 2009 found landscape composition to be a significant influence in flying squirrel occurrence; flying squirrels were found more frequently within landscapes containing greater amounts of old forest cover. Zabel et al. (1995) and Carey et al. (1992) determined that where woodrats are a primary food source, NSO home ranges are significantly smaller and contain significantly more edge habitat and less older forest than other areas in the range of the NSO. In these areas NSOs are more likely to use a variety of habitats, including younger stands, brushy openings in older stands, and edges between forest types in response to higher prey density in some of these areas (Solis 1983; Sakai and Noon 1993; Carey et al. 1999; Sakai and Noon 1997; Franklin et al. 2000).

**Dispersal Habitat**
Empirical data on dispersal habitat use are not available specifically for the California Klamath Province. A recent study from the eastern Washington Cascades suggests that dispersing juveniles select stands with relatively high canopy closure similar to those selected by adults for roosting (about 66 percent) (Sovern et al. 2015). Similar findings for the presence of older trees and denser canopy closure are described in earlier studies in the Oregon Coast range and in parts of Washington (Miller et al. 1997, Buchannan et al. 1995, and Herter et al. 2002). This BO refers to habitats dominated by 11 inch dbh trees with an average of 40 percent canopy cover as “dispersal” (D) habitat, this habitat is available to dispersing NSOs but may be of inferior quality for roosting and or foraging.

**5.0 ENVIRONMENTAL BASELINE**
The environmental baseline is defined as “the past and present impacts of all Federal, state, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early Section 7 consultation, and the impact of State and private actions which are contemporaneous with the consultation in process [50 CFR 402.02].” Such actions may include, but are not limited to, previous timber harvests and other land-management activities.

**5.1 NSO Habitat in the Westside Fire Recovery Action Area**
The size of the action area in the proposed action is approximately 277,720 acres. This landscape
is a good representative of the vegetative diversity, and naturally and human-influenced habitat conditions found throughout the Klamath Province as described above. The vegetation is dominated by mixed-conifer and mixed-conifer hardwood habitat, with some mixed-conifer/riparian mesic vegetation, inter-woven with shrub associations or non-forested areas. Anthropogenic factors have contributed to vegetation conditions throughout the action area including crowded, fire intolerant Douglas-fir dominated stands and conifer plantations that often are typically homogenous and lack structural variability. The action area is dominated by Federal lands, but the portion within the Beaver fire area contains a checkerboard ownership with industrial timberlands that has a long history of forest management. Further information is in the section 7 of this document.

5.1.1 General fire effects in the action area
The KNF utilized RAVG data together with their NSO habitat layer to evaluate action area conditions after the fires. RAVG data are derived from remotely sensed vegetation burn severity data from Landsat Thematic Mapper imagery (BA p. 22-33).

Based on RAVG data from October 2014, the KNF estimates that 69 percent of the acres that burned within the 2014 fires burned at low severity. The FEIS indicates large high severity fire patches correlate primarily to elevated fuel loads combined with record setting hot weather over the past three years and prolonged drought (USDA Forest Service 2015, p. 5). Variation in weather, terrain and vegetation conditions resulted in different fire patterns and severities across the three fire areas (table 3). The KNF has reported that the majority of forests classified as having burned at moderate severity a few months after the fire have since experienced subsequent mortality in the months following the fire (FEIS, appendix E-5). Data quantifying the subsequent mortality has not been provided. RAVG for these fires are further described in detail in the FEIS, pp. 6-8. The typical fire regime in the action area and California Klamath Province (based on a century of data) and the uncharacteristically severe intensity of the 2014 fires due to elevated fuel loading and prolonged drought are described in the FEIS (p. 141-158, 180-188, 214-224, and 245-252). Many large high severity patches were located on upper slopes. However, within Walker and Grider Creek watershed lower slopes experienced very large patches of high severity fire (over 1,000 acres).

Based on Odion 2004, these fires burned similar overall to patterns observed in 1987 fires where 40 percent total moderate and high severity was observed. These proportions are similar to the Beaver fire area and higher than the other two 2014 fires in the action area (see table 3 below). Portions of the 2014 fires in the action area experienced high severity fire both in 1987 or 2003 and during re-burn from 2014 fires. Several studies have observed a similar pattern (Thompson et al. 2007 and Thompson and Spies 2010), but it is not clear what role re-establishment of plantations or not treating all the fine fuels may have played in re-burn severity. No data was available to FWS to look at plantations relative to re-burn severity in 2014 fires in the action area.

Citations and literature discussed in the FEIS indicates 15-20 percent moderate and high severity may be more typical for the Klamath in the contemporary era. It is important to note that standardized methods of collecting fire severity data has only been consistently recorded and mapped for the past several decades (Thode and Miller 2007 and Finco et al. 2012). For
limitations of determining long term historical fire regimes from fire scar data see Marlon et al. (2012). However, regardless of debates over the exact fire ecology of the Klamath provinces, Agee (2002), Miller et al. (2009), Davis (2011 and 2015), and many others researchers have noted that overall in dry portions of the NSO range we are seeing increases in fire size, NSO habitat loss, and overall size of high severity / stand replacing fire patches. This is why the Recovery Plan cautioned against passive management and calls for balancing fuels reduction needs with NSO recovery (USDI FWS 2011a).

Table 3. Total acres of fire perimeter and burn severity, by fire area¹.

<table>
<thead>
<tr>
<th>Fire Area</th>
<th>Acreage &amp; Percentage Low-Severity or unburned¹</th>
<th>Acreage &amp; Percentage Moderate Severity</th>
<th>Acreage &amp; Percentage High-Severity</th>
<th>Total Acres Burned</th>
<th>Acres of Federal Land Burned</th>
<th>Total Acres Burned within LSR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beaver</td>
<td>17,225 (53%)</td>
<td>2,275 (7%)</td>
<td>13,000 (40%)</td>
<td>32,500</td>
<td>14,600</td>
<td>0</td>
</tr>
<tr>
<td>Happy Camp</td>
<td>82,040 (70%)</td>
<td>7,032 (6%)</td>
<td>26,956 (23%)</td>
<td>117,200</td>
<td>115,050</td>
<td>56,412</td>
</tr>
<tr>
<td>Whites</td>
<td>23,322 (69%)</td>
<td>1,690 (5%)</td>
<td>8,788 (26%)</td>
<td>33,800</td>
<td>32,900</td>
<td>24,804</td>
</tr>
<tr>
<td>Total</td>
<td>122,587-</td>
<td>10,997-</td>
<td>48,744-</td>
<td>183,500</td>
<td>162,580</td>
<td>81,216</td>
</tr>
</tbody>
</table>

¹Data derived from FEIS p. 7 and appendix E, page E-8, table 2; we note that the 183,500 acre estimate does not quite match the total of all three groups of fire severities (about 182,330).

Because of the variability in fire patterns and severity within the Beaver, Happy Camp complex, and Whites fire areas, we refer to the individual fire areas in describing the proposed action (table 3; figure 1). About 81,000 acres of LSR boundaries were within the fire perimeters (FEIS, appendix E, page E-1), of which about 31 percent burned at high and moderate severity (FEIS appendix E, table 2, page E-8).
Figure 1. Fire severities within Beaver, Happy Camp, and Whites fire areas with action area boundaries.
**Beaver Fire** – The Beaver fire was the smallest of the three fires, (about 32,500 acres) but significantly more of it burned at high and moderate severity (table 3). Federal ownership in this portion of the action area occurs in a checkerboard pattern of alternating one square mile sections, with 45 percent Federal and 55 percent non-Federal ownership. On the Federal land, a small portion of one NSO critical habitat subunit is within the action area (KLE6). Adjacent private lands are dominated by industrial timberlands generally managed intensively for wood fiber production. This fire area is predominately a south facing aspect and includes a low percentage of suitable NSO NRF habitat resulting either from past and current forest management or areas that are not capable of being forested due to ecological site conditions. Salvage logging (clearcut harvest) on some industrial private timberlands was initiated shortly after the fires were contained. Effects of completed harvest are incorporated in our environmental baseline and current and future non-Federal activities are addressed in section 7 of this document. Consequently, this portion of the action area now contains very large openings with few areas of green tree or snag retention within those areas salvaged on non-Federal land. Post salvage condition on the non-Federal land has resulted in limited connectivity in those areas.

**Happy Camp Complex** – The Happy Camp complex fire was about 117,000 acres and consisted primarily of Federal land. Portions of two NSO critical habitat subunits overlap the action area (KLE7 and K LW7). Much of this fire overlaps with the Seiad LSR, where about 56,400 acres burned, of which about 18,500 acres burned at moderate and high severity (FEIS, appendix E-8, table 2). Non-Federal ownership in this fire complex is comprised primarily of small parcels of non-industrial ownership along the Scott and Klamath River corridors. Two watersheds in this complex experienced especially severe fire behavior, resulting in large patches of forested and non-forested areas that burned at high severity, ranging in size from 100 to over 1,000 acres across the LSR. The number and size of these openings will negatively influence this area’s ability to provide long-term connectivity of late-successional habitats.

**Whites Fire** – The Whites fire was about 33,800 acres and consisted primarily of Federal land. Federal lands in this area are almost exclusively the Eddy LSR and designated NSO critical habitat (subunit K LW8). About 24,800 acres burned within the LSR, of which about 26 percent burned at moderate and high severity. Non-Federal ownership consists primarily of small parcels of non-industrial ownership along the Salmon River corridor. The fires burned in a mosaic of severities, with a few patches of high severity fire. The patterns of fire here likely resemble the mix of severities that burned historically and do not represent a concern for NSO habitat connectivity.

**5.1.2 Current NSO Habitat Baseline for the Westside Recovery Action Area**
The 2014 wildfires burned with different fire severities in each of the fire complexes, variably affecting the quality, quantity and distribution of NSO NRFD habitat within the action area. Some significant portions burned under extreme conditions that resulted in high severity patches ranging in size from 100 acres to over 1,000 acres. This occurred particularly in the eastern portion of the Happy Camp complex. A summary of the pre and post 2014 fire NSO habitat in the action area is provided in table 4.

Pre-fire NSO habitat was analyzed using a combination of remote sensing data and on-the-
ground assessments. EVEG 2007 (a remotely sensed contiguous GIS layer) was used in conjunction with aerial photography (using the 2009/2010 and 2012 National Agricultural Imagery Program (NAIP)), field verification, and knowledge and expertise of district and forest personnel. Post fire, limited field reconnaissance was conducted during the fall, winter, and spring of 2014/2015. FWS completed some field verification with multiple field trips to Happy Camp complex and the Beaver fire and one field trip to the Whites fire. The majority of salvage units in the Whites fire were visited by representatives from both the KNF and FWS. FWS also completed site specific review using pre-and post-fire aerial photographic GIS imagery (USDA-FSA-APFO 2016) and tiff images. Approximately 30 NSO sites were reviewed in the field for effects of private land harvest and fire effects. In the Beaver fire area review focused on recent non-Federal harvest and in the Whites fire area focused on fire burn severity in salvage units. NAIP review and adjustments were made to EVEG west of Grider Ridge in Happy Camp complex where NRF habitat was occasionally underrepresented by available pre fire data. This field reconnaissance and aerial imagery review of habitat classification was utilized to supplement information provided by the KNF for evaluating fire and treatment effects to NSO habitat.

Table 4: NSO habitat within the 277,720 acre action area, including estimates from non-Federal fire salvage (acreage estimates rounded to nearest ten).

<table>
<thead>
<tr>
<th>Habitat Type</th>
<th>Acres Prefire¹</th>
<th>Acres after fire and private harvest²</th>
<th>Change in Habitat</th>
<th>Percent Reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>NRF</td>
<td>95,830</td>
<td>74,070</td>
<td>-23,590</td>
<td>-25%</td>
</tr>
<tr>
<td>Dispersal</td>
<td>67,170</td>
<td>51,600</td>
<td>-15,540</td>
<td>-23%</td>
</tr>
<tr>
<td>FANR³</td>
<td>------</td>
<td>1,210</td>
<td>-----</td>
<td>-----</td>
</tr>
<tr>
<td>Post-Fire Foraging (PFF)³</td>
<td>------</td>
<td>16,540</td>
<td>----</td>
<td>----</td>
</tr>
<tr>
<td>Total</td>
<td>163,000</td>
<td>143,420</td>
<td>----</td>
<td>-----</td>
</tr>
</tbody>
</table>

¹Data derived from BA table 7.
²Data derived from BA table 7 and FWS GIS analysis estimates (rounded to the nearest hundred). 2,500 acres of NRF, 2,900 acres D, 100 acres FANR, and 1,400 acres of PFF1 and PFF2 removed by recently completed salvage on non-Federal lands within Fruitgrower’s Supply Company ownership. Acres adjusted from Table 7 in the BA to account for known non-Federal harvest. FWS analysis of dispersal habitat was not done in GIS, the 2,000 acres was a visual estimate of completed private harvest.
³FANR is fire affected nesting and roosting habitat. PFF is post fire foraging habitat. For a description of criteria used to identify FANR and PFF habitat types see BA pp. 26-33.

The distribution of post-fire habitat varies across the action area. About 20 percent of the available NRFD habitat in the action area was burned at moderate and high severity (BA table 7). Within the checkerboard Beaver fire area, NRF habitat is generally limited due to natural conditions or by past and current non-Federal timber harvest. Scattered small stands of NRF habitat primarily occur within riparian areas or on the KNF. Within the western portion of Happy
Camp complex, habitat is a rich mosaic of conifer and hardwood stands, with more tanoak than elsewhere in the action area. Openings from past fires and plantations are scattered throughout the drainages, but overall, much of this landscape contains at least F habitat, with small stands of NR habitat. The eastern portion of Happy Camp complex experienced six distinct areas of high severity fires, significantly fragmenting the available NRF habitat. A large block of high quality NRF habitat remains within the upper reaches of Grider Creek; other relatively smaller blocks of contiguous NRF habitat occur in the northwest portion of this fire area, or are associated with the main drainages or tributaries of Grider, Walker, O’Neil, Middle, Kelsey and Tompkins Creeks. The Whites Fire area is dominated by NRF habitat, providing high quality suitable habitat for NSOs.

**Post-Fire Foraging Habitat**

For the purposes of this analysis, the interagency team of staff biologists from KNF and FWS agreed on an approach that recognizes NSO use of previously suitable habitat that experienced a range of fire severities. The term “post-fire foraging” (PFF) habitat was established to identify pre-fire NRF habitat that may still provide some limited foraging function for some time based on local conditions. While post-fire foraging areas may not meet the standard definitions of NSO foraging habitat, NSO use of these burned areas has been documented (Clark 2007, Comfort 2014, Eyes 2014, appendix B). Our assumptions regarding use of burned habitat incorporate information on NSO biology and foraging strategies, and use of edges as described in section 3.1. NSOs utilize a perch-and-hunt foraging strategy, relying on some protective cover and structures on which to perch while looking for prey.

KNF and FWS staff biologists assumed that all PFF habitat is not likely all equally selected by NSOs, rather, some PFF would likely receive more use by foraging NSOs depending on its proximity to existing suitable habitat where prey, protective cover, and structural complexity was not as affected by fire. As the distance of the PFF increased from NRF habitat, use for foraging would likely diminish and in general would not exceed 500 feet into the patches of moderate and high severity burned areas. As such, a 500-foot buffer was applied to areas of currently suitable post-fire NRF habitat. When pre-fire NRF habitat burned at moderate to high severity and occurred within this 500-foot buffer, it was identified as “PFF1”. Habitat classified as NRF habitat which burned at moderate to high severity and occurred further than 500 feet from existing suitable habitat, was identified as “PFF2”.

For the purposes of the effects analysis contained herein, PFF habitat is assumed to contribute, to some degree, to habitat fitness (survival and reproduction) of NSOs at least in the short-term. In some areas, important components of habitat have been significantly reduced (i.e. lack of stand structure, diversity, cover, or heterogeneity), but in others, the high severity patches are interspersed within a matrix of mixed severity and unburned habitat and could still be utilized by NSOs. Therefore, FWS determines some of the habitat displayed as “reduced” in table 4 (and also reflected as PFF habitat) may provide some habitat function for NSOs, depending on its juxtaposition to NRF habitat.

“Fire-affected nesting/roosting” (FANR) was delineated by KNF as NR habitat that burned at moderate severity. Such stands are assumed to contain relatively high structural complexity pre fire and where it burned at moderate fire severity, a range of stand conditions could result. If a
fire burned at the low end of moderate severity then the stand could function in the long term as higher quality foraging or even roosting habitat due to the continued presence of over and understory canopy structure or other attributes of NSO foraging habitat such as coarse wood.

To best determine post-fire habitat suitability for NSO, KNF cross-walked pre-fire habitat with classes of burn severity, (table 5). RAVG data are derived from remotely sensed vegetation burn severity data from Landsat Thematic Mapper imagery (BA p. 22-33). While KNF chose to consider the pre-fire nesting/roosting habitat burned at moderate severity as “fire affected nesting/roosting” (FANR) for the purpose of our analysis we are considering these habitat types as “foraging habitat” because these stands likely contain at least some of the structural features such as canopy cover and stand complexity associated with foraging habitat. Analysis of post fire habitat data in the BA (table 14b, p. 80) indicates that the majority of NRF burned at moderate to high severity (17,750 acres) is within 500 feet of NRF burned at lower severities. PFF1 accounts for 54% (9,500 of 17,750 acres) of NRF burned moderate to high severity and the remaining 36% is FANR or PFF2”.

Table 5. NSO post-fire habitat and fire severity crosswalk

<table>
<thead>
<tr>
<th>Pre-fire Habitat type</th>
<th>RAVG Basal Area LOSS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Grid code 1 (0-25%)</td>
</tr>
<tr>
<td>Nesting/Roosting</td>
<td>Nesting/Roosting</td>
</tr>
<tr>
<td>Foraging</td>
<td>Foraging</td>
</tr>
<tr>
<td>Dispersal</td>
<td>Dispersal</td>
</tr>
</tbody>
</table>

¹Foraging habitat burned at severities up to 50 percent basal area lost may be over-represented in the action area due to post-RAVG mapping mortality.
² The FWS will evaluate this as Foraging habitat, but this too may be an over-representation across the action area.

**Nesting/Roosting and Foraging Habitat**

Table 4 displays the pre- and post-fire acres of suitable habitat within the action area. KNF was unable to conduct site specific habitat validation for this proposed action, both for baseline conditions and effects of the proposed action. Instead they assumed the remotely-sensed habitat layer was accurate (BA, p. 23). Field reviews of habitat conditions should be made in the future to validate these assumptions. For the purposes of this analysis, we combine the categories of NR, and F because we concur with KNF’s conclusion in the BA that the quantification of “suitable” (nesting, roosting, and foraging habitat) is generally correct at the 277,720 acre action area scale. We have noted that the western portion of the Happy Camp complex appears generally to under represent NRF habitat pre fire based on aerial photography image review and habitat mapping. We based our analysis on data provided by KNF however based on other data sources it is likely that more NRF habitat is available to NSOs than is displayed on maps in the
Happy Camp complex fire area.

We estimate that NRF habitat currently comprises about twenty seven percent of the 277,720 acre action area; the majority of which is under Federal ownership (table 4). Private land is dominated by low quality foraging, dispersal habitat and unsuitable habitat. KNF estimated that about 7,050 acres of NR habitat and 12,210 acres of F habitat burned at moderate and high severity fire (about 21 and 20 percent of those available habitats, respectively).

Dispersal Habitat
About twenty percent of the available habitat classified as dispersal (not including NRF habitat) was affected by moderate and high severity fire (about 22 percent). Much of this change was in blocks of high severity fire within the Beaver fire and Happy Camp complex. The location and distribution of these effects are likely to negatively influence dispersal capability for many years.

5.1.3 Previous and Current Federal Activities in the Action Area
The baseline includes numerous past and ongoing management activities that have occurred within the action area; tree planting, commercial and noncommercial thinning, prescribed burning, clearcutting, and mastication of vegetation (FEIS, appendix C). Of these, fire and timber harvesting have been the primary influences on NSO habitat on Federal and non-Federal lands since the mid-1960s. Timber harvesting has played a reduced role in the removal of NSO habitat over the last 25 years. Our analysis assumes the majority of the habitat affected by past even-aged Federal timber harvest was suitable for NSO; these areas are now represented by early seral, or otherwise mainly unsuitable habitats. The current late- and mid-successional forests are a result of the mixed severity fires prior to, or after suppression efforts began in the early 1900’s.

Fuelwood gathering also likely occurs in the action area. Legal fuelwood gathering on the KNF requires a permit and fuelwood gathering areas have specific guidelines. Fuelwood gatherers remove down logs, trees, or snags along the roadside, and areas that experience concentrated removal of fuelwood tend to be highly dispersed from one another. These activities may remove NSO habitat elements (such as snags or trees with structure), but are not expected to significantly affect habitat within the action area at a stand scale.

5.1.4 Previous and Current Private Actions in the Action Area
An additional source of habitat change that has affected the baseline in the action area is past and current harvest on adjacent industrial timberlands. The KNF utilized remotely-sensed data and field reconnaissance to assess habitat conditions on private land. At the time the draft BA was submitted in April it appeared private lands harvest was occurring only in moderate to high severity burned NRF habitat. Subsequent field reviews determined that areas RAVG classified as unburned and/or low severity burned were also being clear cut harvested. The BA concluded that large areas of private lands have either already been or are likely to be harvested in the near future (p. 44) and that all non-Federal lands would be unsuitable habitat within the action area (p. 55 table footer and p. 60 text); however, our analysis differs slightly. The independent analysis of FWS biologists is based on NAIP imagery, field review, maps provided by Fruitgrowers Supply Company (FGS) and the Michigan–California Timber Company (MCTC), and data obtained from CAL FIRE website (ftp://thp.fire.ca.gov/THPLibrary/Cascade_Region/).
In the Beaver fire area, two private timber companies, MCTC and FGS, conducted salvage operations in 2014 and 2015. We estimate that about 19 percent of what FGS identified to be salvaged within NSO NRFD, FANR, and PFF habitat remains unharvested. About 8,500 acres were harvested on non-Federal lands, within FGS ownership, of which 6,900 acres was comprised of NSO habitat (NRF, D, FANR, and PFF). About 30 percent of the total harvest was in low to very low severity burned NRF (2,500 of 8,500 acres). MCTC provided FWS with information pertaining to one emergency exemption notice. We determined the effects of this harvest were limited and insignificant. Additional salvage may have occurred elsewhere however spatial data and acres in emergency exemptions are not currently available to FWS. The effects of known private timber harvesting through 2015 have been incorporated into the existing conditions reported in this BO. See Cumulative Effects to the NSO, section 7, for estimates of future harvest on non-Federal lands in the action area.

5.1.5 Westside Recovery Action Area Contribution to NSO Conservation.
The proposed action is located within an important area for NSO recovery. It is located primarily within Federally-reserved land allocations; characterized by LSR and containing four 2012 NSO designated critical habitat (CH) subunits. These two designations together play important roles in NSO conservation. LSRs are expected to support viable NSO populations and were designed to be managed to maintain, protect, and develop older forest habitats (USDA et al. 1994, ROD B-4, 5). The 2012-designated CH subunits within the California Klamath Province were identified as connected areas containing the highest value physical and biological features essential to the conservation of the NSO, they include both NSO-occupied and unoccupied areas (USDI FWS 2012).

In summary, the action area plays an important role in NSO survival and recovery as it is expected to contribute to the maintenance and enhancement of large, interconnected blocks of high quality NSO NRF habitat. The habitat blocks are capable of supporting successful NSO breeding, survival, and dispersal to an extent that facilitates stable to increasing NSO owl populations within a designated Recovery Unit (i.e., the California Klamath Province). The steep rate of the rangewide population decline noted above magnifies the importance of the NSO population in the action area and in the Province to maintaining a viable rangewide population. Maximizing the capability of the action area and the Province to sustain a viable source population of NSOs during this rangewide demographic bottleneck depends on maintaining and enhancing habitat conditions for NSO nesting, roosting, and foraging.

5.2 NSO in the Westside Recovery Action Area

5.2.1 Approach to determining post-fire NSO occupancy and demographic support (RA 10 value)
Prior to the 2014 wildfires, KNF data suggests that NSOs were relatively evenly distributed throughout the NRF habitat in the action area and contributed to the survival and recovery of the species both at the province scale and rangewide. As described in section 5.1, the combination of wildfires and non-Federal salvage logging has substantially altered the quality, quantity and distribution of suitable habitat within the action area. Large patches of high severity burned habitat and openings created from large-scale harvest on private lands (primarily in the Beaver fire portion of the action area) are likely to have long-term negative impacts to the action area’s
ability to provide for NSO life history functions. These impacts have likely reduced the ability of the action area to provide the demographic contribution to NSO populations relative to pre-fire habitat conditions.

An ecological disturbance such as the 2014 fires represents short- and long-term stressors for NSOs in the action area. We assume large patches of habitat that burned at high severity no longer contain the protective cover and other habitat attributes associated with NSO nesting and roosting habitat. Fire can also alter or reduce the abundance, diversity, and distribution of NSO prey species. Where NSO sites are affected by fire (any range of severities) but sufficient habitat remains in the home range, site fidelity may cause NSOs to increase the size of their home ranges or shift locations of their core use areas to utilize the best available habitat rather than completely vacate the burned site (King et al. 1998, Clark 2007, Clark et al. 2011, 2013). Thus, a shift in core and home range area used by NSOs may occur under conditions where the burned area is presumably still at least marginally functional. Some studies have also documented NSOs temporarily occupying their pre-fire home ranges, though the home range no longer contained sufficient habitat to support long-term NSO occupancy (appendix B). This was observed in at least two NSO sites in the action area (KL-New3A/B and KL0283) in 2015.

Long-term effects to NSO occupancy after wildfires are not well documented; however, in general, recent studies suggest a negative influence of high severity wildfire on affected NSO site occupancy and survival. Additionally, there may be lags in the response of NSOs to habitat changes as a result of fire. Over time changes or reductions in habitat amounts and location caused by fire may negatively influence occupancy, habitat carrying capacity, or habitat connectivity for NSOs which could affect the persistence of NSO populations over time (Anderson and Mahato 1995, Lamberson et al. 1992 and 1994).

Our analysis of likely NSO occupancy and use of the post-fire landscape in the action area relies on the combination of existing data, best professional judgment, and interpretation of available literature (appendix B). This includes our analysis of pre- and post-fire habitat conditions in the action area, data in the literature on NSO habitat use and occupancy following both fire and post-fire forest management practices, and other site-specific information. In addition to the pre- and post-fire habitat conditions, where possible, we considered available KNF data on NSO occupancy in the action area, location and type of burn severity in conjunction with abiotic location (e.g. distance to streams, slope position, elevation, and aspect) of NRF and PFF habitat that influence site selection by NSO (Forsman et al. 1984, Irwin et al. 2007, USDI 2009). These factors were considered in determining which areas are likely to be occupied and used to rank individual NSO sites as high, moderate or low priority for conservation (RA10) in the action area.

5.2.2 Post-fire Occupancy of Known NSO Sites

Strategic surveys for the NSO were not conducted for the proposed action but NSO surveys have been completed periodically by KNF in different portions of the action area since the 1980’s. Pre-fire data from those surveys suggest that 85 NSO sites were known to occur in the action area; of these, about 70 were occupied by pairs, 40 of which were documented as nesting pairs (USDA Forest Service 2015, appendix C).
The majority of the action area was surveyed six times in 2015, although not all survey results were available at the time the BA was finalized. Some remote or inaccessible areas potentially did not fully meet methods described in the current survey protocol (BA p. 58). NSOs were detected at 17 sites in 2015 (includes 2 nesting pairs (1030B and 1047B), six pairs (non-nesting or nesting unknown) and eight singles (BA table 9 p. 60; appendix A, table 6.2). The majority of these 16 sites were documented as pairs or nesting pairs in previous years (e.g. nest known when 2015 surveys detected a pair only or pair known when 2015 surveys detected a single only). In response to the amount and/or location of high severity fire, some NSO sites were observed to, or assumed to have shifted their core use area and home range. We also evaluated the potential for NSOs to use alternative NSO cores.

KNF determined that five of the 85 historical NSO sites would not be affected by the proposed action; therefore, we evaluate 80 historical NSO sites that may be affected by the proposed action. Some NSO sites are grouped together because multiple alternate sites most likely represent one “territory” (i.e., a pair or resident single NSO).

Prior to 2015, surveys within the action area were limited and varied in quality and time. Additionally, many years have elapsed since some NSO sites were surveyed. In lieu of a strong survey dataset, KNF and FWS staff biologists working together completed the prioritization process that is outlined in the Recovery Plan’s RA10 (see Conserving NSO Sites and High Value Habitat, section 3.3). The prioritization for this action area was based on estimated relative conservation value based on current estimated suitable habitat amounts, quality, distribution and location, referred to in this BO as RA10 value. NSO sites were determined to have a lower value when existing conditions, fire, harvest, or a combination of the two removed a high proportion of the suitable NRF habitat and we concluded that there is insufficient NSO habitat nearby that could facilitate a NSO ‘shifting’ to establish a new home range. However, there are several exceptions in the NSO sites with a low RA10 value. The BA describes in greater detail (pp. 37-40). This relative value for each NSO site is displayed in appendix A, table 6.1).

Of the sites evaluated, the majority are considered high or moderate RA10 value (see table 6 below). Note the BA includes two Beaver fire area sites (0283 West Fork Doggett and 99913 Fishtrap) and one in the Happy Camp complex fire area (1202 Tyler Meadows) as low that FWS considers to be moderate. At the two Beaver fire area sites KNF assumed all non-Federal land as unsuitable; however, NRF and PFF habitat still occurs and is not currently included in a submitted THP or approved emergency salvage plan. As a result we concluded that these sites ranked as low by KNF appear to currently contain over 20 percent suitable NRF habitat in the home range, using the criteria we established for determining a ‘moderate’ RA 10 value. One of the two had a daytime detection of a single NSO in 2015. Data provided to FWS in 2015 by FGS indicated that further salvage is planned by FGS in 2016 but as of December 21, 2015, the area has not been identified in a submitted or approved emergency salvage operation.
Table 6. Number of sites and relative contribution to recovery and demographic support (RA10 value) of NSO sites.

<table>
<thead>
<tr>
<th>RA 10 Value post-fire</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>35</td>
</tr>
<tr>
<td>Moderate</td>
<td>38</td>
</tr>
<tr>
<td>Low</td>
<td>12</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>85</strong></td>
</tr>
</tbody>
</table>

1 Includes the 5 NSO sites in the action area that are not affected by the proposed action.

**Happy Camp Complex**

Forty-six of the 80 NSO sites evaluated are entirely or partially located within this fire complex (about 57 percent). The majority of these NSO sites are ranked as high or moderate RA10 value (appendix A, table 6.1). The FWS determined these 46 sites are occupied by 43 pairs of NSOs. Within the Happy Camp complex, due to differences in fire effects it is important to characterize the differences between the fire area west of Grider ridge from the area east of Grider ridge. Fire effects resulted in differing post fire NSO habitat amounts and distribution. The west side of this fire area was minimally affected by fire. FWS expects this western portion to largely contain the same distribution of NRF habitat and density of NSOs that existed pre-fire. The east side of this fire area was profoundly affected by fire and large scale high severity burned areas (>1,000 acres) occurred primarily within two sub-watersheds (e.g. Walker and Grider Creeks). Prior to the fire, on average, many NSO home ranges were comprised of roughly 50 percent NRF habitat and post-fire average 30 percent NRF habitat. Although this is a significant reduction in habitat amount and quality, FWS has noted that some NSO home ranges and/or cores are comprised of less than the recommended habitat minimums. The RA10 values for the historical NSO sites are shown in the table 6 above. Seven of the nine barred owl territories documented in the BA or in the spatial data KNF provided are within this fire area. Note the barred owls in combination with the fire effects may be negatively influencing NSO detectability.

**Beaver Fire**

Ten of the 80 NSO sites in the action area are located within the Beaver fire area (about eight percent). The BA states that the vast majority of NSO sites in this area are extremely unlikely to persist and assumed habitat burned at any severity on private land was removed by salvage harvest under emergency exemptions in 2014 and 2015. Site specific differences between KNF and FWS analysis outcomes are documented in section 6 “Direct and Indirect Effects of the Westside Project”. Some NSO sites have only a small portion of the home range within the fire perimeter that would be subject to potential salvage and therefore would remain moderate to high RA10 value based on available habitat quantity and configuration. The RA10 values for the NSO sites are shown table 6.1. No barred owl detections were described in data provided by KNF but data provided by FGS and other private landowners indicates there may be two barred owl territories in this fire area.

---

1 Based on a comprehensive review of current and historical NSO survey records, adjacent NSO sites in East Walker Creek 1 and 2 (New 3A and New3B), Happy Horse and Horse Creek (9991 and 1212), Kohl Creek 1 and 2 (0346 and 4146), and Three Biscuit Gulch (9995 and 1214). These 8 sites are assumed to be used by 4 pairs of NSOs.
Whites Fire
Fifteen of the 80 NSO sites analyzed occur in this fire area (about 19 percent). The majority of these NSO sites were minimally affected by habitat change due to fire and, therefore; are ranked as having high or moderate RA10 value. These sites are largely within the boundaries of KLW8. Due to the patterns and severities of the fires, FWS expects the NSO associated with habitat in this fire area will largely continue to occupy home ranges similar to their pre fire locations. Three NSO sites identified as moderate RA10 value sites may experience shifts in their core use area or home range due to habitat changes resulting from the fire. Two of the nine barred owl territories documented in the BA or in the spatial data KNF provided to FWS are within this fire area. Barred owls in combination with fire effects may also be negatively influencing NSO detectability.

The habitat baseline for the 80 NSO sites we analyzed is displayed in table 6.4 of appendix A.

6. DIRECT AND INDIRECT EFFECTS OF THE WESTSIDE PROJECT ON NORTHERN SPOTTED OWLS AND THEIR HABITAT IN THE ACTION AREA.

6.1 NSO Habitat and NSO sites
6.1.1 Analytical Approach
Specific terms are used to categorize the estimated degree of change to NSO habitat elements that may or are likely to be caused by the proposed action. The term treat and maintain indicates that we expect that changes to NSO habitat will be neutral or beneficial to habitat function, even though some elements of habitat may be modified. This is because the proposed action, as described, will retain habitat such that it continues to support the existing habitat condition post implementation. The term degrade signifies that the proposed action will influence the quality of habitat to such a degree that important habitat elements will be reduced, but not to the degree where existing habitat function (e.g. nesting, roosting, foraging, dispersal) is changed. The terms remove and downgrade signify that the proposed treatments will have a negative influence on the NSO habitat by removing or reducing habitat components that supports NSO life history requirements to the extent that the habitat no longer functions as it did pre-treatments. The significance of the changes to NSO habitat likely to be caused by proposed activities, and whether these changes are likely to adversely affect NSOs or their critical habitat, must also be based on an analysis of existing site conditions and the scope and scale of the proposed action.

Based on research in the California Klamath Province, the FWS recommends analyzing habitat conditions around a NSO site at three scales: nest stand, core, and home range (see table 1.2 in appendix A for definitions of core and home range). Nest stand as the term is used in the site specific analysis below is approximated by a 100 acre circle around the NSO site (see table 1.2 appendix A for definition of NSO site). The most critical scales are the nest stand and core. Generally FWS recommends land managers: 1) avoid habitat modification in the nest stand; maintain a 80 percent NRF habitat in the core (250 acres NR and 150 acres F habitat); and 3) maintain40 percent NRF habitat in the home range. The recommended habitat minimums are based on research which associated these amounts of NRF with higher survival and reproductive
success rates of NSO pairs or higher fitness (USDI FWS 2009). In general, we assume adverse effects, and perhaps take, could occur if an action will reduce the availability of NRF habitat to below the recommended minimums. In addition, the function and quality of habitat for NSOs is strongly influenced by landscape position, distance to nest site, and other abiotic features; therefore, these recommended NRF habitat amounts are general guidelines and not strict thresholds.

As indicated earlier, occupied NSO sites in the Oregon and California Klamath Provinces have been observed to contain NRF habitat at the core and home range scales below the recommended minimums. Specifically, in the recent Medford Douglas Post-Fire Salvage Project BO (USDI FWS 2014, Table 5) the eight sites with adverse effects that were determined to be occupied contained an average of 135 acres NRF habitat in the core (ranged from 100 to 240 acres) and an average of 680 acres in the home range (ranged from 475 to 1050 acres). It is important to note that the action area for the Medford BLM Douglas Post-Fire Salvage Project largely overlaps the Oregon Klamath Mountains Province density study area which has had over two decades of NSO surveys including surveys in 2014 after the 2013 Douglas fire. This information was the basis for FWS and KNF biologists selecting 680 acres or 20 percent of home range comprised of NRF habitat as a threshold for consideration in separating high and moderate RA10 sites from low RA10 sites in this analysis. Please see section 5.2.1 and BA (pp. 37-40) for a full description of factors considered in establishment of RA10 values for NSO sites in this action area.

The effects analysis in this BO differs, to some extent, from analyses typically conducted under formal consultation that evaluate the effects of green tree timber harvest. The differences in analysis process between green tree harvest and post fire salvage are due to the relative uncertainties in how NSOs use a landscape the first several years after a large disturbance event, such as wildfire. This assessment is based on the likely effects to NSOs of the proposed action on our understanding of how NSO use burned landscapes, the patterns of NSO habitat use post fire use reported in the literature, and the presence of NSOs in burned landscapes reported anecdotally by private landowners and federal land managers. Please see appendix B for a complete discussion.

### 6.1.2 Effects of the Proposed Action to NSO Habitat

The section below describes the general effects from the proposed action related to habitat modification. These general anticipated effects serve as a starting point for the more detailed analysis of: 1) “Disturbance (Visual, auditory, or smoke related) or Habitat Modification in the Breeding Season” (section 6.2.2); effects to each individual NSO site within the action area (section 6.3.2); and 3) effects to NSO critical habitat (section 8).

The effects to NSO habitat from fire (described in appendix B) may be compounded by prior forest management or post-fire management activities (Bond et al. 2002, Clark et al. 2011, Clark et al. 2013, Jenness et al. 2004, Lee et al. 2012 and Roberts et al. 2011). The scale and type of habitat removal in NSO cores and home ranges likely determines whether the removal from the proposed action will compound the impacts of the loss of forest cover and structure due to moderate and high severity fire. NRF, FANR, and PFF1 have higher expected NSO use than PFF2 or D.
Overall, the KNF and FWS analysis expect adverse effects from the proposed action because key habitat elements such as: large diameter trees that may have nesting structure, canopy cover, and multiple canopy layers will be removed or reduced in areas of likely NSO use. Additional alteration of habitat in the landscape by the proposed action will likely also result in further changes in prey abundance, diversity and distribution. Salvage and fuels reduction treatments are likely to negatively impact landscape-level habitat connectivity for small mammals that use downed wood as cover. The removal of large trees, down wood and overall forest canopy reduces overall concealment cover, foraging perches, suitable microclimate conditions and other valuable functions necessary for NSO survival and reproduction. These habitat changes also are likely to result in both greater exposure and greater vulnerability to predation.

Stressors to NSOs from the fires are expected to be further increased by the proposed action in some areas. The BA notes, “Irwin et al. (2011) found NSOs in the Klamath region would often forage within more open stands that contained brush or a low basal area of conifer trees, and that the presence of a few scattered trees or snags likely facilitated hunting for prey such as woodrats, citing a particular telemetered pair that made extensive use of a burned area with manzanita shrubs and scattered live trees. This would indicate that, at least under certain circumstances, NSOs will venture into more open habitats, such as areas burned at high and moderate severity, when enough structure is present to offer perching or a certain degree of cover, though the exact level of cover is unknown” (p. 51). The Recovery Plan reviewed results from the three radio-telemetry studies of NSOs completed prior to 2012 and each indicated that spotted owls use forest stands that have been burned, but generally do not use stands that have been burned and logged (USDI FWS 2011a). The Recovery Plan further notes that Clark et al. 2007 documented infrequent foraging by NSOs in stands that had been harvested post-fire. However this infrequent foraging, was restricted to areas with live trees such as those in riparian areas (Clark 2007)

Long term changes in prey abundance and distribution are anticipated in areas of intense treatment (habitat downgrade or removal), particularly in NRF, FANR, and PFF1 habitat based on our review of available literature (see section 6.4). The BA notes, “NSO are assumed to be using fire-affected habitat for foraging during the short term, possibly a few years, depending on the time it takes for the branches and needles to fall off and/or fire killed trees to fall. PFF and FANR may be used more in areas where unburned habitat types are more common” (p. 74). Since, FWS and KNF biologists agree NSOs are using NRF habitat burned moderate to high severity (at least for the short term), it is reasonable to conclude that removal of this habitat will result in NSOs expending additional energy due to traveling longer distances to locate prey or adequate hunting perches due to snag removal. Clark et al. 2007 predicted reductions in NSO prey or NSOs difficulty finding prey after combined effects of fire and salvage harvest due to higher extinction rates observed in some areas that were burned and logged. Traveling greater distances to forage particularly during the breeding season in combination with the reduction in suitable nest trees (from downgrade of low severity burned NRF in fuels treatments – described below), may negatively affect NSO reproduction.

Removal or reductions of habitat elements that require long timeframes to develop (e.g. large trees and snags) have longer-term effects to the amount and quality of NSO habitat. The removal of moderate and high severity burned pre-fire NRF habitat (post fire PFF or FANR habitats) in any significant amounts in relationship to the spatial location, scale and other factors discussed
herein is likely to adversely affect NSOs. Breeding, feeding, and sheltering opportunities are likely to be significantly reduced for NSOs associated with NSO sites in which removal or downgrade of low severity burned post-fire NRF, and, or, or in conjunction with removal of FANR and PFF1 habitat. Fitness of NSOs would also be reduced (e.g. less successful reproduction, lower survival, or in some instances site abandonment) after implementation of the proposed action in some NSO sites (see section 6.3.2 below).

The tables below summarize the acres of habitat removed or downgraded which are considered long term effects and the acres degraded which are considered short term effects. Acres described in the BA (table 14b p. 80) as “treat and maintain” were analyzed by the FWS as degrade with the exception of “prescribed underburning only”, because we lacked sufficient information to conclude there would be no loss of quality in the treated habitat when individual elements (primarily large snags) were removed.

Harvest by the proposed action that removes or downgrades low severity burned NRF habitat would preclude or significantly delay the re-development of complex NRF habitat and post-fire recovery of LSRs. The FWS expects it will take 70-150 years for foraging to redevelop (USDI FWS 2011a) and 150-370 years for nesting roosting to redevelop (Thomas et al., 1990). Removal of PFF1 and FANR in the amounts proposed constitutes a substantial reduction in post-fire foraging opportunities for NSOs in some sites. It is important to note NSOs are generally not expected to nest or roost in areas burned at moderate to high severity. Although, we are aware of two instances of NSO roosting in areas RAVG indicates are moderate severity (based on FWS review of fires prior to 2014 on Shasta Trinity NF or KNF) and one instance in the action area after the 2014 fires.

**Table 7. Summary of long-term adverse effects to NSO habitat within the action area based on acres of habitat affected by each treatment type as described in table 14b of the BA (rounded to the nearest ten) and Current NSO Habitat Baseline (Section 5.1.2).**

<table>
<thead>
<tr>
<th>Habitat Type</th>
<th>Total removed or downgraded by habitat type</th>
<th>Total available of each habitat type</th>
<th>Percent reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>NRF</td>
<td>2,290</td>
<td>74,070</td>
<td>3</td>
</tr>
<tr>
<td>FANR</td>
<td>200</td>
<td>1,210</td>
<td>17</td>
</tr>
<tr>
<td>PFF1</td>
<td>1,883</td>
<td>16,540</td>
<td>22</td>
</tr>
<tr>
<td>PFF2</td>
<td>1,640</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>D</td>
<td>30</td>
<td>51,600</td>
<td>&lt;1</td>
</tr>
<tr>
<td>Total</td>
<td>6,060</td>
<td>143,420</td>
<td>4</td>
</tr>
</tbody>
</table>
Table 8. Summary of short-term adverse effects to NSO habitat within the action area based on acres of habitat affected by each treatment type as described in table 14b of the BA (rounded to the nearest ten) and Current NSO Habitat Baseline (Section 5.1.2).

<table>
<thead>
<tr>
<th>Habitat Type</th>
<th>Total degraded(^1) by habitat type</th>
<th>Total available of each habitat type</th>
<th>Percent degraded</th>
</tr>
</thead>
<tbody>
<tr>
<td>NRF</td>
<td>3,860</td>
<td>74,070</td>
<td>5</td>
</tr>
<tr>
<td>FANR</td>
<td>0</td>
<td>1,210</td>
<td>0</td>
</tr>
<tr>
<td>PFF1 and PFF2</td>
<td>0</td>
<td>16,540</td>
<td>0</td>
</tr>
<tr>
<td>D</td>
<td>4,380</td>
<td>51,600</td>
<td>8</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>8,240</strong></td>
<td><strong>143,420</strong></td>
<td><strong>6</strong></td>
</tr>
</tbody>
</table>

\(^1\)As stated above all treatments described in BA as treat and maintain were analyzed as degrade because we lacked sufficient information to support a treat and maintain determination with the exception of the areas with prescribed under-burning only.

Table 9. Summary of short-term insignificant or beneficial effects in areas treated and maintained by Prescribed Burning within the action area based on acres of habitat affected by each treatment type as described in table 14b of the BA (rounded to the nearest ten) and Current NSO Habitat Baseline (Section 5.1.2).

<table>
<thead>
<tr>
<th>Habitat Type</th>
<th>Total degraded or treated and maintained by habitat type</th>
<th>Total available of each habitat type</th>
<th>Percent degraded</th>
</tr>
</thead>
<tbody>
<tr>
<td>NRF</td>
<td>3,300</td>
<td>74,070</td>
<td>5</td>
</tr>
<tr>
<td>FANR</td>
<td>0</td>
<td>1,210</td>
<td>0</td>
</tr>
<tr>
<td>PFF1 and PFF2</td>
<td>0</td>
<td>16,540</td>
<td>0</td>
</tr>
<tr>
<td>D</td>
<td>2,070</td>
<td>51,600</td>
<td>4</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>5,370</strong></td>
<td><strong>143,420</strong></td>
<td><strong>4</strong></td>
</tr>
</tbody>
</table>

**Effect by Treatment Type**

**Effects from Prescribed Fire**
Approximately 5,270 acres of NRFD habitat will be underburned (BA, table 14b, p. 80). Where underburning does not overlap with fuels or roadside treatments we consider the effects to be insignificant or have overall beneficial effects to NSO due to the short- and long-term ecological benefits that generally result from low intensity under-burning. Additionally, underburning primarily occurs within areas previously burned by the 2014 fires (in order to maintain the existing lower level of fuel loading) and is a maintenance burn. The KNF determined the overall function of habitat will remain the same or be improved by prescribed fire (BA, p. 70).

**Effects from Road and Landing Construction**
Approximately 25 acres of NRF, 15 acres of D habitat, and 30 acres of PFF1 and PFF2 will be removed from road and landing construction (BA, table 14b, p. 80). These actions have the potential to remove key habitat elements, including large-diameter trees with nesting cavities or platforms, multiple canopy layers, adequate cover, and hunting perches. No canopy will exist within roadbed after the construction. However due to the limited size and linear nature of this
construction we do not anticipate that the removal of these key habitat features will reduce nesting, roosting, foraging, and dispersal opportunities for NSOs adjacent to these areas.

**Effects from Commercial Salvage and Concentrated Roadside Hazard Tree Removal**

We evaluate these treatments together because the concentrated hazard tree units are either associated with commercial units or are blocks of treatments extending 200 feet on either side of roadways. Approximately 5,000 acres of commercial salvage is proposed, of which the KNF estimates will harvest; 1,031 acres of PFF1, 1,127 acres of PFF2, 133 acres FANR, 58 acres of NRF, and 17 acres of D (BA table 14b p. 80). Commercial salvage accounts for the majority of the total PFF1, and PFF2 removal across the action area (2,160 of 3,540 acres total removed). It represents a removal of about 13 percent of available PFF1 and PFF2 (3,540 of 16,540 acres) and about 11 percent of FANR removed (133 of 1,210 acres). About 50 of 320 miles of total hazard tree removal (over 2,000 acres) and concentrated roadside hazard and will remove large snags and future downed logs across a broad area of the burned landscape. About 550 acres of PFF1 is proposed for removal from concentrated roadside hazard tree treatments. Together with salvage, these total about 1,581 acres of PFF, or about 17 percent of the PFF1 available in the action area based on information in the BA (table 14b, p. 80). As described earlier, we assume that NSOs are likely to utilize or rely on PFF1 more than PFF2 due to its proximity to existing suitable habitat. Due to safety concerns, the roadside units are unlikely to contain individual retention trees or aggregates of retained snags.

**Table 10. Salvage harvest and acres removed by each NSO habitat type. This is a clip of table 14 in BA with only the row that pertains to salvage harvest. Columns titled “degrade” or “treat and maintain” were also excluded.**

<table>
<thead>
<tr>
<th>Treatment Type</th>
<th>NRF Removed (acres)</th>
<th>FANR Removed (acres)</th>
<th>PFF1 Removed (acres)</th>
<th>PFF2 Removed (acres)</th>
<th>Dispersal Removed (acres)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Salvage Harvest</td>
<td>58</td>
<td>133</td>
<td>1,031</td>
<td>1,127</td>
<td>17</td>
</tr>
</tbody>
</table>

The BA also outlines key assumptions (pp. 24-25) related to analysis of salvage treatment:

- The NSO habitat layer, derived from the EVEG 2007 remotely sensed data, provides a generally accurate depiction of NSO habitat at the scale of the action area. The majority of the uncertainty in the habitat typing within the layer stems from the category assigned to the habitat (i.e. ‘nesting/roosting’ or ‘foraging’), but the designation as ‘suitable’ is generally correct.
- Unburned habitat within units will be retained and that NRFD habitat removal will occur incidentally (from damage or where avoidance is not practicable) on up to 10 percent.

FWS review indicates the vast majority of the NRF in salvage units occurs in less than five acre pockets where low severity burn is juxtaposed with higher burn severities. Based on this, we concluded it is unlikely NSOs would nest within any of the salvage units. Generally the inclusions of NRF were larger in some stretches of concentrated roadside hazard tree removal.
Salvage and concentrated roadside hazard tree removal are focused in larger contiguous areas where the burn pattern was dominated by moderate to high severity (over 50 percent basal area loss). Within units, salvage will remove the majority of the snags that would provide for future NRF stand development. However, many salvage units have retention areas included within their boundaries that retain legacy trees, riparian areas, or clumps of trees burned at lower severities. Units range in size from 2 to 571 acres and the retention areas (including riparian reserves) range from 1-98 acres in size (BA, table 6, p. 36). About 37 units totaling 900 acres have no retention (BA, table 6, p. 36). Snag retention areas and untreated riparian reserves will partially compensate for the removal of large trees with that will occur across the remainder of the unit providing for current and future stand structure important to NSO habitat. Where retention aggregates do not occur, especially in larger units, the resulting large openings will result in future forested stands that lack these important structural elements that provide habitat for NSOs and their prey.

The BA indicates there are differences between the treatment in concentrated roadside hazard tree removal and commercial salvage. Concentrated roadside hazard tree removal:

- Generally covers smaller contiguous areas;
- Is not subject to LSR criteria that the unit must contain over 10 acres of contiguous high severity burn with less than 40 percent canopy cover;
- Applies a 60 percent, rather than 70 percent chance of mortality marking guideline;
- Will not include retention of snags in riparian reserves or any other partial retention areas;
- Will not include project design features to retain biological legacies as the KNF determined this would defeat the purpose of removing hazards from along the road;
- Snag retention will only occur where pockets of lower burn severity are interspersed with high severity burns and are not targeted for treatment;
- This treatment was generally not modified within cores of NSO sites that are moderate or high RA10 value.

Concentrated roadside hazard tree removal and commercial salvage will affect the current post-fire foraging opportunities for NSO and re-development of future NRF habitat. Where these two treatments occur, the majority of fire-damaged, dead, or dying trees (>60 percent probability of mortality) will be removed, creating large openings with little structure or cover with the exception of the retention patches. The BA notes, “Large snags and large down logs are considered biological legacies in the post-fire environment and play an important role in the long term growth of the future stand (Lindenmayer et al. 2008). Large snags and large down logs are also essential attributes for the development of the old forest ecosystem and associated species such as the NSO. Snags may stand for decades and in time, may become future nest trees as the regenerating forest nears maturity, although few large snags may be expected to remain intact by that time” (p. 75). In the short term, post-fire foraging opportunities for NSO will be reduced (see appendix B), NSO prey species abundance or distribution will be altered (see section 6.4), and the additive impacts of salvage likely compound or exacerbate the fire effects in some areas (USDI FWS 2011a).

These treatments remove fire damaged trees that would otherwise remain standing and could be used by foraging NSO (see appendix B and BA p. 24-27). The effects to NSO will vary
depending on the locations of treatments in relation to NSO sites, and the availability and
distribution of habitat within their home range and core in conjunction with the amount and
distribution of treatment types (see section 6.3.2 for effects to individual NSO sites). The
negative effect of snag and dying tree removal is expected to be greatest along administratively
closed roads (maintenance level 1) and roads where high clearance vehicles are required
(maintenance level 2) because data on the KNF indicate these areas could be used by nesting
NSOs. The negative effects are much lower on high traffic roads either paved or suitable for all
types of vehicles (maintenance level 3 and 4 often maintained by county). This is because NSOs
generally avoid nesting near high traffic roads.

In the long-term, the removal of large dead, dying and fire damaged trees and the creation of
large openings may delay or preclude future stand development. The Recovery Plan states,
“Consistent with restoration goals, post-fire management in these [burned] areas should promote
the development of habitat elements that support spotted owls and their prey, especially those
which require the most time to develop or recover (e.g., large trees, snags, downed wood). Such
management should include retention of large trees and defective trees (Beschta et al. 2004,
anticipate many cases where the best approach to retain these features involves few or no
management activities” (USDI FWS 2011a). Retention of biological legacies is especially
important in lands being managed for NSO conservation. Much of the habitat removal proposed
occurs within LSRs.

Large snags are essential attributes for the development of structurally complex forests
associated with NRF habitat (BA, p. 48) and associated species such as the NSO (BA, p. 75).
The BA notes that without removal, the large snags may stand for decades and in time may
become future nest trees as the regenerating forest reaches maturity (page 75). Dead and fire-
damaged trees enhance habitat for NSO prey whether they remain standing or fall and play an
essential ecological role as down wood. Large dead or fire damaged trees would likely remain as
large snags for many decades and would retain elements of late seral habitat in the early seral
stands as the stands develop and grow post fire if they were not removed.

KNF has minimized effects where feasible by including design feature suggested by DellaSala et
al. 2005 and others, including:

- Avoiding salvage in low to moderate severity, riparian areas, and roadless areas.
- Snag retention guidelines to ensure retention of legacy tree features.
- Limited operating periods (LOPs) that partially minimized effects to NSO during the
  breeding season.
- The majority of salvage will occur with cable and helicopter logging systems (wherever
  feasible) to avoid ground disturbance.

The BA included a summary of snag dynamics and how salvage logging may influence
reforestation and future fires (BA pp. 75-76), “Snag dynamics are complex and depend on many
factors (Cluck and Smith 2007). Once recruited into coarse woody debris on the ground, it serves
as an important element in owl habitat as part of many aspects in the life cycles of NSO prey
(Verner et al. 1992). Thus, decaying wood serves different functional roles overtime, first
providing cover for spotted owl prey in the complex early seral stage of the forest, and ultimately
decaying and playing a critical role in soil development of older forests. The removal of
dead/dying trees and down woody material through salvage harvest reduces fuel loading, and the
reduction in fuel loading may promote the development of old forest habitat. However, the
effectiveness of salvage (and fuels) treatments proposed is difficult to predict and there is
considerable uncertainty with how salvage logging influences future fire. A review of recent
research on post-wildfire management and the associated controversy can be found in Long et al.
(2014).

Salvage harvest is controversial because few short-term positive ecological effects and many
potential negative effects have been associated with post-fire logging (Long et al. 2014).
However, it is known that salvage harvest reduces fuel loading over time (i.e. as snags fall, large
surface fuel loadings result) and reduced surface fuel loads may reduce soil and forest regrowth
damage in a re-burn (Peterson et al. 2015). Re-burns in areas of high severity fire can lengthen
the time for establishment of late successional forest needed for the reproductive success of the
NSO (USDI FWS 2011a). Further, salvage may improve the likelihood of future reforestation
that, contingent upon future surface fuels management and treatment at appropriate scales, would
re-establish forests with large trees and sufficient canopy cover within shorter time frames
(USDA FS 2015b).

The effect salvage logging has on re-burn fire severity of future mature forest habitat is highly
variable depending on numerous factors including fuels treatments, fire management, climate
and drought conditions. However, as stated in the FEIS (chapter 3, p. 178-213) reducing fuel
loads, especially activity generated fuels, is expected to reduce flame lengths and fire line
intensities. Preventing high fuel loadings along roadsides is expected to play an important role in
reducing fire severity in the developing mature forest habitat. This may be especially true where
fuel reduction occurs along roads are identified as critical fire management features. Salvage
harvest may benefit NSOs in the project area by providing some method for reducing the size
and effects of high severity fire that can remove large portions of suitable NSO habitat for
extended periods of time, though the degree of effectiveness of treatment is debated in current
research.”

The FEIS speaks further to potential benefits of salvage logging and concentrated roadside
hazard tree removal. It states, “Acres that are not planted are likely to remain as brushfields with
isolated trees for multiple decades and possibly centuries and that the trends of areas that are
salvaged are dramatically different in Forest Vegetation Simulator (FVS) than on untreated
areas” (USDA FS 2015b). FWS does not disagree, re-forestation may occur more quickly;
however, the long term benefit is not clear since there are few (if any) documented instances of
NSOs selecting plantations over naturally regenerating stands for foraging and salvage reduces
the biological legacies that may increase NSOs use of early seral stands as NRF habitat is
redeveloping. Additionally, the discussion in the BA is similar to the Recovery Plan (USDI FWS
2011a) that support is lacking and debate remains about the contention that reduction of fuels
from post fire harvest reduces the intensity of future fires. The Recovery Plan further states that
planting trees after harvest can have the opposite effect.
Scattered Roadside Hazard Tree Removal
NSO habitat within 200 feet of either side of 118 miles of ingress/egress roads may be affected by implementation of roadside hazard tree removal along ingress/egress roads during the breeding season. About 1600 acres of NRF are degraded within the units, of which 1,390 acres was burned at very low severity (grid code 1) and 220 acres were burned at low severity (grid code 2) (BA table 10, p. 67). The majority of acres of roadside hazard tree removal (8,300 of 14,320 acres) are proposed in very low and low severity burned NRF habitat that is more likely to support nesting NSO than NRF habitat burned at moderate to high severity (BA table 12, p. 69 and description of proposed action in BA, p.15). Dispersal habitat is also degraded, but the treatment affects a small proportion relative to this habitat type’s availability within the action area.

Treatments primarily remove two key elements of the habitat: dead trees and fire damaged trees. These are key elements that could have otherwise been used by NSOs. Removal of dead or fire damaged trees by the proposed action will have adverse effects due to degrade of NRF habitat which comprises a much smaller proportion of the action area. Secondarily, the proposed action will reduce future down wood and damage to residual green trees. Damage to residual green trees occurs when trees or snags are hauled by cable yarding systems to the nearest road or when yarding corridors are cleared of vegetation. Where this occurs in combination with fuels treatments, there is an additional negative effect to the habitat from treating both the dead and damaged trees in the overstory and the simplification of the understory structure (hazardous fuels reduction proposes to remove portions or all of the live and dead vegetation less than 12 inches in diameter depending on prescription).

The BA states that this treatment type will cause no reduction in habitat quality (“treat and maintain”). However, the FWS determined a lack of sufficient information to differentiate effects of this treatment from the effects of other treatments which the BA describes as removing individual elements at a scale that reduces overall quality of habitat (degrade). Therefore, we considered the treatment to degrade NSO NRFD habitat.

Additional mortality from beetle and disease infestation and very dry conditions has been incidentally noted and discussed between the KNF and FWS. KNF asserts many areas typed as NRF habitat may now function as only PFF habitat. Unfortunately, FWS was not provided any spatial or quantitative data on where this has occurred in significant amounts to enable us to analyze the potential change in habitat quality asserted by the KNF. Additionally, such changes were not incorporated into the habitat classification layer (EVEG) used to generate table 14b (p. 80), Table 20 (p. 94), and all other quantitative summaries of effects to habitat in the BA. Lacking these specifics, we analyzed the potential impacts as reported in the BA tables and final GIS spatial data that accompanied the BA.

In addition to degrade of NRFD habitat, there is the potential for nest trees to be cut in NRF habitat. The BA did not evaluate known nest locations within roadside hazard tree removal units, but GIS spatial layers contained results from KNF NSO surveys that have been entered into NRIS as well as 2015 NSO surveys. The spatial data indicate that three known nest stands (associated with KL4143, KL1047, and KL1214) overlap with proposed units and were along maintenance level (ML) 2 roads. Since only 40 to 70 percent of the three fire areas within the
action area have been surveyed in the past decade (BA p. 56) it is possible that additional previously unidentified nest trees will be cut or subject to habitat modification within stands along both ML 1 (administratively closed) and ML 2 roads (rated only for high clearance vehicles). KNF and FWS determined there is a low likelihood of a nest near ML 3 or ML 4 roads, which receive high levels of traffic use, woodcutting, recreation, etc.

Effects to Habitat from Hazardous Fuels Treatments

**Roadside Complete and Roadside Modified**
The two primary hazardous fuels treatments proposed along roads have a prescription or treatment intensity based on an analysis of the solar radiation and the influence this has on fire behavior, existing vegetation, and NSO habitat (BA, p. 6). Based on FWS review of spatial data provided by KNF, roadside complete fuels reduction generally will have a much lower likelihood of negative effects to NSO habitat than WUI or roadside FMZ (see below) because many of these treatments are proposed in areas that appear to have a low likelihood use by NSOs (ridges and hot dry slopes). It is expected to downgrade NRF habitat to dispersal habitat, and remove FANR and PFF habitat (BA pp. 77-78). The majority of adverse effects to NSO will occur when this treatment occurs in areas of likely NSO use (e.g. lower two-thirds of slope).

The roadside modified fuels reduction will partially remove or reduce understory components, leaving trees and shrubs in a mosaic pattern. These treatments are not expected to affect overstory complexity or have long term impacts to herbaceous vegetation or coarse wood. Treatments are expected to degrade habitat (reduce quality but maintain function). Because affected habitat are in areas of higher likelihood of use by NSO, the modified roadside hazard fuels treatment has a higher potential to affect NSOs, depending on extent and location of the treatment relative to NSO core areas. There is a fairly low risk of removing trees used for nesting or roosting as fuels treatment are generally targeting trees less than 12 inches and snags less than 16 inches. The duration of impacts from the fuels treatments proposed is generally considered short term where BA describes degrade of NRF habitat. The primary effects are reduced foraging opportunities from the reduction in canopy layering, stand complexity, understory cover, and mid-story hunting perches.

**Wildland urban interface and fuel management zones**
WUI and FMZ treatments result in very similar effects to NSO habitat as roadside complete described above. The treatment will not target overstory trees except to prune limbs of larger trees. These treatments are intended to break up the fuel continuity to provide effective breaks for fire control and suppression, and largely result in a complete removal of the understory vegetation. NRF habitat is expected to be downgraded to dispersal habitat by WUI and FMZ fuels reduction.

Approximately 1,800 acres of NRF habitat is expected to be reduced to dispersal by FMZ and WUI treatments. While these impacts to habitat are more severe, these treatments generally are not located in areas of likely use by NSOs. Additionally, these and other fuels reduction treatments in the proposed action may result in long term benefits to NSO habitat in the action area. Fuel treatments have the potential to alter fire behavior at the landscape scale (Fulé et al. 2012, Safford et. al 2012), potentially preserving much more NRF habitat from loss in future
fires than is downgraded by the proposed action.

**Summary of Effects to Habitat From all Treatment Types**
The proposed action will impact about 20,000 acres of all NSO habitat types over a ten year period (about 14 percent of available habitat in the action area). This includes the downgrade and removal of about 6,480 acres of all habitat types (about 4 percent of available habitat in the action area). Reductions in NRF, FANR, and D habitat total 2,940 acres. Reductions in PFF1 and PFF2 total 3,540 acres. The majority of habitat reductions come in the first three years (see Table 11 below).

**Long-term habitat effects from the proposed action**
NSOs are associated with structurally complex late successional or mid-and late successional mixed conifer forests. Habitat attributes associated with these forests typically do not develop until 150-200 years of age (Thomas et al. 1990). In this portion of the range, NSOs utilize a wide variety of habitat types for foraging, including forest composed of smaller trees or forests with lower canopy cover (USDI FWS 2011a and 2012). An example of “intensively used” areas and roosting sites on the KNF would contain trees with a mean age range of 73-367 years (Thomas et al. 1990). Actions that significantly reduce habitat elements that take a long time to develop (such as large trees/logs/multi-structured complex stands) which are categorized above as downgrade or removal of habitat, are considered long-term effects. FWS estimates the duration of effects is approximately 40-50 years for removal of dispersal habitat, 70 to 150 years for removal of foraging habitat, and 150-370 years for removal of nesting and roosting habitat. Downgrade will have effects of a shorter duration. Commercial salvage and concentrated roadside hazard tree removal account for the majority of PFF removal while hazardous fuels reduction account for the majority of NRF downgrade. See Table 14b in the BA (p. 80) for summaries by individual treatment types.

**Short-term habitat effects from the proposed action**
Actions that result in minor changes to habitat structure or effects to prey distribution and availability that would return to pre-action habitat conditions relatively quickly are considered as short-term effects. Short-term effects to habitat are characterized as “degrade.” The majority of these effects stem from roadside hazard treatments in low severity burn areas and fuels treatments (primarily under burning and roadside fuels). See tables 10 and 11 below.
Table 10. Effects to all NSO habitat (all treatments combined) rounded to the nearest ten and broken out by duration of effects to NSO habitat. See Table 14b in BA (p. 80-81) for acres by each individual treatment type.

<table>
<thead>
<tr>
<th>Acres harvested and percent of action area habitat affected</th>
<th>Habitat removed or downgraded¹ (Long-term effects)</th>
<th>Habitat degraded² (Short-term Effects)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>6,480 (4 percent) all habitat types; 2,940 NRF</td>
<td>8,210 (10 percent) all habitat types; 1700 NRF</td>
<td>14,690 (20 percent) all habitat types; 4,640 NRF</td>
<td></td>
</tr>
</tbody>
</table>

¹Includes NRFD, PFF1, PFF2, and FANR. Percent is acres treated divided by baseline of all habitat types.
²Excludes 5,370 acres prescribed under-burning only which was determined to have insignificant or beneficial effects to NSO habitat.

Table 11 is primarily to show the timing of different treatments (proportion occurring within the first three years versus years three to ten) and does include acres of prescribed under-burning which table above excluded due to insignificant or beneficial effects to NSO habitat.

Table 11. Effects to NSO habitat in action area (rounded to the nearest hundred acres) broken out by generalized treatment categories.

<table>
<thead>
<tr>
<th>Treatment type</th>
<th>Total treatment years 1-3 (acres)²</th>
<th>Total treatment years 3-10 (acres)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commercial Salvage¹</td>
<td>2,400</td>
<td>0</td>
</tr>
<tr>
<td>Roadside³</td>
<td>7,300</td>
<td>0</td>
</tr>
<tr>
<td>Other Fuels⁴</td>
<td>1000</td>
<td>9,000</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>10,700</strong></td>
<td><strong>9,000</strong></td>
</tr>
</tbody>
</table>

¹Includes only commercial salvage. Areas where salvage units overlap with scattered or concentrated roadside hazard tree removal are excluded from this and counted only with “Roadside” above.
³Includes NRF, D, PFF1, PFF2, and FANR.
⁴Includes the following: scattered and concentrated roadside hazard tree removal, areas where hazard tree removal overlaps with roadside hazardous fuels reduction (Roadside Complete or Roadside Modified), and areas where roadside hazard tree removal overlaps with prescribed burning, road construction, and landing construction).
⁴Includes WUI, FMZ, roadside hazardous fuel reduction (where it occurs alone, no overlap), and prescribed burning.

6.2 Disturbance (Visual, auditory, or smoke related) or Habitat Modification in the Breeding Season

6.2.1 Analytical Approach

The effect of sight- and sound-related disturbance on NSOs is not well studied. Existing studies have had conflicting results in avian species. For example, sometimes overhead flights by aircraft and helicopters caused less flushing than on-the-ground chainsaw use at a comparable distance; other times overhead flights caused more perceived impact. Knight and Skagan (1998) noted the following factors that may influence NSO response to stimuli and level of reaction to disturbance:
1) Timing of the disturbance in relation to nesting chronology;
2) Type, frequency, and proximity of human disturbance;
3) Variation in clutch size;
4) Health of individual NSO;
5) Variation in food supply; and
6) Outcomes of previous interactions between birds and humans which may influence the perceived level of threat.

Further, the effects of noise on birds can be problematic to establish due to difficulties associated with quantifying and categorizing characteristics of disturbance (i.e., type, frequency, proximity) and appropriate response variables (i.e., behavior, reproductive success, survival). Additional factors increase the complexity of evaluating effects of noise disturbance, such as an individual NSO’s tolerance level, ambient sound levels NSOs are accustomed to, and physical parameters of sound and how it reacts with topography, vegetation, and even humidity at a given NSO site. It is important to note that due to the scope of this proposed action we have very little site specific detail on nest locations, ambient / baseline noise levels, or attenuation factors in any given NSO site. Noise attenuation factors (e.g., humidity, topography, and vegetation) vary greatly from site to site and do not tend to mitigate disturbance to birds nesting high in the canopy.

There is a gradient of potential outcomes to each stimulus ranging from not being detected to harassment (i.e., injury). The introduction of a foreign sight or sound stimulus may cause disturbance because the stimulus was not predictable and was perceived as a threat by NSOs. Human activity which exceeds the ambient levels for proximity, frequency, duration, or intensity may result in a disturbance response from NSOs.

In spite of these challenges, numerous avian studies suggest that disturbance can have a negative effect on nest site selection, fitness, productivity, or overall reproductive success (Swenson 1979, Tremblay and Ellison 1979, White and Thurow 1985, Andersen et al. 1989, Belanger and Bedard 1989, Long and Ralph 1998, Piatt et al. 1990, Henson and Grant 1991). Studies have shown that disturbance can also affect productivity through nest abandonment (White and Thurow 1985). The few studies that have examined NSO responses to several types of disturbance (helicopters, chainsaws, hikers) suggest that owl behavior can be disrupted by elevated noise levels. Disruption may be demonstrated by flushing, altered prey delivery rates of adults to their young and decreased prey handling behavior (Delaney et al. 1999, Delaney and Grubb 2001, Swarthout and Steidl 2001 and 2003). In addition to flushing or other obvious behavior responses, NSOs may exhibit no outward behavioral response but still be physiologically responding to disturbances by secreting stress hormones called corticosteroids (Hayward et al. 2011).

Exposure to disturbances that causes a change in NSO behavior can increase predation risks. Flushing may increase the likelihood of predation or injury through the advertisement of the nest’s location or premature departure of a nestling from a nest. Predation by raptors, corvids, and other owl species is thought to be the largest cause of NSO mortality (Forsman et al. 1984 and 2002, Layman 1985, and Verner et al. 1992). Human presence alone in some instances may attract corvids. For example, Forsman et al. (1984) recorded an incident in which ravens...
attempted to predate a nest after survey efforts called the female out of the nest cavity during the day.

In addition to flushing or other obvious behavior responses, NSOs may exhibit no outward behavioral response but still be physiologically responding to disturbances by secreting stress hormones called corticosteroids (Hayward et al. 2011). Although these hormones are essential for survival, extended periods with elevated stress hormone levels may have negative effects on reproductive function, disease resistance, or physical condition (Saplosky et al. 2000). The quantity, glucocorticoid metabolites (fGCs) in feces can be used as a noninvasive measure of physiological stress (Wasser et al. 1997, Wasser and Hunt 2005). Recent studies of fGC levels in NSOs indicate that low intensity noise of short duration and minimal repetition does not elicit a physiological stress response, while acute exposure to vehicle noise generally increased fGCs in the short term. However, prolonged activities, such as those associated with timber harvest, may increase fecal corticosteroids depending on the proximity of the proposed action to NSO core areas (Wasser et al. 1997, Tempel and Gutiérrez 2004, Hayward et al. 2011). Males showed the highest glucocorticoid response to noise disturbance generated in May when they were typically solely responsible for feeding themselves, their mates and their nestlings (Hayward et al. 2011). These studies also indicate that NSO sensitivity varies with stimulus distance, location (aerial or ground), type, and timing of activities, as well as differences in individual NSOs’ responses (Delaney et al. 1999, Delaney and Grubb 2001, Swarthout and Steidl 2001 and 2003, Tempel and Gutiérrez 2003). Negative effects to individual NSO fitness from prolonged elevated stress hormones include many adverse effects such as reduced survival, reduced reproduction, or inability to forage successfully and provide for young.

Disturbance is any potential auditory or visual stimuli or deviation from ambient/baseline conditions an individual bird, at a given site, is likely to detect and potentially react to; however, this does not denote an ESA effects threshold. Harassment is defined [50 CFR §§ 17.3] as "an intentional or negligent act or omission which creates the likelihood of injury by annoying it to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering." FWS interprets a disturbance response to be equivalent to an individual NSO showing apparent recognition or avoidance of the sight or sound by hiding, defending itself, moving its wings or body, or postponing a feeding visit to its young, and is below the level of harassment. Harassment is primarily linked to situations where birds are unable to avoid the disturbance without increasing the likelihood of critical energy expenditure, accidents, or vulnerability to predation. For NSOs, this primarily equates to birds that are nesting or have dependent young.

Examples of harassment include:

• Adult NSO aborts a feeding visit such that the young does not receive the prey item;
• Flushing an adult or juvenile from an active nest during the reproductive period;
• Precluding adult feeding of the young for a daily feeding cycle.

FWS interpretation of the available data on NSO and appropriate surrogate species indicates the above behaviors may manifest when:
• The action-generated sound level substantially exceeds (increased by 20-25 decibels above) ambient conditions;
• The total sound level, including the combined existing ambient and action-generated sound, is very high (exceeds 90 decibels);
• The visual proximity of human activities occurs very close to an active nest site; or
• Sound levels of lesser amplitude or human presence at farther distances from active nests have the potential to disturb these species, but have not been clearly shown to cause behaviors that meet the definition of harassment (USDI FWS 2006).

6.2.2 Effects to NSO from Disturbance (smoke, heat, or noise) or Habitat Modification in the Breeding Season

The BA indicated most treatment types may cause noise and smoke levels to be increased above ambient levels. Because the majority of these treatments occur within 0.25 mile of suitable NRF habitat during the NSO breeding season, they have the potential to affect NSO breeding success by causing loud and continuous noise disturbance and/or smoke disturbance to NSO.

Although it has not been conclusively demonstrated, it is anticipated that nesting NSOs may be negatively affected by heat and smoke intrusion into the nest grove, as can be caused by prescribed burning. Smoke and heat may disturb nesting NSOs or their young by causing them to avoid important foraging areas or flee the nest area prematurely, thereby reducing fitness and increasing the probability of predation. When radio-tracking NSOs during the 1994 fire season on the Yakama Indian Reservation, Bevis et al. (1997) noted that post fire locations appeared to shift outside of the fire area; however, adult and juvenile NSOs were recorded within their territory during July, even when low intensity ground fire and thick smoke were present. They concluded that smoke alone did not drive NSOs off of their territories (Bevis et al. 1997); however, these findings could indicate the reluctance of adults and young to leave their territories during the early nesting season regardless of potential physiological effects.

No information was provided in the BA on the intensity or duration expected for elevated smoke levels. The FWS expects intensity to be low due to prescriptions designed to keep burn severity in the low to moderate range and duration to be fairly short (a few weeks). Additionally, project design criteria restrict the burns to outside of the NSO breeding season unless protocol surveys determine NSO are in non-nesting status that season. Smoke may cause disturbance, but that disturbance is not expected to rise to the level of harassment.

Most treatments in the proposed action have the potential to increase noise above ambient levels in the action area that could rise to levels that may disturb nesting NSOs and their young. By comparing the descriptions of treatments in the BA to the FWS’s most recent guidance on noise disturbance (USDI FWS 2006) we determined that the majority of the action area may experience levels well above (>25 decibels) ambient during implementation of the proposed action. Ambient and noise generated by the proposed action collectively lead to exposure levels ranging from high (81-90 decibels) to extreme (101-110 decibels). The use of equipment such as chainsaws, tractors, yarding systems, and helicopters all have the potential to generate loud noise that can alter normal breeding behaviors. When these operations using noise generating equipment occur during the time period and in a place that could potentially impair essential
behavior patterns of NSOs related to breeding, feeding, or sheltering harassment can occur. The potential for disturbance to rise to the level of harassment is mitigated where the LOPs restrict operations to outside of the breeding season.

Ground-based and cable yarding harvest equipment as well as heavily used haul routes have a high intensity effect level, while hand or mechanical thinning in fuels units is relatively low intensity. According to the BA, noise elevations above ambient levels usually occur during the daytime hours over the span of a few days. In some situations, the noise could last for a longer duration (i.e. weeks) because of the position of the treatment and the number of acres being treated. The FWS expects noise disturbance will occur to nesting NSOs for activities using chainsaws, various yarding systems, and repeated use of major haul routes that are within 0.25 mile distance of NRF habitat. Noise disturbance to nesting NSOs beyond 0.25 mile distances from treatment units and major haul routes may occur due to flight paths and staging areas associated with helicopter use.

The other treatment that occurs both within and adjacent (within ¼ mile) to NRF with no LOPs or surveys prior to operations is roadside hazard tree removal along ingress / egress roads. These comprise 118 miles of the 320 total miles (about 37 percent) of roads proposed for treatment. The BA (table 12, p. 69) summarizes the total amount of noise disturbance from the roadside hazard tree removal units along ingress/egress roads that will occur within the breeding season while surveys are done concurrently. Acres of habitat modification during the breeding season were not quantified for each NSO site, but across the action area there may be up to 8,300 acres of low or very low severity burned NRF habitat degraded. The BA indicates 2,230 acres of NRF within the cores of up to 27 NSO sites may be subject to breeding season disturbance from ingress/egress roadside hazard tree removal that occurs prior to any survey visits (table 12, p. 69). There are additional acres of roadside hazard in unburned NRF habitat addressed; however, based on revised PDFs (see table 1.2 in appendix A) FWS does not expect these areas to receive treatment. The BA did not quantify NRF in home ranges of the 85 sites that may be subject to breeding season disturbance. FWS used GIS spatial data that accompanied the BA to review the potential for ingress/egress roadside hazard tree removal in home ranges to disturb nesting NSO. There is uncertainty in nesting locations, NSO site locations, and core placement due to only one year of surveys and potential shifts from fire. In some instance treatments in home ranges (outside of cores) were considered likely to disturb nesting NSO.

Rather than using distance estimates for specific activities, a 0.25 mile buffer was applied along all the roadside treatment units without LOP’s to generate estimated acres of NRF disturbed. The BA notes that the estimates are likely an overestimate of the disturbance because not all NRF habitats would be occupied in any given year. The specific disturbance in each NSO site was also evaluated in more detail in the BA and described qualitatively (table 17, p. 85) unless habitat modifications had already triggered a likely to adversely affect outcome (table 16, p. 83). The majority of treatment types have at least portion of their activities occurring within 0.25 miles of NRF habitat within the NSO breeding season and have the potential to affect NSO breeding success (BA, p. 64). The BA also states, “Generally these effects are a result of project implementation acting directly in NRF habitat where individuals may reside. For example, if the smoke from a prescribed burn irritates an individual animal or when noise flushes an individual from its nest” (BA, p. 63). The noise disturbance will usually occur during the daytime hours and
have a duration limited to a few days. In some situations, the noise could last for longer durations (weeks) because of the position of the treatment and the number of acres being treated (BA, p. 64). See section 6.3.2 “Effects to Individual NSO Sites” for more detail on where habitat modification and disturbance during the breeding season may occur to the level that take of NSO pairs and NSO young was reasonably certain to result from the proposed action.

There was conflicting information on the survey strategy and related LOPs between BA analysis of disturbance during breeding season (pp. 64-69) and information supplemental to the BA received August 17th (section 1, of appendix A). There was also information that appeared to conflict within different portions of the information supplemental to the BA (summary 1.1 versus table 1.2 in section 1 of appendix A). FWS assumptions are based primarily on summary 1.1 of the information supplemental to the BA and the discussion in the BA. We relied on revised PDF1 only to identify areas referred to as exceptions to the overall survey strategy (commercial salvage units: S005-9-1, 22, 23, 23-15, 23-16, 23-17, 23-18, 23-19, 23-30, 51, 52, 56-1-1, 56-2, 58, 059, 520, 521, 523, 524, 525-1, and 525-2 and all roadside hazard tree removal along 118 miles of ingress / egress roads).

In sum, we assumed roadside hazard tree removal along all ingress/egress roads and the twenty-one commercial salvage unit exceptions (see list of units above) could occur prior to any NSO survey visits in the year of implementation at any time during the breeding season. All other treatments would occur after three survey visits in the year of implementation. If the three survey visits are not done, no operations will occur prior to July 9th. If the three surveys fail to detect NSOs operations may begin at an earlier date. If NSO are detected during operations (within or adjacent to units) operations would cease until nesting status could be determined or until after July 9th. If nesting is known or suspected the July 9th LOP would be extended to September 15th. The BA states, “Nesting status is typically determined by the end of June using protocol methods or the visual confirmation of offspring, so there is no expected gap in the LOP for nesting owls” (p. 67). The supplemental information to the BA (see summary 1.1 in section 1 of appendix A) provides further basis for KNF decision to use the July 9th (noise only LOP) rather than September 15th standard LOP for modification of NRF habitat and states “Given the timeline of surveys completed in 2015 [in the action area], we expect to have at least 5 surveys completed prior to July 9th, thus possibly giving us enough information to determine nesting status.”

6.3 Effects to Individual NSO Sites

6.3.1 Analytical Approach for Effects to Individual NSO Sites

The effects of the proposed action will compound the habitat modifications caused by the wildfires (see section 5 “Environmental Baseline”). Harvest by the proposed action that removes or downgrades NRF habitat may preclude or significantly delay (80-300 years) the re-development of complex NSO habitat and post-fire recovery of late successional reserves and other areas expected to support NSO (critical habitat). Significant reductions in post-fire foraging opportunities (see appendix B) are also expected to result in reductions in fitness or impairment of essential NSO life history functions at some sites.

There are numerous factors that influence NSOs following significant disturbance events such as
those seen from the 2014 fires. NSO response to the changes brought about by these events related to site specific factors, such as habitat availability, prey population response, displacement and relocation of neighboring NSOs, competition for resources, and the presence of barred owls, is complex and not easily predicted. As a result, how these events impact individual NSOs is not fully understood. NSOs have high site fidelity and there may be a time lag before shift of a core use area and/or expansion of their home range occurs.

An additional factor limiting our understanding of NSO status and distribution in the action area is the paucity of recent survey data. The majority of the action area was surveyed six times in 2015. Prior to that, surveys in the action area were limited to small projects and were spaced apart in time and location. Survey records indicate less than 25 percent of sites in the action area had been surveyed for more than two years (BA, appendix C, p. 140). The limited survey data however suggests that between 2005 and 2014 the action area supported high NSO densities and high occupancy rates. The BA indicates that in 2015 NSOs were detected at 17 sites (BA, table 9, p. 60). The 2015 survey results include NSO detections at least three NSO sites (KLNew 3A/New3B - East Walker Creek, KL0283 - Doggett Creek, and KL1041 - Music Creek) that had high proportions of moderate to high severity fire across the core or home range. Similar observations of NSO use of post fire landscapes was also observed with California spotted owls (Strix occidentalis occidentalis; CSO) following the 2013 Rim fire (Rim Fire BA, USDA 2014).

As mentioned previously, from 2005 to 2014 the occupancy rate of the action area by NSOs was relatively high. To deal with the uncertainties related to current NSO post fire occupancy in the action area in an objective fashion, KNF and FWS biologists ranked each NSO site using RA 10 values which are based on the amounts and quality of habitat within NSO cores and home ranges (see Conserving NSO Sites and High Value Habitat, section 3.3).

The team also developed a systematic approach to determine the effect level the proposed action will have on each NSO site, either falling at or below insignificant and discountable effects (NLAA) or adverse effects (LAA). The analysis used specific, measurable characteristics related to the amount (acres of habitat), quality (habitat type), and distribution (core and home range) of habitat and is described in the BA (pp. 82-93 and tables 15 to 19).

Each NSO site was individually reviewed by KNF and FWS.
1) A series of biologically relevant yes/no questions referred to as “intensity factors” (‘intensity factor evaluation’), and/or
2) An intensity factor evaluation in combination with a site-specific review referred to as a ‘site specific evaluation’.

The intensity factor evaluation incorporated information on habitat quantity, quality, and distribution as it may meet the needs of reproductive NSO pairs. Using these habitat data coupled with relevant research, effects determinations from the proposed actions in each NSO site were made. The BA states that these yes/no intensity factor questions relate to biologically important minimum levels of habitat, NSO fitness, and NSO reproduction. The FWS agrees with the results of this evaluation for the majority of NSO sites. See pp. 82-84 of the BA for a more complete description of the intensity factor evaluation process. Section 6.3.2 below outlines and describes
the criteria and information used by the FWS in our independent analysis to determine the significance of the effects of the proposed action and the likelihood of take for each NSO site.

6.3.2 Effects to NSO sites in the action area from the proposed action

This information is intended to provide descriptive rationale for the FWS effects determinations for NSOs associated with NSO sites affected by the proposed action. The descriptive rationale in turn provides the basis for quantifying take of NSOs that is reasonably certain to occur: 1) at the time of implementation of the proposed action; or 2) after the proposed action and due to harm from reduced fitness of NSO caused by habitat modifications and habitat reductions resulting from the proposed action.

Though we will not repeat the definition of “RA10 prioritization” in each NSO site’s descriptive rationale below, we refer to it below to remind the reader of the conservation value of the affected sites. These prioritizations are defined as follows:

- **High RA10 value**: The NSO site is relatively intact post fire with no shift or home range expansion of the NSO site anticipated. These sites are reasonably likely to be occupied and expected to provide short-and long-term demographic support to the NSO population in the action area.

- **Moderate RA10 value**: The NSO site was subjected to fire that reduced the quality, availability and distribution of habitat such that a shift of the NSO core use area or home range expansion could occur. We assume that these sites are reasonably likely to be occupied and would continue to provide short-and long-term demographic support to the NSO population in the action area.

- **Low RA10 value**: The “reasonable likelihood” of occupancy for some of the sites identified as “low” may be difficult to determine. Based on the available information, for some sites, we can conclude a site is unlikely to support occupancy at the historical NSO site during proposed action implementation due to insufficient amounts of habitat to support a resident pair. In those cases, habitat has been reduced from past actions, the amount, extent and severity of the 2014 fires, or a combination of fire and recent salvage harvest on private land. Due to limited amounts of habitat they are much less likely to provide demographic support to NSOs in the action area. In other cases, adverse effects were determined to occur if there was insufficient information to conclude that impacts were insignificant or discountable, or if there was more uncertainty whether “low” sites could be occupied in the short term.

**Assumptions**

Some information in our rationale may differ from data or conclusions presented in the BA. For example, the FWS relied on the final GIS spatial data (received July 10, 2015) that preceded the final BA, CNDDB, CAL FIRE, and/or adjacent non-Federal landowners survey results that were either not used or not available to the KNF at the time of BA development. These data may have updated the ‘year last detected’ field reported in the BA appendix C, reported herein as “year last observed”. This information does not imply that surveys were conducted since the years last observed, rather, it provides the reader with an understanding of all recent NSO detections based
on available survey data. Survey efforts prior to 2015 were highly variable across the action area, in space and time, and 2015 surveys were not conducted to full protocol in all areas.

For the purposes of these rationales, the following abbreviations or terms are used: NRF = Nesting, roosting, and foraging habitat, PFF1 = post-fire foraging 1 habitat, and FANR = fire-affected nesting and roosting habitat. For simplicity, unless specifically indicated, the term “habitat” was used when referring to scenarios where all forms of habitat are affected by the action. “Nest stand” refers generally to a 100 acre circle around the NSO site which encompasses the best available NRF habitat containing known nest(s). NR and F were lumped because a remotely sensed vegetation layer (EVEG) was used for this consultation which cannot distinguish between these two habitat types with a high degree of accuracy. FANR was similarly included in estimates of NRF below due to the highly variable effects of moderate severity fire and because these areas may contain more large snags than F burned at moderate severity. However, across the 277, 720 action area only 203 acres of FANR are removed. At the scale of individual cores and home ranges very minimal amounts of FANR are affected.

KNF and FWS assumed that the majority of NSO foraging in more severely burned habitat would occur within the diffuse edge (defined in this consultation as within 500 feet of lower severity burned, intact NRF stands). Although, removal of PFF2 influences future development of NSO habitat, it was believed to have minimal effects to present day NSOs due to limited use of the interior of large patches of high severity fire (see appendix B). Therefore, although effects to PFF2 were quantified across the action area, PFF2 removal was not addressed at the scale of individual NSO sites in the BA. KNF and FWS biologists agreed that within NSO cores and home ranges, the impacts of PFF1 removal were much greater than impacts of PFF2, due to the relative value of each habitat type (described in Section 5.1.2).

Reference herein is made to “recommended habitat minimums”. This pertains to the generalized analytical approach used in evaluating a site’s core area and home range habitat composition. Refer to section 6.1.1 above.

Through the PDFs, the KNF has minimized the potential for harm from falling occupied NSO nest trees or noise disturbance to nesting NSOs, but not fully avoided it. We assumed nesting would occur in the first year of operations where NRF habitat is proposed for treatment, or where NRF habitat occurs within 0.25 mile of treatment. In these areas, there is the potential for project effects to young NSOs from both the falling of nest trees and noise disturbance that alters the normal nesting behaviors of adult NSOs. Subsequent years of implementation of the proposed action will implement protocol surveys in order to determine NSO nesting status, and will apply a September 15th LOP if nesting NSOs are located. Therefore, in subsequent years of project implementation we assume young will not be affected.

Based on data from nearby demographic study areas, productivity (young per pair) was estimated at approximately 1.0 (to be 0.4 in the nearest Oregon study area (Hollen et al., 2015, Franklin et al. 2015). For the purposes of describing the take of young in each NSO site descriptive rationale we estimate this to be up to one young per pair. The take of up to one young is reasonably certain to occur at 10 NSO sites in the Whites fire area and at 19 NSO sites in the Happy Camp complex fire area where operations are proposed during the first breeding season without breeding season
restrictions. The final estimate of 29 young was then multiplied by NSO productivity rates to estimate take of young at the action area scale because not all NSO pairs would be nesting in any given year and because breeding season operations without prior NSO surveys are only planned in 2016. Based on this methodology of calculating nesting and young produced we determined that breeding season operations overall could result in the take of 12-29 young NSOs.

Due to the scope and scale of non-Federal harvest, cumulative impacts affecting specific NSO sites in the Beaver fire area is addressed within this section. For the Whites and Happy Camp complex fire areas we discuss non-Federal actions in section 7, Cumulative Effects.

**Sites at which NSO are not affected by the action**

The KNF has determined that the five sites listed below will not be affected by the proposed action. In these NSO sites, the proposed action occurs outside of NSO habitat and is located over 0.25 miles from NRF habitat

**Happy Camp Complex Fire Area**

- KL0229 - Stanza Creek 1.
- KL 1117 - Rancheria Creek.
- KL 1164 - no name provided.
- KL0096A - Lower South Fork Kelsey Creek.

**Beaver Fire Area**

- KL4128 – Lime gulch.

**White Fire Area**

KNF determined that all 15 NSO sites within this fire may be affected by the proposed action.

**NLAA Rationale**

In general, the following criteria were used to determine insignificant or discountable effects. Insignificant effects relate to the size of the impact and should never reach the scale where take occurs. Discountable effects are those extremely unlikely to occur. Some sites may be insignificant and discountable; some may just be insignificant. We determined of the NSO sites we evaluated that 20 NSO sites would be subjected to either insignificant or discountable effects due to the proposed action. Effects that we determined were either insignificant or discountable include; habitat modification is not proposed in the nest stand, operations will not occur in the breeding season in areas likely to be used by nesting NSO, and will occur in conjunction with one of the following:

a) Treatments in suitable habitat are not extensive, the core and home range of the NSO site are above recommended NRF habitat minimums post-fire and will remain so after implementation of the proposed action; or

b) The core and home range of the NSO site are below recommended NRF habitat minimums, but treatment units that remove, downgrade, or degrade NRF habitat and PFF1 are very limited in size, or occur in areas with a low likelihood of NSO use (e.g. prominent ridgeline, elevations above 5,800 feet, are separated by significant topographic features from core areas, outer edge of home range); or
c) The quantity of NRF and PFF1 habitat is very limited such that it is unlikely the site can support occupancy of resident NSOs.

**Beaver Fire Area----------**

**KL0254 – Woodchopper Gulch**

- The NSO site RA10 value is low. NSOs were last observed at this site in 1998. The site has very low amounts of NRF habitat in the core and home range due primarily to past harvest, effects of 2014 fires, and recent private land salvage.
- Habitat modification is not proposed in the nest stand. All actions within or adjacent to NRF habitat are restricted to outside of breeding season. The core and home range of the NSO site are below recommended NRF habitat minimums, but treatment units that remove, downgrade, or degrade are very limited in size or occur in areas with a low likelihood of NSO use. Cumulative effects are not anticipated because available information indicates emergency salvage is complete in this area; therefore, the effects at this site are insignificant or discountable.

**KL0284 – Bear Creek 2**

- The NSO site RA10 value is moderate. NSOs were last observed at this site in 2009, but we lack sufficient surveys to conclude it is unoccupied. The site has sufficient NRF habitat to support a pair of resident NSOs.
- Habitat modification from the action is not proposed in the nest stand. All actions within or adjacent to NRF habitat will occur outside of the breeding season. The core and home range of the NSO site are below recommended NRF habitat minimums, but treatment units that remove, downgrade, or degrade NRF and PFF1 habitat are very limited in size or occur in areas with a low likelihood of NSO use. Cumulative effects are very minimal because only seven acres of NRF habitat occurs in the area where private lands overlap the home range; therefore, the effects from the proposed action are insignificant or discountable.

**KL0315 – West Fork Beaver Creek**

- The NSO site RA10 value is high. NSOs were last observed at this site in 1998, but the site lacks sufficient surveys to conclude it is unoccupied. The site has sufficient NRF habitat to support a pair of resident NSOs.
- Habitat modification is not proposed in the nest stand. All actions within or adjacent to NRF habitat are restricted to outside of the breeding season. Cumulative effects may remove 64 acres of NRF habitat. The core and home range of the NSO site are above recommended NRF habitat minimums post-fire and will remain so after implementation of the proposed action and cumulative effects; therefore, the effects of the proposed action are insignificant or discountable.

**KL0322 – Windy Camp**

- The NSO site RA10 value is high. Survey results were not provided for this site either in BA, appendix C (. 140) or additions to appendix C sent in August 2015, in appendix A of this BO (see comment and response 21). Based on habitat availability, occupancy of this site is reasonably likely.
• Habitat modification is not proposed in the nest stand and all actions within or adjacent to NRF habitat will occur outside of breeding season. The core and home range of the NSO site are above recommended NRF habitat minimums post-fire and will remain so after implementation. There are no cumulative effects anticipated because the core and home range do not overlap any portion of the fire perimeter (BA table 18, p. 91); therefore, the effects of the proposed action are insignificant or discountable.

**KL4129 – Cherry Flat**

- The NSO site RA10 value is low, and the only year NSOs were detected at this site was in 1991 despite intermittent surveys. The site has very low amounts of NRF habitat in the core and home range due primarily due to past harvest and effects of 2014 fires; therefore, it is not reasonably likely this activity center is or could be occupied during the life of the project.
- Habitat modification is not proposed in the nest stand. All actions within or adjacent to NRF habitat will occur outside of breeding season. The core and home range of the NSO site are far below recommended NRF habitat minimums. The proposed action downgrades three acres of NRF habitat; therefore, the effects of the proposed action are insignificant.

**KL2124 – Dona Creek**

- The NSO site RA10 value is moderate. The survey history in BA, appendix C indicates the site had NSO detections in 2003, but there are detections from private landowners as recently as 2013 assigned to this site. NSO detections after 2001 are all over 1.5 miles to the southwest in section 30 rather than in section 20 where KNF analyzed the NSO site. The two alternate locations for **KL2124 (SIS0339)** were reviewed closely by FWS in October 2011, and we determined the site in section 20 was likely to be unoccupied during the implementation of two current THPs (2-11-085-SIS and 2-012-087-SIS). In conclusion, the site has sufficient NRF habitat to support a pair of resident NSOs, but long term surveys indicate the site within section 20, adjacent to the KNF project, is not likely occupied.
- Habitat modification is not proposed in the nest stand and operations will occur outside of the breeding season. The proposed action downgrades about 15 acres of NRF habitat in the home range to below recommended habitat minimums. Two current THPs have potential cumulative effects for the site in section 20, but we confirmed with the timber company that the units within this core and home range have already been harvested and there are no plans for emergency salvage in this vicinity. Consequently, no cumulative effects are expected. The NRF habitat reductions from the proposed action are limited in scope, affect very low quality habitat, and occur adjacent to Highway 96 in areas NSOs likely avoid, in addition, the site is likely unoccupied. Therefore, the effects of the proposed action are insignificant or discountable.
Happy Camp Complex Fire Area

**KL0245 – Bear Creek**
- The RA10 value for this site is moderate and supported pairs and nests from 1992 to 1996, but we lack sufficient surveys to conclude it is likely unoccupied. The site has sufficient habitat to support a pair of resident NSOs.
- Habitat modification is not proposed in the nest stand and actions within or adjacent to NRF habitat will occur outside of breeding season. The core and home range of the NSO site are below recommended NRF habitat minimums, but treatment units that remove, downgrade, or degrade are very limited in size or occur in areas with a low likelihood of NSO use. Therefore, the effects of the proposed action are insignificant or discountable.

**KL0247 – Kelsey Creek**
- The RA10 value for this site is high. NSOs were last observed at the site in 2012. Thus, this NSO site is likely to be occupied during the ten years of project implementation.
- Habitat modification is not proposed in the nest stand and all actions within or adjacent to NRF habitat will occur outside of breeding season. The core and home range of the NSO site are below recommended NRF habitat minimums, but habitat effects are very limited or occur in areas with a low likelihood of NSO use; therefore, the effects of the proposed action are insignificant or discountable.

**KL0252 – Negro Creek**
- The RA10 value for this site is low; the site contained very little NRF habitat pre-fire. NSOs were last observed at the site in 2003.
- Habitat modification is not proposed in the nest stand and all actions within or adjacent to NRF habitat will occur outside of the breeding season. The core and home range of the NSO site are below recommended NRF habitat minimums, but habitat modification is very limited or occurs in areas with a low likelihood of NSO use; therefore, the effects of the proposed action are insignificant.

**KL0567 – Cade Creek**
- The RA10 value for this site is high. NSOs were last observed at the site in 2006, but the site lacks sufficient surveys to conclude it is unoccupied. The site has sufficient NRF habitat to support a pair of resident NSOs.
- Habitat modification is not proposed in the nest stand and all actions within or adjacent to NRF habitat will occur outside of breeding season. The core and home range of the NSO site are below recommended NRF habitat minimums, but the action proposes to downgrade only two acres of NRF habitat in the outer portion of the home range; therefore, the effects of the proposed action are insignificant or discountable.

**KL1101 – Cliff Valley**
- The RA10 value is high. NSOs were last observed at the site in 1994, but the site lacks sufficient surveys to conclude it is unoccupied. The site has sufficient NRF habitat to support a pair of resident NSOs.
• Habitat modification is not proposed in the nest stand and all actions within or adjacent to NRF habitat will occur outside of breeding season. The core and home range of the NSO site are above recommended NRF habitat minimums and will remain so after implementation; therefore the effects of the proposed action are insignificant or discountable.

**KL1119 - North Fork Rancheria Creek**

• The RA10 value for this site is high. NSOs were last observed at the site in 1989, but the site lacks sufficient surveys to conclude it is unoccupied. The site has sufficient habitat to support a pair of resident NSOs.
• Habitat modification is not proposed in the nest stand and all actions within or adjacent to NRF habitat will occur outside of breeding season. The core and home range of the NSO site are below recommended NRF habitat minimums but the action proposes to downgrade only two acres of NRF habitat; therefore, the effects of the proposed action are insignificant or discountable.

**KL9993 - Stanza Creek 2**

• The RA10 value for this site is low. NSOs were last observed in 1991. The BA, appendix C indicates only singles are known from this site, but available data indicates it historically had a nesting pair. The core and home range contains limited NRF habitat due to the 2002 Stanza fire.
• Habitat modification is not proposed in the nest stand and all actions within or adjacent to NRF habitat will occur outside of breeding season. The core and home range of the NSO site are below recommended NRF habitat minimums, but habitat modification is very limited or occurs in areas with a low likelihood of NSO use; therefore the effects of the proposed action are insignificant.

**KL9999 – Fish Creek 2**

• The RA10 value for this site is moderate. NSOs were last observed at the site in 1990, but the site lacks sufficient surveys to conclude it is unoccupied. The site has sufficient habitat to support a pair of resident NSOs.
• Habitat modification is not proposed in the nest stand and all actions within or adjacent to NRF habitat will occur outside of breeding season. The core contains only 100 acres of NRF, and the home range is slightly below recommended NRF habitat minimums. However, the action proposes only the removal of one acre of PFF1 and the treatment/maintenance of six acres of NRF habitat in the outer portion of the home range in an area of low likelihood of NSO use; therefore, the effects of the proposed action are insignificant.

**KL0255 – Pat Ford Creek**

• The RA10 value for this site is moderate. NSOs were last observed at the site in 2001, but it lacks adequate surveys to conclude it is unoccupied. The site has sufficient habitat to support a pair of resident NSOs.
Habitat modification is not proposed in the nest stand. Table 20 in the BA is incorrect for this NSO site; spatial data indicate that proposed treatments will remove a very small amount of NRF habitat and will occur during the breeding season within 0.15 miles of NRF habitat (near Wooliver Creek). However, disturbance is highly improbable because operations are all along Scott River road which is a paved, experiences heavy use by vehicles and is a county road with higher than average ambient noise levels. The core and home range of the NSO site are below recommended NRF habitat minimums, but habitat modification is very limited in and or occurs in areas with a low likelihood of NSO use; therefore the effects of the proposed action are insignificant or discountable.

**Whites Fire Area**

**KL0257 - Upper West Fork Sixmile Creek**

- The RA10 value for this site is high. NSOs were last observed at the site in 2008, but the site lacks adequate surveys to conclude it is unoccupied. The site has sufficient habitat to support a pair of resident NSOs.
- Habitat modification is not proposed in the nest stand, and operations will occur outside of breeding season. The core and home range of the NSO site are above recommended NRF habitat minimums and will remain so post-treatment. Habitat modification is limited to areas of low likelihood of NSO use. Therefore, the effects of the proposed action are insignificant.

**KL0365 – no name provided**

- The RA10 value for this site is moderate. NSOs were last observed at the site in 2002, but the site lacks adequate surveys to conclude it is unoccupied. The site has sufficient habitat to support a pair of resident NSOs.
- Habitat modification is not proposed in the nest stand and operations will occur outside of breeding season. The core and home range of the NSO site are below recommended NRF habitat minimums, but habitat modification is very limited (four acres) and occurs in areas with a low likelihood of NSO use; therefore, the effects of the proposed action are insignificant.

**KL1028 – Shadow Creek**

- The RA10 value for this site is high. NSOs were last observed at the site in 2008, but the site lacks adequate surveys to conclude it is unoccupied. The site has sufficient habitat to support a pair of resident NSOs.
- Habitat modification is not proposed in the nest stand and no harm is anticipated because operations will occur outside of breeding season. The core and home range of the NSO site are slightly below recommended NRF habitat minimums but habitat modification is limited to areas of low likelihood of NSO use (major ridge at high elevation); therefore the effects of the proposed action are insignificant.
**KL1030B - Upper East Fork Whites Gulch**
- The RA10 value for this site is high, and NSOs were last observed at the site in 2015. Both of which suggest the site will continue to be occupied.
- Habitat modification is not proposed in the nest stand and operations will occur outside of breeding season. The core and home range of the NSO site are below recommended NRF habitat minimums but habitat modification is scattered, affects lower quality habitat, and is limited to areas of low likelihood of NSO use; therefore, the effects of the proposed action are insignificant or discountable.

**KL4026 - Lower West Fork Six mile Creek**
- The RA10 value for this site is moderate. NSOs were last observed at the site in 1991, but the site lacks adequate surveys to conclude it is unoccupied. The site has sufficient habitat to support a pair of resident NSOs
- Habitat modification is not proposed in the nest stand and operations will occur outside of breeding season. The core and home range of the NSO site are below recommended NRF habitat minimums, but habitat modification is very limited (three acres of NRF habitat downgrade in outer home range); therefore, the effects of the proposed action are insignificant or discountable.

**KL0239 – Buckhorn Creek**
- The RA10 value for this site is low. NSOs were last observed at the site in 1991.
- Habitat modification is not proposed in the nest stand and operations will occur outside of breeding season. The core and home range of the NSO site are below recommended NRF habitat minimums and the proposed action further reduces NRF habitat but these areas are linear, along roads and a prominent ridge, near the Klamath River. Cumulative effects are not anticipated because private lands salvage is not currently proposed in this area. The core and home range of the NSO site are below recommended NRF habitat minimums, but habitat modification is very limited; therefore, the effects of the proposed action are insignificant or discountable.

**KL4144 – Miller Gulch**
- The 10 value for this site is low, containing less than 500 acres of NRF habitat in the core and home range. NSOs were last detected at this site in 1994. 2014 fires and subsequent non-federal salvage operations have reduced the home range by about 250 acres of NRF habitat, suggesting that this site is not reasonably expected to be occupied.
- Habitat modification is not proposed in the historical nest stand and operations will occur outside of breeding season. The core and home range of the NSO site are below recommended NRF habitat minimums and the proposed action further reduces NRF habitat (about 18 acres) but these are not in areas of likely NSO use. Cumulative effects are not expected because private lands salvage appears to be complete in this area. Therefore, the effects of the proposed action are insignificant or discountable.
LAA No Take Rationale

Seventeen sites were determined to be adversely affected by the proposed action, but take is not reasonably likely to occur. Adverse effects are determined from a variety of factors but in some cases these impacts are not expected to cause significant impairment of essential behavioral patterns such as breeding, feeding, or sheltering to the point where it actually kills or injures NSO. Our analysis of the proposed action indicates that adverse effects to NSOs will occur due to habitat modification, but the habitat modification is not extensive, or intensive, to the level where we would expect take of NSOs to occur. In general, adverse effects are anticipated because of one or more of the following:

1) The core and home range of the NSO site are above recommended NRF habitat minimums and will remain so post-treatment. Treatments that remove, downgrade, or degrade NRF or PFF1 habitat are not insignificant and occur in areas associated with NSO use.

2) The core and home range of the NSO site are above recommended NRF habitat minimums post-fire and the proposed action is anticipated to reduce NRF habitat below recommended habitat minimums. Treatment units that remove, downgrade, or degrade NRF or PFF1 habitat do not occur in areas associated with NSO use.

3) The core and home range of the NSO site are below recommended NRF habitat minimums and the proposed action further reduces NRF or PFF1 habitat at a scale that is not insignificant or discountable. Treatment units that remove, downgrade, or degrade suitable habitat are limited in size and not occur in areas associated with NSO use.

4) The core and home range of the NSO site are above recommended NRF habitat minimums and the treatments proposed will remove PFF1 habitat at a scale that is not insignificant. Such treatments will create large openings and will reduce the availability of edge habitats created by mixed severity fires at a scale that could negatively impact quality of remaining NRF habitat such that NSOs may adjust their foraging behavior.

Beaver Fire Area

KL0346 / KL 4146 – Kohl Creek 1 and 2:

- The RA10 value for these two alternate sites is low. NSOs were last observed in 2010. Neither site is likely to be occupied by resident NSOs because habitat is severely limited in both cores and home ranges due to fire and private land salvage logging.

- Habitat modification is not proposed in the nest stands. Operations will not occur before July 9th unless a minimum of three survey visits in the year of operation fail to detect NSOs. If NSOs are detected on survey visits three to six operations will cease until nesting status can be determined. NSOs suspected or known to be nesting will have additional protections (BA, p. 64)

- The cores and home ranges of both NSO sites are well below recommended habitat minimums due to fire and salvage. The proposed action will further reduce NRF habitat along watercourses in areas of likely NSO use. Cumulative effects from harvest on non-Federal lands will further reduce habitat in the home range.

- Adverse effects will occur. However, we cannot be reasonably certain take will result from the proposed action due to a low likelihood the site is occupied.
**KL0499 – Dead Cow Creek:**

- The RA10 value for this site is high. The BA indicates NSOs were last detected at the site in 1997, but private landowners recorded detections in 2012. There were also detections in 2015, 1.1 miles to the north from historical site center but it is unclear if they are associated with this site or constitute a new site. Based on current NRF habitat amounts and configuration the site is likely occupied by a resident NSO pair.
- Habitat modification is not proposed in the nest stand. Operations will not occur before July 9th unless a minimum of three survey visits in the year of operation fail to detect NSOs. If NSOs are detected on survey visits three to six operations will cease until nesting status can be determined. NSOs suspected or known to be nesting will have additional protections (BA, p. 64).
- The Beaver fire only impacted the very southeastern edge of the home range. The core of the NSO site is very close to recommended NRF habitat minimums while the home range is above. The proposed action includes the removal of one acre of NRF habitat at the edge of the home range along a ridge. Cumulative effects are expected from the Pipeline THP (2-14-089-SIS). The Pipeline THP proposes the removal of about 120 acres of foraging habitat. FWS reviewed this THP and determined the core and home range would contain sufficient NRF habitat post-implementation to support a resident pair of NSOs. The NRF habitat reduction by the proposed action is on the outer edge of the home range and further than 1.3 miles from the most recent NSO detections. The core may be below recommended NRF habitat minimums after the proposed action and cumulative effects, but the home range will likely remain above.
- Adverse effects will occur. However, we cannot be reasonably certain take will result due to the scope and scale of impacts from the proposed action and cumulative effects.

**KL4145 – Doggett Creek:**

- The RA10 value for this site is low and NSOs were last observed at the site in 2004. The site has severely limited amounts of NRF habitat in the core and home range due primarily to past harvest, effects of 2014 fires, and recent private land salvage. The site is not likely to be occupied by resident NSOs.
- Habitat modification is not proposed in the nest stand. Operations will not occur before July 9th unless a minimum of three survey visits in the year of operation fail to detect NSOs. If NSOs are detected on survey visits three to six operations will cease until nesting status can be determined. NSOs suspected or known to be nesting will have additional protections (BA, p. 64).
- The core and home range of the NSO site are below recommended NRF habitat minimums and the proposed action further reduces NRF habitat. The proposed action will downgrade about 20 acres and degrade about 30 acres of NRF habitat. The BA indicates the proposed action includes roadside modified and roadside hazard tree removal in core and three fuels treatments (FMZ, WUI, and roadside complete) in the home range. Cumulative effects are not expected because private lands salvage appears to be complete in this area.
- Adverse effects will occur. However, we cannot be reasonably certain take will result from the proposed action due to a low likelihood the site is occupied.

**KL99914 – Buckhorn Gulch:**
• The RA10 value for this site is low and NSO detections were last reported at the site in 2003. The site is not likely to be occupied by resident NSOs because NRF habitat is severely limited in both cores and home ranges due to the combination of large patches of high severity fire and private land salvage logging.

• Habitat modification is not proposed in the nest stand. Operations will not occur before July 9th unless a minimum of three survey visits in the year of operation fail to detect NSOs. If NSOs are detected on survey visits three to six operations will cease until nesting status can be determined. NSOs suspected or known to be nesting will have additional protections (BA, p. 64). The core and home range of the NSO site are well below recommended NRF habitat minimums and the proposed action will further reduce NRF habitat by about 25 acres along watercourses (high NSO use). There are also fairly extensive cumulative effects which will result in an additional reduction of 15 percent of the current NRF and PFF1 habitat.

• Adverse effects will occur. However, we cannot be reasonably certain take will result from the proposed action due to a low likelihood the site is occupied.

Happy Camp Complex Fire Area

KL0272 – Tom Martin:

• The RA10 value for this site is high. NSOs were last observed at the site in 1992, but the site lacks adequate surveys to conclude it is not occupied. Current habitat amounts and habitat configuration indicate the site is likely to be occupied by a pair of resident NSOs.

• Habitat modification is not proposed in the nest stand. There are no documented nesting attempts at this NSO site. Several small commercial salvage units located on the edge of home range as well as use of major haul routes, construction and use of helicopter landings, and overhead helicopter flights will occur during the breeding season prior to the completion of any survey visits. The BA estimates about five days of noise disturbance (table 17, p. 85). Surveys will be done concurrent with operations. If NSOs are detected operations will cease until nesting status can be determined. NSOs suspected or known to be nesting will receive additional protections (BA, p. 64).

• NRF habitat in this NSO site’s core and home range was minimally affected by moderate to high severity fire. The core is slightly below recommended NRF habitat minimums and no habitat modification occurs in the core. The home range is above recommended NRF habitat minimums and no NRF habitat is affected by the proposed action. PFF1 removal (about 40 acres) occurs adjacent to areas of high NSO use based on abiotic factors, but is well outside the core on the outer edge of the home range.

• Adverse effects will occur. However, no nesting attempts have been documented at this site, there are no known barred owls influencing NSO detections, and the majority of the noise disturbance occurs outside of the core. Therefore, we cannot be reasonably certain take will result from the proposed action.
**KL0277 - Bishop Creek / Titus Peak:**

- The RA10 value for this site is high. NSOs were last observed at the site in 2003, but the site lacks adequate surveys to conclude it is unoccupied. Current NRF habitat amounts and habitat configuration indicate the site is likely to be occupied by a pair of resident NSOs.
- Habitat modification is not proposed in the nest stand. Operations will not occur before July 9th unless a minimum of three survey visits in the year of operation fail to detect NSOs. If NSOs are detected on survey visits three to six operations will cease until nesting status can be determined. NSOs suspected or known to be nesting will receive additional protections (BA, p. 64).
- The fire had minimal effects on NRF habitat. Adverse effects will occur because the core and home range of the NSO site are below recommended NRF habitat minimums and the proposed action reduces NRF habitat by two percent (25 acres). About 15 acres of NRF are degraded in the home range.
- Adverse effects will occur. The NRF habitat downgraded and degraded is located in areas of higher likelihood of NSO use based on abiotic factors. However, due to the small amount of NRF habitat affected (40 acres), we cannot be reasonably certain take will result from the proposed action.

**KL0278A – Doolittle Elk 1:**

- The RA10 value for this site is moderate. NSOs were last observed at the site in 2002, but the site lacks adequate surveys to conclude it is unoccupied. Current habitat amounts and habitat configuration indicate the site is likely to be occupied by a pair of resident NSOs.
- Habitat modification is not proposed in the nest stand. Operations will not occur before July 9th unless a minimum of three survey visits in the year of operation fail to detect NSOs. If NSOs are detected on survey visits three to six operations will cease until nesting status can be determined. NSOs suspected or known to be nesting will receive additional protections (BA, p. 64).
- About five percent of NRF habitat in the core and home range burned at moderate to high severity. Adverse effect will occur because the core and home range are below recommended NRF habitat minimums and the proposed action will further reduce NRF habitat. The BA states, “Treatment occurs along a mid-level topographic feature adjacent to suitable NRF habitat and would downgrade 26 acres but would not result in a condition where NSOs would no longer be able to disperse across the treated areas to other areas within the home range,” (BA, p. 89). The proposed action will reduce NRF habitat in the core by about four percent. No removal of PFF1 will occur.
- Adverse effects will occur. However, due to the relatively small reduction in NRF habitat (26 acres), we cannot be reasonably certain take will result from the proposed action.

**KL0278B - Doolittle Elk 2:**

- The RA10 value for this site is moderate and NSOs were detected in 2015. The recent NSO detections, current habitat amounts, and habitat configuration indicate the site is likely to be occupied by a pair of resident NSOs.
- Habitat modification is not proposed in the nest stand. Operations will not occur before July 9th unless a minimum of three survey visits in the year of operation fail to detect NSOs. If NSOs are detected on survey visits three to six operations will cease until nesting status can
be determined. NSOs suspected or known to be nesting will receive additional protections (BA, p. 64).

- About five percent of NRF habitat in the home range burned at moderate to high severity. There were minimal impacts to NRF habitat in the core. The core and home range of the NSO site are below recommended NRF habitat minimums and the proposed action will further reduce NRF habitat (about 50 acres).
- Adverse effects will occur because the reduction in NRF is not limited in size and does occur within the core. However, these habitat reductions will primarily occur along a ridgeline (low NSO use). Therefore, we cannot be reasonably certain take will occur as a result of the proposed action.

KL0293 – Stanza

- The RA10 value for this site is moderate and NSOs were detected last in 2003. The site lacks adequate surveys to conclude it is not occupied. There is some uncertainty about whether this should be considered an alternate of KL0241 (Grider campground). Barred owls were detected between these two areas in 2009 and 2010, but not during 2015 surveys. For the purposes of this analysis, we assumed KL0293 is a separate site. Current NRF habitat amounts and habitat configuration indicate the site is likely to be occupied by a pair of resident NSOs.
- Habitat modification is not proposed in the nest stand, but operations will occur within the breeding season adjacent to NRF habitat prior to the completion of any survey visits based on our GIS analysis. Surveys will be done concurrent with operations. If NSOs are detected operations will cease until nesting status can be determined. NSOs suspected or known to be nesting will receive additional protections (BA, p. 64).
- The core and home range of the NSO site are below recommended NR habitat minimums and the proposed action further reduces NRF habitat (about 25 acres). The downgrade of NRF occurs on the outer edge of the home range or along a major ridgeline (low NSO use).
- Adverse effects will occur. However, no nesting attempts have been documented at this site and there are no known barred owls influencing NSO detections. Additionally, the vast majority of the potential noise disturbance and NRF habitat modification during the breeding season occurs outside of the core. Therefore, we cannot be reasonably certain take will occur as a result of the proposed action.

KL1100 – Lower West Fork Tomkins:

- The RA10 value for this site is moderate, and NSOs were detected last in 1997. The NSO site lacks adequate surveys to conclude it is unoccupied. Current habitat amounts and habitat configuration indicate the site is likely to be occupied by a pair of resident NSOs.
- There is no habitat modification in the nest stand. BA, table 17 (pp. 85-90) and the text of BA (p. 83) appear to conflict. We assumed table 17 is correct and that this NSO site will be affected by noise associated with helicopter landings for harvest in commercial salvage units with operations within the breeding season (units 520-525) prior to the completion of any survey visits. Roadside hazard tree removal also occurs during the breeding season causing noise disturbance to about 60 acres of NRF habitat in the core. Habitat modification during the breeding season was not quantified, but it appears to be largely outside of the core based on maps and GIS spatial layers that accompanied the BA. Surveys will be done concurrent with operations. If NSOs are detected operations will cease until nesting status can be
determined. NSOs suspected or known to be nesting will receive additional protections (BA, p. 64).

- The fires reduced NRF habitat associated with this NSO site. The core and home range of the NSO site are now below recommended NRF habitat minimums. Limited amounts of PFF1 and FANR (about 30 acres) are removed primarily along ridgelines (lower likelihood of NSO use). The impacts to NRF habitat primarily occur outside of the core or along major ridgelines.

- Adverse effects will occur. However, we cannot be reasonably certain take will result from the proposed action due to: 1) the limited size of the habitat reductions; and 2) breeding season operations are located outside of the core in areas NSOs are less likely to be nesting.

**KL1116 – Fish Creek 1 / Upper Grider:**

- The NSO site RA10 value is high. NSOs were last observed in 1990, but we lack adequate surveys to conclude the site is unoccupied. Based on habitat amounts and configuration the site is likely occupied by a resident NSO pair.

- Habitat modification is not proposed in the nest stand. Roadside hazard tree removal along one ingress/egress road will occur prior to the completion of any survey visits, but is located outside of the core. The remaining treatments will not occur before July 9th unless a minimum of three survey visits in the year of operation fail to detect NSOs. If NSOs are detected on survey visits three to six operations will cease until nesting status can be determined. NSOs suspected or known to be nesting will have additional protections (BA, p. 64).

- The core and home range of the NSO site are above recommended NRF habitat minimums and will remain so post-treatment. Treatments that remove, downgrade, and degrade NRF habitat and PFF1 occur in abiotic areas associated with NSO use, but are limited in size.

- Adverse effects will occur. However, take is not reasonably certain to result from the proposed action because NRF habitat is abundant within this site’s core and home range and the majority of the proposed action is located outside of the core.

**KL1121 – Bark Shanty Creek:**

- The RA10 value for this site is moderate. NSOs were last observed at the site in 1992, but we lack adequate surveys to conclude the site is unoccupied. Based on habitat amounts and configuration the site is likely occupied by a resident NSO pair.

- Habitat modification is not proposed in the nest stand. Roadside hazard tree removal that degrades NRF habitat is proposed within the breeding season prior to the completion of any survey visits, but it is on the outer edge of the home range.

- The fires reduced NRF habitat in this core and home range by five to 10 percent. The site is below recommended NRF habitat minimums and the proposed action will further reduce NRF habitat by about 35 acres, along a major ridge. Habitat impacts from the proposed action combined with the effects of the fire are not insignificant.

- Adverse effects may occur, but take is not reasonably certain to result from the proposed action because habitat reductions will occur in areas with a lower likelihood of use by NSOs and ingress / egress road is along the outer edge of the home range.
KL1122 – Limestone Bluffs:

- The RA10 value for this site is moderate. NSOs were last detected at the site in 1989, but the site lacks adequate surveys to conclude it is not occupied. Based on habitat amounts and configuration the site is likely occupied by a resident NSO pair.
- Habitat modification is not proposed in the nest stand. Operations will not occur before July 9th unless a minimum of three survey visits in the year of operation fail to detect NSOs. If NSOs are detected on survey visits three to six operations will cease until nesting status can be determined. NSOs suspected or known to be nesting will receive additional protections (BA, p. 64).
- The core of the NSO site is below recommended NRF habitat minimums and the proposed action further reduces NRF habitat in the core by 45 acres, though the majority of the downgraded habitat is along a ridge. The BA indicates NSOs most likely nest in Grider Creek (well to the east of areas where the proposed action will reduce habitat) and the site is likely centered on nighttime detections when NSOs were pulled to the road.
- Although adverse effects may occur, take is not anticipated because habitat reductions occur in areas with a lower likelihood of use by NSOs.

KL1202 – Tyler Meadows:

- The NSO site is considered a low RA10 value. NSOs were last observed at the site in 1996. NRF habitat is severely limited in this core. This site was profoundly affected by high severity fire, resulting in complete loss of suitable habitat in the core (there are about 15 acres of NRF in core remaining). About 600 acres of NRF habitat exists in small scattered blocks in the western and northwestern portions of the home range, but FWS determined these areas outside of the core were not likely to support occupancy by a resident pair of NSOs.
- There is habitat modification within the nest stand. Commercial salvage will occur during the breeding season adjacent to small patches of NRF habitat prior to the completion of any survey visits. The BA also discusses disturbance from concentrated haul routes and roadside hazard tree removal (p. 88), so we assume ingress/egress roads cross the core. For all other treatments, operations will not occur before July 9th unless a minimum of three survey visits in the year of operation fail to detect NSOs. If NSOs are detected on survey visits three to six operations will cease until nesting status can be determined. NSOs suspected or known to be nesting will receive additional protections (BA, p. 64).
- Adverse effects will occur because the core and home range of the NSO site are below recommended NRF habitat minimums and the proposed action will further reduce NRF habitat in the home range by about 20 acres and degrade about 50 acres. The scale and amount of PFF1 removal within the core and home range will result in additional adverse effects.
- Although adverse effects are expected, take is not reasonably certain to result from the proposed action due to low likelihood the site is occupied.

KL9990 – McGuffy Creek:

- The RA10 value for this site is low and NSOs were last observed at the site in 1990. NRF habitat is severely limited in the core and the home range and the site is not likely to be occupied by a resident pair of NSOs.
Habitat modification is not proposed in the nest stand. Operations (commercial salvage, landings, and roadside hazard tree removal) will occur during the breeding season with the potential for disturbance (BA, p. 88). Habitat modifications associated with these treatments during the breeding season was not quantified. For all other treatments operations will not occur before July 9th unless a minimum of three survey visits in the year of operation fail to detect NSOs. If NSOs are detected on survey visits three to six operations will cease until nesting status can be determined. NSOs suspected or known to be nesting will receive additional protections (BA, p. 64).

Adverse effects will occur because the home range is below recommended NRF habitat minimums and the proposed action further reduces NRF habitat in the home range. Four acres of NRF habitat and about 100 acres of PFF1 will be removed. About 100 acres of NRF habitat will also be degraded.

Although adverse effects are expected, take is not reasonably certain to result from the proposed action due to low likelihood the site is occupied.

KL9994 – Huckleberry:

The RA 10 value for this site is moderate. NSOs were last observed in 1992, and the site lacks adequate surveys to conclude the site is unoccupied. Current habitat amounts and configuration indicate the site could support occupancy by a resident pair of NSOs.

Habitat modification is not proposed in the nest stand. Operations will not occur before July 9th unless a minimum of three survey visits in the year of operation fail to detect NSOs. If NSOs are detected on survey visits three to six operations will cease until nesting status can be determined. NSOs suspected or known to be nesting will receive additional protections (BA, p. 64).

The site had minimal effects from 2014 fires. Adverse effects will occur because the home range of the NSO site is slightly below recommended NRF habitat minimums and the proposed action will cause a further reduction in NRF habitat. The NRF habitat downgrade is about 30 acres along a ridgetop in an area of low likelihood of use by NSOs.

Although adverse effects will occur, take is not reasonably to result from the proposed action because habitat modification will occur in areas with a low likelihood of use by NSO.

Whites Fire Area – There are no NSO sites with a likely to adversely affect, no take determination in this fire area.

LAA with Take Rationale

Harm is defined as an act which actually kills or injures wildlife, and was further defined (50 CFR 17.3) by FWS to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing behavioral patterns such as breeding, feeding, or sheltering. Harassment is defined by FWS (50 CFR 17.3) as actions that create the likelihood of injury to a listed species by annoying it to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity.
Limited operating periods (LOPs) will not apply to roadside hazard tree removal along roads designated as maintenance level 3-5, and select high clearance roads used for ingress/egress. Additionally, specified commercial harvest units and their associated landings and haul routes will not implement the three visit survey protocol prior to operations (further detail provided in section 6.2). Where three visits will be completed prior to operations (and subsequent cessation of operations if nesting NSOs are suspected), harm or harassment may be minimized but not completely avoided. In lieu of completed surveys (no visits or three visits), the status and location of NSOs are uncertain. There is uncertainty both in NSO site placement (due to potential shift from fire) and in where trees are being removed in roadside hazard tree removal units. Due to this uncertainty, we have determined that harm (habitat loss or modification that leads to actual injury or death due to significant impairment of feeding, breeding, or sheltering) is anticipated from habitat modification or breeding season operations within a site determined to have a reasonably high likelihood of occupancy (defined earlier), or one or more of the following conditions apply:

1) Alteration of NRF, PFF1, or FANR habitat in the nest stand.
2) Removal or downgrade of NRF or FANR habitat from core or home ranges of NSO sites but the site will retain habitat quantities above recommended habitat minimums. Treatment units that remove, downgrade, or degrade are not limited in size.
3) Treatments that remove or downgrade NRF or FANR habitat from core or home ranges of NSO sites below recommended habitat minimums in areas of likely NSO use and are not limited in size.
4) The scale and amount of PFF1 habitat removal within NSO cores and home ranges results in a reduction of foraging opportunities. This determination will be informed by a combination of factors, such as the amount, location and spatial arrangement of pre and post-harvest habitat conditions.

**Beaver Fire Area----------------**

**KL0283 - West Fork Doggett Creek:**

- The RA10 value for this site is moderate and the last NSO detections were in 2015. Based on the recent detections, habitat amounts, and habitat configuration the site is likely to be occupied by a resident pair of NSOs despite being profoundly affected by fire.
- Habitat modification is not proposed in the nest stand. Operations will not occur before July 9th unless a minimum of three survey visits in the year of operation fail to detect NSO. If NSO are detected on survey visits three to six operations will cease until nesting status can be determined. NSOs suspected or known to be nesting will receive additional protections (see BA page 64).
- About 50 percent of the NRF habitat in the core and home range burned at moderate to high severity. Adverse effects will occur because site is already below recommended NRF habitat minimums at the core and home range scales due to fire and recent salvage logging on private lands. The action and cumulative effects will further reduce NRF and PFF1 habitats. The habitat reductions occur in areas of likely NSO use.
- These habitat impacts will impair essential life history functions and reduce fitness of NSO associated with this site; therefore, the proposed action combined with cumulative effects is likely to result in take of one pair of NSOs associated with this site.
KL4143 – Fishtrap Creek:

- The RA10 value for this site is moderate. NSOs were last detected in 1995, and the site lacks adequate surveys to conclude it is not occupied. Current habitat amounts and habitat configuration indicate the site is likely to be occupied by a resident pair of NSOs at least for the short term.
- Habitat modification is not proposed in the nest stand. Operations will not occur before July 9th unless a minimum of three survey visits in the year of operation fail to detect NSO. If NSO are detected on survey visits three to six operations will cease until nesting status can be determined. NSOs suspected or known to be nesting will receive additional protections (see BA page 64).
- A relatively minor proportion of the NRF habitat in this core and home range burned moderate to high severity. However, extensive amounts of NRF habitat were removed by recent salvage operations on private lands. The BA estimates the home range had about 600 acres of NRF habitat removed by this salvage (page 91). FWS determined the NRF habitat removal was slightly less than 600 acres, because some units planned on private lands have not yet been harvested. Adverse effects are expected because the site is below recommended NRF habitat minimums at the core and home range scales and the proposed action and cumulative effects will further reduce NRF or PFF1 habitat. Additionally, the removal or downgrade of suitable habitat occurs in areas of likely NSO use.
- These additional reductions in habitat will impair essential life history functions and reduce fitness of NSO associated with this site. Therefore, the proposed action combined with cumulative effects is reasonably certain to result in take of one pair of NSOs.

KL99913 - Deer Camp Meadows:

- The RA10 value for this site is moderate. NSOs were last detected in 1999, and the site lacks adequate surveys to conclude it is unoccupied. Barred owls were detected at this site in 2015. Based on habitat amounts and configuration, the site is likely to be occupied by a resident pair of NSOs at least for the short term.
- Habitat modification is not proposed in the nest stand. Operations will not occur before July 9th unless a minimum of three survey visits in the year of operation fail to detect NSOs. If NSOs are detected on survey visits three to six operations will cease until nesting status can be determined. NSOs suspected or known to be nesting will receive additional protections (see BA page 64).
- About 15 percent of the NRF habitat in the core and 25 percent of the NRF habitat in the home range burned at moderate to high severity. Extensive amounts of NRF and PFF1 habitat were removed by recent salvage operations on private lands. The BA estimates the home range had about 460 acres of NRF habitat removed by this salvage (page 91). FWS determined the NRF habitat removal was slightly less than 460 acres, because some units planned on private lands have not yet been harvested. Adverse effects will occur because the NSO site is below recommended habitat minimums at the core and home range scales and the proposed action will further reduce NRF habitat. NRF habitat reductions are also expected from cumulative effects. Additionally, the removal or downgrade of NRF habitat occurs in areas of likely NSO use.
These additional reductions in habitat will impair essential life history functions and reduce fitness of NSO associated with this site; therefore, the proposed action combined with cumulative effects is reasonably certain to result in take of one pair of NSOs.

**KL99915 – Lumgrey Creek:**

- The RA10 value for this site is moderate. NSOs were last detected in 1999, and the site lacks adequate surveys to conclude it is unoccupied. Barred owls have been detected in the past five years just north of this site in Bumble Bee Creek. Based on habitat amounts and configuration the site is likely to be occupied by a resident pair of NSOs.
- Habitat modification is not proposed in the nest stand. Operations will not occur before July 9th unless a minimum of three survey visits in the year of operation fail to detect NSOs. If NSOs are detected on survey visits three to six operations will cease until nesting status can be determined. NSOs suspected or known to be nesting will receive additional protections (see BA page 64).
- A relatively minor proportion of the NRF habitat in this core and home range burned moderate to high severity. However, extensive amounts of NRF habitat were removed by recent salvage operations on private lands. The BA estimates the home range had about 410 acres of NRF removed by this salvage (page 91). FWS determined the NRF habitat removal was slightly less than 410 acres, because some units planned on private lands have not yet been harvested. Adverse effects will occur because the NSO site is below recommended NRF habitat minimums at the core and home range scales and the proposed action will further reduce NRF or PFF1 habitat. NRF habitat is also expected to be reduced due to cumulative effects. Additionally, the removal or downgrade of habitat by the proposed action and cumulative effects will occur in areas of likely NSO use.
- These habitat reductions will impair essential life history functions and reduce fitness of NSOs associated with this site; therefore, the proposed action combined with cumulative effects is likely to result in take of one pair of NSOs.

**Happy Camp Complex Fire Area**

**KL0241 – Grider Campground:**

- The RA10 value for this site is high. NSOs were last detected in 1991, and the site lacks adequate surveys to conclude it is unoccupied. Based on habitat amounts and configuration, the site is likely to be occupied by a resident pair of NSOs.
- Habitat modification is not proposed in the nest stand, but operations will occur during the breeding season within or adjacent to NRF habitat prior to the completion of any survey visits. These operations may remove undetected nest trees. If this occurs, young NSO/s would likely be crushed by the impact, fall out of the nest and be subject to predation, or die from exposure or starvation. Extensive noise disturbance during the breeding season may cause an increased flushing response or reduced feeding of young NSOs by adult NSOs; increasing the likelihood of exposure, predation, or starvation of young NSOs.
- About 20 percent of the NRF habitat in the core and the home range burned at moderate to high severity. Adverse effects will also occur because the NSO site is below recommended NRF habitat minimums at the core and home range scales and the proposed action will further reduce NRF habitat (reduction of about 20 percent). The removal or downgrade of NRF habitat will occur in areas of likely NSO use.
These habitat reductions will impair essential life history functions and reduce fitness, or directly harm, NSOs associated with this site. Therefore, the proposed action is likely to result in take of one pair of adult NSOs and up to one young NSO.

**KL0380 – Copper Creek:**

- The NSO site has a high RA10 value and NSOs were last detected in the vicinity in 2015. The site lacks adequate surveys to conclude it is not occupied. Current habitat amounts and habitat configuration indicate the site is likely to be occupied by a resident pair of NSOs.
- Habitat modification is not proposed in the nest stand. About 20 acres of NRF habitat is degraded by roadside hazard tree removal along ingress egress, some of which may occur during the breeding season prior to the completion of any survey visits. One acre is proposed for modification in the 0.5 mile core from roadside hazard (BA table 20, p. 94) and five acres of NRF in the core will be exposed to noise from adjacent operations (BA table 12, p. 69). Extensive noise disturbance during the breeding season may cause an increased flushing response or reduced feeding of young NSO by adult NSOs; increasing the likelihood of exposure, predation, or starvation of young NSOs. For all other treatments, operations will not occur before July 9th unless a minimum of three survey visits in the year of operation fail to detect NSOs. If NSOs are detected on survey visits three to six operations will cease until nesting status can be determined. NSOs suspected or known to be nesting will receive additional protections (see BA page 64).
- About ten percent of the NRF habitat in the core and the home range burned at moderate to high severity. Adverse effects will occur because the NSO site is below recommended NRF habitat minimums at the core and home range scales, and the proposed action will further reduce NRF habitat by five percent (about 65 acres). The removal or downgrade of NRF habitat will occur in areas of likely NSO use.
- These NRF habitat reductions will impair essential life history functions and reduce fitness of NSOs, or directly harm NSOs associated with this site. Therefore, the proposed action is likely to result in take of one pair of adult NSOs and up to one young.

**KL0381 Cougar Creek**

- RA10 value for this site is moderate. NSOs were last observed in 2013. Based on recent NSO detections, habitat amounts, and habitat configuration it is likely the site is likely to be occupied by a resident pair of NSOs.
- Adverse effects occur from degrading about 10 acres of NRF habitat in the nest stand. Operations will not occur before July 9th unless a minimum of 3 survey visits in the year of operation fail to detect NSO. If NSO are detected on survey visits 3 to 6 operations will cease until nesting status can be determined. NSOs suspected or known to be nesting will receive additional protections (see BA page 64).
- About 10 percent of the NRF habitat in the core and 15 percent of the NRF in the home range burned at moderate to high severity. Adverse effects will occur because the proposed action will reduce NRF habitat in a NSO site below recommended NRF habitat minimums. The removal or downgrade of NRF habitat will occur in areas of likely NSO use. The BA indicates about 50 acres of NRF habitat will be degraded and downgraded across the core and home range. FWS independent analysis including review of aerial imagery indicates NRF habitat is likely under-represented in EVEG (habitat layer for action area) in treatment along roadsides (roadside hazard tree removal, roadside complete, and roadside modified...
units). Thus, we have determined that the reduction of NRF habitat may be twice as much as indicated in the BA (up to 100 acres).

- Impacts to NRF habitat in the nest stand and downgrade of NRF habitat in the core will impair essential life history functions and reduce fitness of NSOs associated with this site. Therefore, the proposed action is likely to result in take of one pair of adult NSOs.

**KL0383 – Little Elk Creek:**

- The RA10 value for this site is moderate and NSOs were detected in 2015. The recent NSO detections, current habitat amounts, and habitat configuration all suggest the site is likely to be occupied by a resident pair of NSOs.
- Habitat modification is not proposed in the nest stand. Roadside hazard tree removal will occur during the breeding season adjacent to NRF habitat prior to the completion of any survey visits. About 140 acres of NRF habitat in the core will be exposed to noise during the breeding season (BA table 12, page 69). Extensive noise disturbance during the breeding season may cause an increased flushing response or reduced feeding of young NSO by adult NSOs; increasing the likelihood of exposure, predation, or starvation of young NSOs. For all other treatments, operations will not occur before July 9th unless a minimum of three survey visits in the year of operation fail to detect NSOs. If NSOs are detected on survey visits three to six operations will cease until nesting status can be determined. NSOs suspected or known to be nesting will receive additional protections (see BA page 64).
- About 20 percent of the NRF habitat in the core and the home range burned at moderate to high severity. Adverse effects will occur because the site is below recommended NRF habitat minimums and the proposed action will further reduce NRF habitat by two percent in the core and ten percent in the home range. The areas of NRF habitat downgraded and PFF1 habitat removed (about 120 acres total) are immediately adjacent to the core, within an area of expected NSO use. The scale and amount of PFF1 removal results in a reduction of foraging opportunities.
- These habitat impacts combined with breeding season operations prior to the completion of any NSO surveys will impair essential life history functions and reduce fitness, or directly harm, NSOs associated with this site. Therefore, the proposed action is likely to result in take of one pair of NSOs and up to one young NSO.

**KL1109 - West Fork Tomkins Creek**

- The RA10 value for this site is high, and NSOs were detected in 2015. The recent NSO detections, current habitat amounts, and habitat configuration all suggest the site is likely to be occupied by a resident pair of NSOs.
- Habitat modification is not proposed in the nest stand. Operations will occur during breeding season within NRF habitat in the core or home range prior to the completion of any survey visits. About 50 of 120 acres of NRF habitat will be degraded and operations may remove undetected nest trees. If this occurs, young NSOs would likely be crushed by the impact, fall out of the nest and be subject to predation, or die from exposure or starvation. About 225 acres of NRF in the core will be exposed to noise during the breeding season (BA table 12, page 69). Extensive noise disturbance during the breeding season may cause an increased flushing response or reduced feeding of young by adult NSOs increasing the likelihood of exposure, predation, or starvation of young NSOs.
• About ten percent of the NRF habitat in the home range burned at moderate to high severity. The core was minimally affected by fire. The site is below recommended NRF habitat minimums and the proposed action further reduces habitat. The areas of NRF and PFF 1 habitat reduction (65 acres within the home range) and NRF habitat degrade (50 acres in core) are in areas expected to receive high levels of NSO use.

• These habitat impacts combined with breeding season operations prior to the completion of any NSO surveys will impair essential life history functions and reduce fitness, or directly harm, NSOs associated with this site. Therefore, the proposed action is likely to result in take of one pair of NSOs and up to one young NSO.

KL1110 - Tomkins Creek
• The RA10 value for this site is moderate and NSOs were detected in 2015. The recent NSO detections, current habitat amounts, and habitat configuration all suggest the site is likely to be occupied by a resident pair of NSOs.

• Habitat modification is not proposed in the nest stand. Roadside hazard tree removal will degrade NRF habitat in the core (30 acres) and expose NRF habitat in the core to noise. About 56 acres of NRF in the core will be exposed to noise during the breeding season from roadside hazard (BA table 12, page 69). Major haul routes (commercial salvage) expose additional large proportions of the NRF habitat in the core and home range to breeding season noise disturbance. These operations may remove undetected nest trees. If this occurs, young NSOs would likely be crushed by the impact, fall out of the nest and be subject to predation, or die from exposure or starvation. Extensive noise disturbance during the breeding season may cause an increased flushing response or reduced feeding of young NSOs by adult NSOs; increasing the likelihood of exposure, predation, or starvation of young NSOs.

• About ten percent of the NRF habitat in the core and five percent of the NRF habitat in home range burned at moderate to high severity. Adverse effects will occur because the site is below recommended NRF habitat minimums at the core and home range scales, and the action will further reduce NRF habitat. The reduction of NRF and PFF1 habitat occurs in areas of likely NSO use and the scale of overall habitat removal will result in a reduction of foraging opportunities.

• These habitat impacts combined with breeding season operations prior to the completion of any NSO surveys will impair essential life history functions and reduce fitness, or directly harm, NSOs associated with this site. Therefore, the proposed action is likely to result in take of one pair of NSOs and up to one young.

KL1112B - Walker Creek
• The NSO site has a moderate RA10 value and NSOs were detected in 2015. The recent NSO detections, current habitat amounts, and habitat configuration all suggest the site is likely to be occupied by a resident pair of NSOs.

• There is no habitat modification in the nest stand. Breeding season operations will occur adjacent to NRF prior to the completion of any survey visits. Commercial salvage and major haul routes may also cause noise disturbance to NSO. The haul route is near the 2015 pair detections in an area NSO are likely to be nesting. Extensive noise disturbance during the breeding season may cause an increased flushing response or reduced feeding of young NSO
by adult NSOs increasing the likelihood of exposure/ predation, or starvation of young NSOs.

- A large proportion of this home range burned at moderate to high severity and NSO associated with this site have shifted their core based on 2015 surveys. The site is below recommended NRF habitat minimums and the proposed action will remove moderate amount of PFF1 in areas of likely NSO use.

- These habitat impacts combined with breeding season operations prior to the completion of any NSO surveys will impair essential life history functions and reduce fitness of NSOs, or directly harm NSOs associated with this site. Therefore, the proposed action is likely to result in take of one pair of NSOs and up to one young NSO.

KL1130 – O’Neil Creek:

- The 10 value for this site is moderate and NSOs were detected in 2015. The recent NSO detections, current habitat amounts, and habitat configuration suggest the site is likely to be occupied by a resident pair of NSOs.

- No habitat modification occurs in the nest stand. Roadside hazard tree removal will occur in the core or home range in NRF habitat prior to the completion of any survey visits. About 126 acres of NRF habitat in the core will be exposed to noise during the breeding season from roadside hazard (BA table 12, page 69). Noise disturbance is also expected from two helicopter landings adjacent to the core. Commercial salvage is across a ridge from the core. Extensive noise disturbance during the breeding season may cause an increased flushing response or reduced feeding of young by adult NSOs; increasing the likelihood of exposure, predation, or starvation of young NSOs. For all other treatments, operations will not occur before July 9th unless a minimum of three survey visits in the year of operation fail to detect NSO. If NSO are detected on survey visits three to six operations will cease until nesting status can be determined. NSOs suspected or known to be nesting will receive additional protections (see BA page 64).

- About 40 percent of the NRF habitat in the core and home range burned at moderate to high severity. Adverse effects will occur because the site is below recommended NRF habitat minimums at the core and home range scales and the proposed action will further reduce NRF habitat. The removal and downgrade of NRF habitat occurs in areas of likely NSO use. Additionally, the scale and amount of PFF1 habitat removal within the home range will result in a reduction of foraging opportunities and there will be extensive amounts of degraded habitat in the core and home range.

- These habitat impacts combined with breeding season operations prior to the completion of any NSO surveys will impair essential life history functions and reduce fitness, or directly harm NSOs associated with this site. Therefore, the proposed action is reasonably certain to result in take of one pair of NSOs and up to one young NSO.

KL1212 /9991 - Happy Horse and Horse Creek:

- The NSO sites are moderate and high RA10 value. There was one NSO detection between the two sites in 2015, NSO nested in 9991 in 2013 and in 1212 in 2014. The nests are a little over a mile apart in the same drainage. FWS determined it is likely only one pair between the two sites. Based on the recent detections and habitat amounts and configuration, the site is likely to be occupied by a resident pair of NSOs.
There is no habitat modification the known nest stands. Breeding season operations in NRF in the core or home range (roadside hazard tree removal and commercial hauling) will occur prior to the completion of any survey visits. These operations may remove undetected nest trees. If this occurs, young NSOs would likely be crushed by the impact, fall out of the nest and be subject to predation, or die from exposure or starvation. About 33 acres of NRF habitat in the core will be exposed to noise during the breeding season from roadside hazard (BA table 12, page 69). Extensive noise disturbance during the breeding season may cause an increased flushing response or reduced feeding of young by adult NSOs; increasing the likelihood of exposure, predation, or starvation of young NSOs. For all other treatments, operations will not occur before July 9th unless a minimum of three survey visits in the year of operation fail to detect NSOs. If NSOs are detected on survey visits three to six operations will cease until nesting status can be determined. NSOs suspected or known to be nesting will receive additional protections (see BA page 64).

The NSO sites are below recommended NRF habitat minimums at the core and home range scale and will have further reductions in NRF habitat in areas of likely NSO use. Large amounts of NRF habitat are also degraded in areas of likely NSO use (about 70 acres in KL9991 home range and 230 acres in KL1212 home range).

These habitat impacts combined with breeding season operations prior to the completion of any NSO surveys will impair essential life history functions and reduce fitness, or directly harm NSOs associated with this site. Therefore, the proposed action is likely to result in take of one pair of NSOs and up to one young NSO.

**KL1213 – Upper Elk Creek:**

- The RA10 value for this site is moderate and NSOs were last detected in 1995. The site lacks adequate surveys to conclude it is not occupied. Current amounts and configuration of habitat indicate the site is likely occupied by a resident pair of NSOs.
- There is habitat modification in the nest stand. Roadside hazard tree removal within and adjacent to NRF habitat will occur prior to the completion of any survey visits. These operations degrade NRF habitat in the core (50 acres) and may remove undetected nest trees. If this occurs, young NSOs would likely be crushed by the impact, fall out of the nest and be subject to predation, or die from exposure or starvation. Extensive noise disturbance during the breeding season may cause an increased flushing response or reduced feeding of young by adult NSOs; increasing the likelihood of exposure, predation, or starvation of young NSOs. For all other treatments, operations will not occur before July 9th unless a minimum of three survey visits in the year of operation fail to detect NSOs. If NSOs are detected on survey visits three to six operations will cease until nesting status can be determined. NSO suspected or known to be nesting will receive additional protections (see BA page 64).

- The core was unaffected by fire, but about 20 percent of the NRF habitat in the home range burned at moderate to high severity. Adverse effects will occur because the site is below recommended NRF habitat minimums at the core and home range scales, and the action will further reduce NRF habitat in areas likely to receive use by NSOs. Operations both within and outside of the breeding season collectively will degrade about 70 percent (170 acres) of the NRF habitat in the core. Hazardous fuels reduction will also degrade and downgrade moderate amounts of NRF habitat at the core and home range scales.
These habitat impacts combined with breeding season operations prior to the completion of any NSO surveys will impair essential life history functions and reduce fitness, or directly harm NSOs associated with this site. Therefore, the proposed action is likely to result in take of one pair of NSOs and up to one young NSO.

**KL1214 / 9995 – Upper and Lower Three Biscuit Gulch:**

- The RA10 values are moderate and high. One NSO pair alternates between the two sites. NSOs nested in 2013 at KL9995. Barred owls have been documented in the area and may suppress NSO detections. Based on the recent detections, habitat amounts, and habitat configuration, the site is likely to be occupied by a resident pair of NSOs.
- Habitat modification occurs in the nest stand. Breeding season operations will occur within NRF habitat in the core or home range prior to the completion of any survey visits. These operations may remove undetected nest trees or cause noise disturbance. If a nest tree is cut, young NSOs would likely be crushed by the impact, fall out of the nest and be subject to predation, or die from exposure or starvation. About 59 acres of NRF habitat in the core will be exposed to noise during the breeding season from roadside hazard (BA table 12, page 69). Extensive noise disturbance during the breeding season may cause an increased flushing response or reduced feeding of young by adult NSOs; increasing the likelihood of exposure, predation, or starvation of young NSOs. For all other treatments, operations will not occur before July 9th unless a minimum of three survey visits in the year of operation fail to detect NSOs. If NSOs are detected on survey visits three to six operations will cease until nesting status can be determined. NSOs suspected or known to be nesting will receive additional protections (see BA page 64).
- KL1214 and 9995 respectively had 5 and 20 percent reductions in NRF habitat in the core from fire and 20 and 10 percent NRF habitat reductions in the home range. Both sites are below recommended NRF habitat minimums, with the exception of KL9995 home range. Reductions in NRF habitat and PFF1 combined with areas of degraded NRF habitat will reduce NSO, nesting, roosting, and foraging opportunities.
- These habitat impacts combined with breeding season operations prior to completion of any NSO surveys will impair essential life history functions and reduce fitness, or directly harm NSOs associated with these sites. Therefore, the proposed action is reasonably certain to result in take of one pair of NSOs and up to one young NSO.

**KL1265 - No Name Creek:**

- The RA10 value for this site is moderate. NSOs were detected last in 2007, and the site lacks adequate surveys to conclude it is unoccupied. Based on the configuration and current amounts of habitat, we expect the site is likely occupied by a pair of resident NSOs, at least for the short term, despite being profoundly impacted by fires.
- Adverse effects will occur from breeding season operations (commercial salvage and major haul routes), and downgrade or removal of NRF habitat in the nest stand. The BA did not specify amount or proportion of NRF habitat being affected (table 16, p. 83). Information supplemental to the BA (appendix A section 1,) clarified there were no documented nesting attempts. The 100 acre circle (nest stand) still is the most likely place NSOs would nest because it centers on the most recent pair daytime detections. These operations may remove undetected nest trees. If this occurs, young NSOs would likely be crushed by the impact, fall out of the nest and be subject to predation, or die from exposure or starvation. Extensive
noise disturbance may cause an increased flushing response or reduced feeding of young by adult NSOs; increasing the likelihood of exposure, predation, or starvation of young NSOs.

- A large proportion of the NRF habitat in the core and home range burned at moderate to high severity (about 85 and 50 percent respectively). The site is below recommended NRF habitat minimums at the core and home range scales, and the action will further reduce NRF habitat. The removal and downgrade of NRF habitat occurs in areas of likely NSO use and the scale and amount of PFF1 habitat removal will result in a reduction of foraging opportunities.
- These habitat impacts combined with breeding season operations prior to completion of any NSO surveys will impair essential life history functions and reduce fitness, or directly harm, NSOs associated with this site. Therefore, the proposed action is reasonably certain to result in take of one pair of NSOs and up to one young NSO.

**KL1266 – Salt Creek Grider:**
- The RA10 value for this site is high, and NSOs were detected last in 2012. Based on recent detections and current amounts of habitat, the site is likely to be occupied by a pair of resident NSOs.
- There is no habitat modification in the nest stand. Breeding season operations will occur within and adjacent to NRF habitat prior to completion of any NSO surveys and causes noise disturbance adjacent to the core. Extensive noise disturbance may cause an increased flushing response or reduced feeding of young by adult NSOs increasing the likelihood of exposure/predation, or starvation of young NSOs. For all other treatments, operations will not occur before July 9th unless a minimum of three survey visits in the year of operation fail to detect NSOs. If NSOs are detected on survey visits three to six operations will cease until nesting status can be determined. NSOs suspected or known to be nesting will receive additional protections (see BA page 64).
- About one-third of the NRF habitat in the core and half of the NRF habitat in the home range burned at moderate to high severity. Adverse effects will occur, because the site is below recommended NRF habitat minimums at the core and home range scales, and the proposed action will further reduce NRF habitat. Additionally, the removal and downgrade of NRF habitat will occur in areas of likely NSO use. The scale and amount of PFF1 removal will result in a reduction of foraging opportunities.
- These habitat impacts combined with breeding season operations prior to the completion of any NSO surveys will impair essential life history functions and reduce fitness of NSOs associated with this site. Therefore, the proposed action is reasonably certain to result in take of one pair of NSOs and up to one young NSO.

**KL4099 - Middle Creek (Scott):**
- The RA10 value for this site is high, NSOs were detected last in 2001, and the site lacks adequate surveys to conclude the site is unoccupied. Based on configuration and current amounts of habitat we expect the site is likely to be occupied by a pair of resident NSOs.
- There is no habitat modification in the nest stand. There are no breeding season operations within or adjacent to NRF habitat prior to completion of any NSO surveys. For all treatments, operations will not occur before July 9th unless a minimum of three survey visits in the year of operation fail to detect NSOs. If NSOs are detected on survey visits three to six operations will cease until nesting status can be determined. NSOs suspected or known to be nesting will receive additional protections (see BA page 64).
There were minimal impacts to the core from fire. About 30 percent of the NRF habitat in the home range burned at moderate to high severity. The NSO site is below recommended NRF habitat minimums at the core and home range scale and the proposed action will further reduce NRF habitat by about five percent in areas of likely NSO use. Additionally, the scale and amount of PFF1 removal and degrade of NRF habitat within the home range is likely to result in a reduction of foraging opportunities.

The habitat impacts described above will impair essential life history functions and reduce fitness of NSOs associated with this site. Therefore, the proposed action is likely to result in take of one pair of NSOs.

**KL9992 – Wood Creek:**

- The RA10 value for this site is high, NSOs were detected last in 2002, and we lack adequate surveys to conclude it is unoccupied. Based on the configuration and current amount of habitat, the site is likely to be occupied by a pair of resident NSOs.
- There is NRF habitat modification in the nest stand and roadside hazard tree removal degrades about 100 acres of NRF habitat in the home range and about 15 acres of NRF habitat in the core prior to the completion of any NSO surveys. These operations may remove undetected nest trees. If this occurs, young NSOs would likely be crushed by the impact, fall out of the nest and be subject to predation, or die from exposure or starvation. Extensive noise disturbance during the breeding season may cause an increased flushing response or reduced feeding of young by adult NSOs; increasing the likelihood of exposure, predation, or starvation of young. For all other treatments, operations will not occur before July 9th unless a minimum of three survey visits in the year of operation fail to detect NSOs. If NSOs are detected on survey visits three to six operations will cease until nesting status can be determined. NSOs suspected or known to be nesting will receive additional protections (see BA page 64).
- Fire impacts to NRF habitat were minimal, yet the site is below recommended NRF habitat minimums at the core and home range scales. The proposed action will further reduce NRF habitat by 10 percent in the core and 25 percent in the home range. Some of these NRF habitat reductions are located in areas of likely NSO use.
- These habitat impacts combined with breeding season operations prior to the completion of any NSO surveys will impair essential life history functions and reduce fitness of NSOs associated with this site. Therefore, the proposed action is reasonably certain to result in take of one pair of NSOs and up to one young NSO.

**KL9996 – Elk Creek:**

- The RA10 value for this site is moderate, and NSOs were detected in 2015. Based on recent detections and current amounts of habitat, the site is likely to be occupied by a pair of resident NSOs.
- There is no habitat modification in the nest stand. Roadside hazard tree removal will occur within and adjacent to NRF habitat in the core or home range prior to the completion of any NSO surveys. These operations may remove undetected nest trees. If this occurs, young NSOs would likely be crushed by the impact, fall out of the nest and be subject to predation, or die from exposure or starvation. About 15 acres of NRF habitat in the core will be exposed to noise during the breeding season from roadside hazard (BA table 12, page 69). Extensive noise disturbance may cause an increased flushing response or reduced feeding of young by adult NSOs increasing the likelihood of exposure/predation, or starvation of young NSOs.
For all other treatments, operations will not occur before July 9th unless a minimum of three survey visits in the year of operation fail to detect NSOs. If NSOs are detected on survey visits three to six operations will cease until nesting status can be determined. NSOs suspected or known to be nesting will receive additional protections (see BA page 64).

- About 10 percent of the NRF habitat in the core and home range burned at moderate to high severity. Adverse effects will occur because the site is below recommended NRF habitat minimums at the core and home range scales, and the proposed action will further reduce NRF habitat in areas of likely NSO use. The proposed action reduces NRF habitat by about 10 percent.

- These NRF habitat impacts combined with the breeding season operations prior to the completion of any NSO surveys will impair essential life history functions and reduce fitness, or directly harm NSOs associated with this site. Therefore, the proposed action is reasonably certain to result in take of one pair of NSOs and up to one young NSO.

**KL9998 – East Fork Elk Creek:**

- The RA10 value for this site is moderate, and NSOs were detected in 2015. Based on recent detections and current amounts of habitat, the site is likely to be occupied by a pair of resident NSOs.

- There is no NRF habitat modification in the nest stand, but breeding season operations will occur within and adjacent to NRF habitat in the core or home range prior to the completion of any NSO surveys. These operations may remove undetected nest trees. If this occurs, young NSOs would likely be crushed by the impact, fall out of the nest and be subject to predation, or die from exposure or starvation. About 89 acres of NRF habitat in the core will be exposed to noise during the breeding season from roadside hazard tree removal (BA table 12, page 69). Extensive noise disturbance during the breeding season may cause an increased flushing response or reduced feeding of young by adult NSOs; increasing the likelihood of exposure, predation, or starvation of young NSOs. For all other treatments, operations will not occur before July 9th unless a minimum of three survey visits in the year of operation fail to detect NSOs. If NSOs are detected on survey visits three to six operations will cease until nesting status can be determined. NSOs suspected or known to be nesting will receive additional protections (see BA page 64).

- There were minimal impacts to NRF habitat in the core from fires. About 20 percent of the NRF in the home range burned at moderate to high severity. Adverse effects will occur because the site is below recommended NRF habitat minimums at the core and home range scales and the action will further reduce NRF and PFF1 habitat in areas of likely NSO use. The proposed action is reducing habitat across all habitat types by five percent.

- The impacts to habitat, in combination with the breeding season operations prior to the completion of any NSO surveys, will impair essential life history functions and reduce fitness, or directly harm NSOs associated with this site. Therefore, the proposed action is reasonably certain to result in take of one pair of NSOs and up to one young NSO.

**KL0276A – Malone Creek 1:**

- The RA10 value for this site is moderate, NSOs were detected last in 1991, but the site lacks adequate surveys to conclude it is unoccupied. Based on the configuration and current amounts of habitat, we expect the site could support occupancy by a pair of resident NSOs.
- There is no NRF habitat modification in the nest stand. There are no breeding season operations within or adjacent to NRF habitat that will occur prior to the completion of any NSO surveys. Operations will not occur before July 9th unless a minimum of three survey visits in the year of operation fail to detect NSO. If NSOs are detected on survey visits three to six operations will cease until nesting status can be determined. NSOs suspected or known to be nesting will receive additional protections (see BA page 64).

- There were minimal NRF habitat effects from fire. The NSO site may be below recommended NRF habitat minimums at the core and home range scales perhaps due to past vegetation management on the KNF lands and private property inholdings. Adverse effects will occur because the proposed action will reduce habitat (primarily NRF and PFF1) in areas which likely receive NSO use. Across all habitat types, the proposed action will result in a three percent reduction in the core and six percent reduction in the home range. Additionally, roadside hazard tree removal will degrade substantial amounts of NRF habitat in core.

- These habitat impacts will impair essential life history functions and reduce fitness of NSOs associated with this site. Therefore, the proposed action is reasonably certain to result in take of one pair of NSOs.

**KL0276B - Malone Creek 1:**

- The RA10 value for this site is moderate, NSOs were detected last in 1992, and the site lacks adequate surveys to conclude it is unoccupied. Based on the configuration and current amounts of habitat, the site is likely to be occupied by a pair of resident NSOs. There is no NRF habitat modification in the nest stand. There are no breeding season operations within or adjacent to NRF habitat that is likely to contain nesting NSOs prior to the completion of any NSO surveys. Operations will not occur before July 9th unless a minimum of three survey visits in the year of operation fail to detect NSOs. If NSOs are detected on survey visits three to six operations will cease until nesting status can be determined. NSOs suspected or known to be nesting will receive additional protections (BA, p. 64).

- There were minimal effects from fire, yet the NSO site is below recommended NRF habitat minimums at the core and home range scales. The proposed action will result in further reductions of NRF habitat in areas of likely NSO use. Additionally, roadside hazard tree removal will degrade substantial amounts of NRF habitat in the core.

- These habitat impacts will likely impair essential life history functions and reduce the fitness of NSOs associated with this site. Therefore, the proposed action is likely to result in take of one pair of NSOs.

**KLNew3A / KLNew 3B – East Walker Creek 1 and 2:**

- One pair of NSOs has used two alternate sites in past years. The RA10 values are low and moderate. NSOs were detected at night in both sites in 2015. NSOs are likely to shift their core or expand their home range. Based on the configuration and current amounts of habitat, we expect the site is likely occupied by a pair of resident NSOs, at least for the short-term, despite being profoundly impacted by fires.

- There is no NRF habitat modification in a nest stand. Operations will occur during the breeding season within and adjacent to NRF habitat in the core or home range (roadside hazard tree removal and commercial salvage) prior to the completion of any NSO surveys. These operations may remove undetected nest trees. If this occurs, young NSOs would likely be crushed by the impact, fall out of the nest and be subject to predation, or die from exposure or starvation. Across both cores about 42 acres of NRF habitat in the core will be...
exposed to noise during the breeding season from roadside hazard tree removal (BA table 12, page 69). Extensive noise disturbance may cause an increased flushing response or reduced feeding of young by adult NSOs; increasing the likelihood of exposure, predation, or starvation of young NSOs. For all other treatments, operations will not occur before July 9th unless a minimum of three survey visits in the year of operation fail to detect NSOs. If NSOs are detected on survey visits three to six operations will cease until nesting status can be determined. NSOs suspected or known to be nesting will receive additional protections (see BA page 64).

- The majority of the NRF habitat in the cores and home ranges burned at moderate to high severity. New3A had 60 and 65 percent reduction in NRF habitat, and New3B had 90 and 70 percent reductions of NRF habitat respectively in the core and home ranges. Both sites are below recommended NRF habitat minimums at the core and home range scales and will have further reductions of NRF habitat in areas of likely NSO use due to the proposed action. The scale and amount of PFF1 removal within the home range will result in a reduction of foraging opportunities.

- These habitat impacts in combination with breeding season operations prior to the completion of any NSO surveys are likely to impair essential life history functions and reduce fitness, or directly harm NSOs associated with these alternate sites. Therefore, the proposed action is likely to result in take of one pair of NSOs and up to young NSO.

**KLNew7A – China Creek 1:**

- The RA10 value for this site is moderate, and NSO s were detected last in 2011. Barred owl have been detected immediately adjacent to this site and may be suppressing NSO detections. Based on recent detections as well as the configuration and current amounts of habitat we expect the site could support occupancy by a pair of resident NSOs.

- Habitat modification will not occur in the nest stand. Roadside hazard tree removal will occur within or adjacent to NRF habitat in the home range during the breeding season prior to the completion of any NSO surveys. It is unknown what amount of NRF habitat in the home range will be exposed to noise during the breeding season from roadside hazard. FWS was unable to determine where the 2011 NSO detections reference in the BA (appendix C, p. 140) were located, but based on NRIS and CNDDB it appeared the last NSO detections in the core were in 2008. Barred owl presence creates uncertainty in potential nesting locations. Extensive noise disturbance may cause an increased flushing response or reduced feeding of young by adult NSOs increasing the likelihood of exposure/predation, or starvation of young NSOs. For all other treatments, operations will not occur before July 9th unless a minimum of three survey visits in the year of operation fail to detect NSOs. If NSOs are detected on survey visits three to six operations will cease until nesting status can be determined. NSOs suspected or known to be nesting will receive additional protections (see BA page 64).

- There were minimal effects to NRF habitat at this site from the fires. Adverse effects are expected to occur because roadside hazard tree removal will degrade substantial amounts of NRF habitat in the core during the breeding season (over two miles and 150 acres which degrades about 25 percent of NRF habitat in the core), the NSO site is below recommended NRF habitat minimums at the core and home range scales and the action proposes further reductions of NRF habitat within areas of likely NSO use. Hazardous fuels reduction will downgrade 38 acres in the home range.
• These habitat impacts combined with breeding season operations prior to the completion of any NSO surveys will impair essential life history functions and reduce the fitness, or directly harm NSOs associated with this site. Therefore, the proposed action is likely to result in take of one pair of NSOs and up to one young NSO.

*KLNew7B China Creek 2:*

• The RA10 value for this site is moderate, NSOs were last in observed 2011, and the site lacks adequate surveys to conclude it is unoccupied. Barred owl have been detected immediately adjacent to this site and may be suppressing NSO detections. Based on recent detections, as well as the configuration and current amounts of habitat, the site is likely to be occupied by a pair of resident NSOs.

• There is no habitat modification that will occur in the nest stand. Roadside hazard tree removal will degrade about 14 percent of NRF habitat in core prior to the completion of any NSO surveys. These operations may remove undetected nest trees. If this occurs, young NSOs would likely be crushed by the impact, fall out of the nest and be subject to predation, or die from exposure or starvation. All NRF habitat in the core may be unburned based on RAVG (BA table 12, page 69). It is unknown what amount of NRF habitat in the home range will be exposed to noise during the breeding season from roadside hazard. These NSO were detected roosting outside of the core in 2011 (the last year of detection) near salvage unit 262. Barred owl presence creates uncertainty in potential nesting locations. Extensive noise disturbance may cause an increased flushing response or reduced feeding of young by adult NSOs; increasing the likelihood of exposure, predation, or starvation of young NSOs. For all other treatments, operations will not occur before July 9th unless a minimum of three survey visits in the year of operation fail to detect NSO. If NSOs are detected on survey visits three to six operations will cease until nesting status can be determined. NSOs suspected or known to be nesting will receive additional protections (see BA page 64).

• About 10 percent of NRF habitat in the home range burned at moderate to high severity. The core was minimally impacted by fires. The NSO site is below recommended NRF habitat minimums at the core and home range scales and the action will further reduce NRF habitat in areas of likely NSO use. Additionally, the scale and amount of PFF1 removal (80 acres) will result in a reduction of foraging opportunities.

• The combination of these habitat impacts and breeding season operations prior to the completion of any NSO surveys will impair essential life history functions and reduce the fitness, or directly harm, NSOs associated with this site. Therefore, the proposed action is likely to result in take of one pair of NSOs and up to one young NSO.

*KL4133 – Louie Creek:*

• The NSO site has low RA10 value and had NSO detections last in 2011, and we lacks adequate surveys to conclude the site is unoccupied. Based on the configuration and current amounts of habitat, we expect the site is likely occupied by a pair of resident NSOs, at least for the short term, despite being profoundly impacted by fires.

• There is habitat modification in the nest stand, but NSOs are unlikely to nest there due to burn severity. Operations are proposed during the breeding season within and adjacent to NRF habitat prior to the completion of any NSO surveys. These operations may remove undetected nest trees. If this occurs, young NSOs would likely be crushed by the impact, fall out of the nest and be subject to predation, or die from exposure or starvation. Extensive
noise disturbance may cause an increased flushing response or reduced feeding of young by adult NSOs; increasing the likelihood of exposure, predation, or starvation of young NSOs. For all other treatments, operations will not occur before July 9th unless a minimum of three survey visits in the year of operation fail to detect NSOs. If NSOs are detected on survey visits three to six operations will cease until nesting status can be determined. NSOs suspected or known to be nesting will receive additional protections (see BA page 64).

- The core and home range were profoundly affected by fire. Substantial amounts of PFF1 will be removed. The proposed action also reduces NRF habitat by about 40 acres.
- These impacts to habitat in combination with breeding season operations prior to the completion of any NSO surveys are likely to impair essential life history functions and reduce the fitness, or directly harm NSOs associated with this site. Therefore, the proposed action is reasonably certain to result in take of one pair of NSOs and up to one young NSO.

**Whites Fire Area**

**KL1027 – West Whites:**

- The RA10 value for this site is moderate and NSOs were last observed in 2010. Barred owl have been detected immediately adjacent to this site and may be suppressing NSO detections. Based on configuration and current amounts of habitat, the site is likely to be occupied by a pair of resident NSOs.
- Habitat modification is not proposed in the nest stand. Roadside hazard tree removal will occur during the breeding season adjacent to NRF habitat (about 80 acres) prior to the completion of any NSO surveys. Extensive noise disturbance may cause an increased flushing response or reduced feeding of young by adult NSOs; increasing the likelihood of exposure, predation, or starvation of young NSOs. For all other treatments, operations will not occur before July 9th unless a minimum of three survey visits in the year of operation fail to detect NSO. If NSOs are detected on survey visits three to six operations will cease until nesting status can be determined. NSOs suspected or known to be nesting will receive additional protections (see BA page 64).
- About 10 percent of NRF habitat in the core and 15 percent of NRF habitat in the home range burned at moderate to high severity. The site is below recommended NRF habitat minimums at the core and home range. The proposed action will further reduce NRF and PFF 1 habitat in areas of likely NSO use.
- The combination of these habitat impacts and breeding season operations prior to the completion of any NSO surveys is likely to impair essential life history functions and reduce fitness, or directly harm NSOs associated with this site. Therefore, the proposed action is likely to result in take of one pair of NSOs and up to young NSO.

**KL1029 - Lower East Fork Whites Gulch:**

- The RA10 value for this site is high, and NSOs were last observed in 2008. The site lacks adequate surveys to conclude it is unoccupied. Based on the configuration and current amounts of habitat, the site is likely to be occupied by a pair of resident NSOs.
- NRF Habitat modification is not proposed in the nest stand. Breeding season operations will occur, within and adjacent to NRF habitat in the core, prior to the completion of any NSO surveys (BA, table 17, p. 86). These operations may remove undetected nest trees. If this occurs, young NSOs would be crushed by the impact, fall out of the nest and be subject to
predation, or would die from exposure or starvation. Extensive noise disturbance may cause an increased flushing response or reduced feeding of young by adult NSOs; increasing the likelihood of exposure, predation, or starvation of young NSOs.

- About 15 percent of NRF habitat burned at moderate to high severity in the core and home range. The NSO site is below recommended NRF habitat minimums in the core, but above recommended habitat minimums in the home range. The home range would stay above recommended NRF habitat minimums post treatment. The proposed action will degrade 100 acres of NRF habitat in the core (35 percent of NRF habitat available in core) and 600 acres of NRF in the home range. The majority of the degraded NRF habitat occurs in areas of likely NSO use.

- The combination of these habitat impacts and breeding season operations prior to the completion of any NSO surveys is likely to impair essential life history functions and reduce fitness, or directly harm NSOs associated with this site. Therefore, the proposed action is likely to result in take of one pair of NSOs and up to one young NSO.

**KL1039 - Russian Creek:**

- The RA10 value for this site is high, NSOs were last observed in 1995, and the site lacks adequate surveys to conclude it is unoccupied. Based on configuration and current amounts of habitat, the site is likely to be occupied by a pair of resident NSOs.

- There is no NRF habitat modification in the nest stand. Breeding season operations will occur adjacent to NRF habitat in the core prior to the completion of any NSO surveys. About 58 percent of the NRF habitat in the core (140 acres) will be affected by noise. Extensive noise disturbance may cause an increased flushing response or reduced feeding of young by adult NSOs; increasing the likelihood of exposure, predation, or starvation of young NSOs. For all other treatments, operations will not occur before July 9th unless a minimum of three survey visits in the year of operation fail to detect NSOs. If NSOs are detected on survey visits three to six operations will cease until nesting status can be determined. NSOs suspected or known to be nesting will receive additional protections (see BA page 64).

- About 12 percent of NRF habitat burned at moderate to high severity in the home range. Fire impacts to NRF habitat in the core were minimal. The site is below recommended NRF habitat minimums at the core and the proposed action will further reduce NRF in the core. Also, NRF habitat in the home range will be reduced from about 1,500 acres to near recommended NRF habitat minimums.

- The combination of these habitat impacts and breeding season operations prior to the completion of any NSO surveys is likely to impair essential life history functions and reduce fitness, or directly harm NSOs associated with this site. Therefore, the proposed action is likely to result in take of one pair of NSOs and up to one young NSO.

**KL1040 – Applesauce Gulch:**

- The RA10 value for this site is high, NSOs were last observed in 1999, and the site lacks adequate surveys to conclude it is unoccupied. Based on configuration and current amounts of habitat, we expect the site could support occupancy by a pair of resident NSOs.

- There is no habitat modification in the nest stand. Roadside hazard tree removal will occur immediately adjacent to high quality NRF habitat in the core prior to the completion of any NSO surveys. These operations may remove undetected nest trees. If this occurs, young NSOs would likely be crushed by the impact, fall out of the nest and be subject to predation, or die from exposure or starvation. Extensive noise disturbance may cause an increased
flushing response or reduced feeding of young by adult NSOs; increasing the likelihood of exposure, predation, or starvation of young NSOs. For all other treatments, operations will not occur before July 9th unless a minimum of three survey visits in the year of operation fail to detect NSO. If NSOs are detected on survey visits three to six operations will cease until nesting status can be determined. NSOs suspected or known to be nesting will receive additional protections (see BA page 64).

- About 30 percent of NRF habitat burned at moderate to high severity in the core and home range. The core is below recommended NRF habitat minimums and the proposed action proposes will downgrade and remove NRF habitat in the core (seven acres) in areas of likely NSO use.
- These impacts to habitat combined with breeding season operations prior to the completion of any NSO surveys are likely to impair essential life history functions and reduce the fitness, or directly harm NSOs associated with this site. Therefore, the proposed action is likely to result in take of one pair of NSOs and up to one young NSO.

**KL1041 – Music Creek:**

- The RA10 value for this site is high, and NSOs were detected in 2015. The habitat amounts and configuration, along with recent detections, suggest the site is likely to be occupied by a pair of resident NSOs.
- Habitat modification will not occur in the nest stand. Roadside hazard tree removal will occur within and adjacent to NRF habitat in the core prior to the completion of any NSO surveys. About 196 acres of NRF habitat in the core will be exposed to noise during the breeding season (BA table 12, page 69). It is unknown how much NRF habitat may be degraded during the breeding season. Supplemental information to the BA (appendix A, p. 10, KNF response 22) indicates table 20 has incorrect acres for this site. Corrected acres for table 20 were not provided. These operations may remove undetected nest trees. If this occurs, young NSOs would likely be crushed by the impact, fall out of the nest and be subject to predation, or would die from exposure or starvation. Extensive noise disturbance may cause an increased flushing response or reduced feeding of young by adult NSOs; increasing the likelihood of exposure, predation, or starvation of young NSOs. For all other treatments, operations will not occur before July 9th unless a minimum of three survey visits in the year of operation fail to detect NSOs. If NSOs are detected on survey visits three to six operations will cease until nesting status can be determined. NSOs suspected or known to be nesting will receive additional protections (see BA page 64).
- About 10 percent of NRF habitat in the core and 30 percent of NRF habitat in the home range burned at moderate to high severity. The core and home range are below recommended NRF habitat minimums. NRF habitat (35 acres) will be downgraded in areas of likely NSO use.
- These habitat impacts combined with breeding season operation prior to the completion of any NSO surveys will impair essential life history functions and reduce the fitness, or directly harm NSOs associated with this site. Therefore, the proposed action is likely to result in take of one pair of NSOs and up to one young NSO.

**KL1046 - Cow Creek:**

- The RA10 value for this site is high, and NSOs were last observed in 2011. Based on the configuration and current amounts of habitat and the recent detections, we expect the site could support occupancy by a pair of resident NSOs.
Habitat modification will not occur in the nest stand. Roadside hazard tree removal occurs in the core or home range during the breeding season prior to the completion of any NSO surveys. About 97 acres of NRF habitat in the core will be exposed to noise during the breeding season (BA table 12, page 69). These operations may remove undetected nest trees. It is unknown how much NRF habitat may be degraded during the breeding season. Supplemental information to the BA (appendix A, p. 10, KNF response 22) indicates table 20 has incorrect acres for this site. Corrected acres for table 20 were not provided. If this occurs, young NSOs would likely be crushed by the impact, fall out of the nest and be subject to predation, or die from exposure or starvation. Extensive noise disturbance may cause an increased flushing response or reduced feeding of young by adult NSOs; increasing the likelihood of exposure, predation, or starvation of young NSOs.

About 20 percent of NRF habitat in the core and home range burned at moderate to high severity. The site is below recommended NRF habitat minimums at the core and home range scales and the action proposes to further reduce NRF habitat in areas of likely NSO use.

These habitat impacts in combination with breeding season operations prior to the completion of any NSO surveys will impair essential life history functions and reduce fitness, or directly harm NSOs associated with this site. Therefore, the proposed action is likely to result in take of one pair of NSOs and up to one young NSO.

KL1047B - Etna Summit / North Russian:

The RA10 value for this site is high, and NSOs were last observed in 2015. Based on the configuration and current amounts of habitat and the recent detections, the site is likely to be occupied by a pair of resident NSOs.

No habitat modification will occur in the nest stand. Roadside hazard tree removal will occur in the core or home range prior to the completion of any NSO surveys and may remove undetected nest trees. If this occurs, juvenile NSOs would likely be crushed by the impact, fall out of the nest and be subject to predation, or die from exposure or starvation. About 136 acres of NRF habitat in the core will be exposed to noise during the breeding season (BA table 12, page 69). Extensive noise disturbance during the breeding season may cause an increased flushing response or reduced feeding of juveniles by adult NSOs; increasing the likelihood of exposure, predation, or starvation of juvenile NSOs. For all other treatments, operations will not occur before July 9th unless a minimum of three survey visits in the year of operation fail to detect NSOs. If NSOs are detected on survey visits three to six operations will cease until nesting status can be determined. NSOs suspected or known to be nesting will receive additional protections (see BA page 64).

The NSO site is below recommended NRF habitat minimums at the core and slightly above in the home range. NRF habitat will be downgraded by proposed action in areas of likely NSO use. There appears to be an error in table 20 of the BA which shows more acres of NRF habitat treated than currently exist in the core, so our this analysis is based primarily on the GIS spatial layers that accompanied the BA, table 12, and table 17 BA (pages 69 and 87). There are additional substantial amounts of NRF habitat that will be degraded in the core and home range.

These habitat impacts combined with breeding season operations prior to the completion of any NSO surveys will impair essential life history functions and reduce fitness, or directly harm NSOs associated with this site. Therefore, the proposed action is likely to result in take of one pair of NSOs and up to one young NSO.
**KL1258 – Hickey Gulch**

- This NSO site has moderate RA10 value. NSOs were detected last in 1991. We lack adequate surveys to conclude it is unoccupied. Based on the configuration and current amounts of habitat, the site is likely to be occupied by a pair of resident NSOs.
- Habitat modification is not proposed in the nest stand. There are breeding season operations within and adjacent to NRF habitat in the home range prior to the completion of any NSO surveys. About three acres of NRF habitat in the core is exposed to noise disturbance based on BA (table 12, p. 69). It is unknown how much NRF habitat is exposed to noise in the home range. The GIS spatial data that accompanied the BA does not show any roadside hazard on ingress/egress within 0.25 miles of NRF habitat in the core. The nearest unit in modified alternative 3 is R136. However, FWS chose to analyze the scenario with the greatest impacts to NSO and assumed table 12 in the BA (p. 69) was correct. These operations may remove undetected nest trees. If this occurs, juvenile NSOs would likely be crushed by the impact, fall out of the nest and be subject to predation, or die from exposure or starvation. Extensive noise disturbance during the breeding season may cause an increased flushing response or reduced feeding of juveniles by adult NSOs; increasing the likelihood of exposure, predation, or starvation of juvenile NSOs.
- About 40 percent of the NRF habitat in core and 30 percent in the home range burned at moderate to high severity or during the breeding season. The NSO site is below recommended NRF habitat minimums at the core and home range scales and the proposed action will downgrade NRF habitat in areas of likely NSO use in the home range. Additionally, 160 acres of NRF habitat will be degraded.
- These habitat impacts combined with breeding season operations prior to the completion of any NSO surveys will impair essential life history functions and reduce fitness, or directly harm NSOs associated with this site. Therefore, the proposed action is likely to result in take of one pair of NSOs and up to one young NSO.

**KL99910 – Johns Meadows Creek:**

- The RA10 value for this site is high, and NSOs were last detected in 2013. Barred owls have been detected in the vicinity and may be suppressing NSO detections. Based on the configuration and current amounts of habitat and recent detections, the site is likely to be occupied by a pair of resident NSOs.
- Habitat modification is not proposed in the nest stand. Breeding season operations will occur within and adjacent to NRF habitat and within 0.25 miles of 2013 NSO detections prior to the completion of any NSO surveys. These operations may remove undetected nest trees. If this occurs, juvenile NSOs would likely be crushed by the impact, fall out of the nest and be subject to predation, or die from exposure or starvation. Extensive noise disturbance during the breeding season may cause an increased flushing response or reduced feeding of young NSOs by adult NSOs; increasing the likelihood of exposure, predation, or starvation of young NSOs.
- About 15 percent of NRF habitat in the core and home range burned at moderate to high severity. Adverse effects will occur because the site is below recommended NRF habitat minimums at the core and home range scales and the project proposes to further reduce NRF habitat in areas of likely NSO use. Large amounts of NRF habitat that will be degraded or
downgrades, near both the 1991 nest stand and near 2013 NSO detections (northwest of the core near roadside treatments) will reduce NSO nesting, roosting, and foraging opportunities.

- These habitat impacts combined with breeding season operations prior to the completion of any NSO surveys will impair essential life history functions and reduce fitness, or directly harm NSOs associated with this site. Therefore, the proposed action is likely to result in take of one pair of NSOs and up to one young NSO.

**KL99912 – Eddy Lookout**

- The RA10 value for this site is high, NSOs were last observed in 2009, and the site lacks adequate surveys to conclude the site is unoccupied. Barred owl have been detected immediately adjacent to this site and may be suppressing NSO detections. Based on the configuration and current amounts of habitat, the site is likely to be occupied by a pair of resident NSOs.
- Based on available data we assumed degrade of NRF habitat will occur in the nest stand. The majority of NRF habitat in the core is treated during the breeding season (270 acres degraded and seven acres removed). These operations may remove undetected nest trees. If this occurs, juvenile NSOs would likely be crushed by the impact, fall out of the nest and be subject to predation, or die from exposure or starvation. Extensive noise disturbance during the breeding season may cause an increased flushing response or reduced feeding of young NSOs by adult NSOs; increasing the likelihood of exposure, predation, or starvation of young NSO.
- About 20 percent of NRF habitat in the core and 10 percent of NRF habitat in the home range burned at moderate to high severity. The site is below recommended NRF habitat minimums at the core and the action proposes to reduce NRF habitat further. NRF habitat is above recommended minimums at the home range scale and will remain so after the action. The scale, location, and amount of PFF1 removal and NRF habitat degrade or downgrade within the home range will result in a reduction of nesting, roosting, and foraging opportunities.
- These habitat impacts combined with breeding season operations prior to the completion of any NSO surveys will impair essential life history functions and reduce fitness, or directly harm NSOs associated with this site. Therefore, the proposed action is likely to result in take of one pair of NSOs and up to one young NSO.

**Summary across the action area**

Forty-eight of the 57 NSO sites with LAA determinations are ranked with moderate to high RA10 value. NSO sites with moderate to high RA10 value should be considered a priority for conservation to provide demographic support to the province and the range. Take is expected of 37 pairs of NSOs associated with 40 NSO sites. Operations during the breeding season, which occur before any completed surveys inform nest locations, may remove undetected nest trees. If this occurs, juvenile NSOs would likely either be crushed by the impact, or would fall out of the nest and be subject to predation or would die from exposure or starvation. Extensive noise disturbance during the breeding season may cause an increased flushing response or reduced feeding of juveniles by adult NSOs increasing the likelihood of exposure/predation, or starvation of juvenile NSOs. In addition to the take of 37 pairs of adult NSOs, we expect the proposed action to result in take of 12-29 young.
6.4 NSO Prey Species

Detailed information pertaining to NSO prey species and foraging habits can be found in appendix C. The following section will focus only on effects to the two primary prey species believed to reside in the action area (northern flying squirrels and dusky-footed woodrats). In addition to these two species, FWS also expects pocket gophers to be an important prey source in areas of early successional habitat adjacent to mid mature and mature forest stands.

Effects to Flying Squirrels

Recent studies show a negative correlation between many types of harvest and flying squirrels fitness, abundance and survival. Lehmkuhl et al. (2006) showed that flying squirrel fitness is associated with understory vegetation diversity, dead wood, defective trees, and ectomycorrhizal truffle and lichen biomass and communities. Reduction of down wood may alter production of truffles on which flying squirrels depend (Lehmkuhl et al., 2004). Harvest which reduced stand density, overstory canopy cover and mid-story structure was found to negatively impact abundance and survival (Wilson 2010, Manning et al. 2012, Wilson and Forsman 2013). Greater canopy cover may provide protection from predators, while thicker litter layers may harbor more truffles, both of which benefit flying squirrels (Meyer et al. 2007). Thus, reductions in any important elements of flying squirrel habitat (stand density, overstory canopy cover, mid-story structure, understory vegetation diversity, dead and down wood, defective trees, truffle and lichen biomass, canopy cover and litter) may negatively influence flying squirrel populations.

Because of the importance of northern flying squirrels as NSO prey, we consider here the potential effects of the proposed action on northern flying squirrels. As a proxy we assume that NSO NRF habitat is potentially suitable for flying squirrels. Treatments that degrade existing NRF habitat also may negatively influence flying squirrels, but the effects will be of a shorter duration. Treatments including FMZ, WUI, and roadside complete prescriptions are expected to have the longest term negative effect on flying squirrels due to the significant reductions in flying squirrel habitat structure and composition.

Salvage harvest and the most intensive roadside treatment planned for stands that have burned at medium to high severity and where many habitat elements (e.g., canopy cover and structure) were destroyed or significantly reduced by the fire, likely no longer serve as habitat for flying squirrels. Removal of post fire foraging and fire-affected nesting and roosting habitat across all treatment types occurs in areas that are no longer expected to provide flying squirrel habitat, so the removals of these two habitat types are not anticipated to further reduce flying squirrel abundance or alter their distribution.

Effects to dusky-footed woodrats

Fire increases the abundance of shrubby vegetation used by woodrats (along with mice and vole species). Edge ecotones created from fire can be areas of increased woodrat abundance and exposure to foraging NSOs (Zabel et al.1995). Several habitat studies have documented NSO use of edge ecotones; NSOs are likely to capitalize on the woodrat abundance in these areas (Clark 2007, Folliard 1993, Irwin et al. 2013, and Comfort 2014). It is unclear whether the 2014 fires in the action area reduced woodrat habitat. The fire reduced late successional, which provides habitat for woodrats. On the other hand, the fire also created conditions that facilitated the
establishment of early successional vegetation. Both late successional forest and early successional vegetation are habitat types associated with high density woodrat populations.

The proposed habitat alterations could negatively influence woodrat abundance by removing smaller live trees and other standing dead or down trees. This may reduce woodrat food sources and concealment cover. In addition, the proposed salvage will cause ground disturbing actions which vary in intensity from ground based to helicopter units. The ground disturbance may preclude occupancy by woodrats in the short-term. However the subsequent early-seral conditions will provide beneficial conditions for woodrats. We anticipate that the remaining NSOs will forage along the edges of the unburned and burned salvaged area; the diverse vegetation along these edges should support a variety of NSO prey species. Within the fire perimeter, we anticipate woodrat habitat connectivity will remain largely.

**Summary of Effects to Prey Species**
The majority of NSO habitat on Federal lands in the action area will not be affected by the proposed action. These untreated areas will continue to provide foraging opportunities for NSOs where prey abundance and distribution is not altered.

Some aspects of the proposed action are likely to negatively impact NSO prey through habitat removal. The Recovery Plan noted that many researchers have examined how to maintain habitat for NSO prey in order to maintain NSO populations (USDI FWS 2011a). For example, Lemkuhl et al. (2006) and Carey (1991) identified the importance of maintaining snags, downed wood, and canopy cover. Gomez et al. (2005) noted the importance of fungal sporocarps, which were positively associated with large downed wood retained on site post-harvest; Carey and Johnson (1995) noted the importance of at least 10 to 15 percent cover of downed wood to benefit prey.

The PDFs (BA, table 4 p. 19) relating to snag and down wood retention will reduce but not eliminate the treatments’ impacts on the NSO’s primary prey species. In addition, given the mosaic of habitat conditions created by the 2014 fires in the action area and the distribution of treatment units of varying sizes and shapes it is also possible that the treatments may increase NSO prey diversity by further creating edge/ecotone habitat adjacent to retained stands of NRF habitat within the action area.

Based on this analysis, the FWS concludes that the proposed action is likely to have both adverse and beneficial effects to prey species.

**6.5 Proposed Action Impacts on NSO/Barred Owl Competition**
Barred owls are a forest habitat generalist but they often select pre-fire NSO nesting, roosting, and foraging habitat (Hamer et al. 2007 and Wiens et al. 2014). Similar to NSO, barred owls may also utilize moderate to high severity burned nesting, roosting and foraging habitat and fire affected nesting-roosting and post fire foraging habitat to some degree. Data relevant to the relationship between NSO survival and reproduction response and barred owl interactions specific to forest management are limited.

Reduced amounts of NRF habitat and reductions in NSO prey density and distribution, especially in landscapes recently affected by the large scale disturbance events, may exacerbate competition.
for resources between barred owls and NSOs where the species co-exist. NSOs displaced because of fire and/or habitat reductions from the proposed action may have increased difficulty in finding new territories to colonize or in expanding their home ranges to compensate for habitat reductions when barred owls are present on the landscape. The overall downgrade and removal of about 2,500 acres (three percent of habitat available) of NRF and FANR habitat in the action area as well as degrade about 4,000 acres of NRF habitat may intensify competition between NSOs and barred owls. The time scale for these effects is largely unknown. See Section 6.1.2, Effects to Habitat, for a complete summary of the habitat reductions and modifications proposed as part of this proposed action.

6.6 Conclusion

In summary, the proposed action will adversely affect the majority of NSO sites (57 of 85) by altering, reducing or removing key habitat elements (such as large diameter trees, canopy cover, multiple canopy layers, concealment cover, foraging perches, suitable microclimate conditions). The proposed action is likely to have both adverse and neutral effects to species. In areas where the proposed action will lead to reductions in distribution, quantity and quality of habitat, competition for resources may increase between NSO and barred owls where the two species co-exist. These and other stressors from the recent fires, habitat modification or breeding season operations are described above in subsections 6.1.2, 6.2.2, and 6.3.2. The stressors collectively likely to lead to reduced NSO fitness and take in the form of harm or harassment of 37 pairs at 40 NSO sites (see table 6.5 in appendix A and section 6.3.2 above). Resident pairs of NSOs at 32 sites are exposed to operations with no breeding season restrictions; based on productivity rates, these sites would be expected to produce 12-29 young owls, which will also be incidentally taken. The sites we expect to be taken currently have moderate to high RA10 values. Thirteen other moderate and 20 high RA10 value NSO sites will be conserved within the action area and will continue to provide demographic support to the province and the range. Another 12 sites with low RA10 values, have a very low likelihood of occupancy, and do not contribute to demographic support. Long term benefits to NSO and late successional habitat may be realized as described in the fuels strategy, including safer accessible routes to and within strategic defensive areas as well as reductions in fuel continuity across the treated portion of the landscape.

Effects from the action have been minimized to some degree through the project design. This includes the implementation of partial surveys prior to implementation in some areas, the retention of large legacy trees, riparian areas, and large coarse wood. Information gained through monitoring will assist in informing future analyses of similar projects.

7. Cumulative Effects to the NSO

Cumulative effects are those effects of future State, Tribal, and private actions that are reasonably certain to occur within the action area. The BA indicates that there are no state or tribal lands in the action area. Future Federal actions will be subject to the consultation requirements established in Section 7 of the ESA and, therefore, are not considered cumulative to the proposed action.

Estimates of effects to habitat from cumulative effects below are based on the KNF EVEG layer submitted for this consultation (EVEG V3B).
**Beaver Fire Area**

Based on FWS GIS analysis, private lands account for approximately half of the Beaver fire area or about 15,000 acres within the action area. MCTC and FGS own the vast majority of the private land in the Beaver fire area. Post-fire salvage harvest was planned on these properties under 50-55 emergency exemptions filed with CAL FIRE in 2014 and 2015 (pers. comm. Damon Denman). Locations and size for a little over half of these emergency exemptions can be determined using the CAL FIRE Forest Practices GIS data download portal (http://calfire.ca.gov/resource_mgt/resource_mgt_forestpractice_gis, accessed 12/15/2015) (cited as “CAL FIRE 2015” for the remainder of the section). At the time of this writing that the majority of harvest activities associated with those 50-55 exemptions actions have been completed (pers. comm. D. Denman).

In July 2015, FGS provided hard copy maps that identified recently completed, in progress, and additional areas planned for harvest in 2016. This harvest overlapped with the home ranges of 14 NSO sites. In general, the completed and in progress harvest was in and between areas burned moderate to high severity, while the 2016 harvest was focused in larger blocks of low burn severity where additional delayed mortality was predicted. With the exception of areas depicted as 2016 harvest, all FGS salvage operations had been completed and are not considered a cumulative effect. The activities designated as 2016 harvest units, which remove NSO habitat, are considered cumulative effects to the proposed action. Based on the areas identified for 2016 harvest, FWS estimates that up to 2,400 additional acres may be salvaged, of which the majority (1,7850 acres) is within the action area. Within the future salvage areas, we estimate 660 acres containing NRF habitat, 240 acres containing PFF habitat, and 880 acres containing dispersal habitat will be removed. The vast majority of the NRF habitat that will be removed is located within NSO home ranges in the action area (see table 12 below). It is not possible at this time to fully understand how these harvest areas relate to the 50-55 emergency exemptions filed with CAL FIRE because spatial data are available for only about half of the emergency exemptions (CAL FIRE 2015). These activities are considered cumulative effects to the proposed action.

Two of the five timber harvest plans (THPs), identified in the BA (pp. 100-101), occur in the Beaver fire area (CAL FIRE 2015). What the BA refers to as THP 41 has a complete THP number of 2-13-041-SIS, and is referred to as Buck/Dog, while THP 27 has a complete THP number of 2-11-027-SIS, and is referred to as Dutch/Beaver. The BA indicates these plans total about 1,840 acres. Our analysis based on unit boundaries from the CAL FIRE Forest Practices GIS (CAL FIRE 2015) indicates the majority (about 1,800 acres) were located within the action area and may remove up to 490 acres of NRF habitat. About 330 acres of PFF habitat and 20 acres of FANR habitat also occur within these THP units and will be removed if it has not already been harvested under emergency exemptions.

Based on CAL FIRE Forest Practices GIS, FWS also identified another THP that overlaps the action area: THP 2-14-089-SIS, referred to as Pipeline (CAL FIRE 2015). Pipeline THP includes units totaling 300 acres. The BA may have excluded Pipeline THP from the cumulative effects discussion because it largely overlaps an area of ongoing salvage harvest with many emergency exemption notices filed as of July 2015 (CAL FIRE 2015). Table 7.1 in appendix A provides a short description of each THP, including the legal location, number of NSO sites nearby, and an
indication if large trees (over 150 years) are being harvested. We estimate about 130 acres of the Pipeline THP are within the home range of NSO site KL0499 and within the action area. The majority of NSO habitat within Pipeline THP units is typed D. Less than 10 acres of NRF habitat and less than 10 acres of PFF habitat and FANR habitat will be removed.

The table below summarizes total NSO habitat affected by emergency exemptions and THP’s in the Beaver fire area.
Table 12. Summary of estimated cumulative effects in the Beaver fire area.

<table>
<thead>
<tr>
<th>Landowner</th>
<th>THP name or possible future emergency exemptions</th>
<th>Total within action area (acres)</th>
<th>NRF removed within action area¹</th>
<th>D removed within action area¹</th>
<th>PFF or FANR removed within action area¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>FGS</td>
<td>Buck / Dog and Dutch / Beaver</td>
<td>1,800</td>
<td>490</td>
<td>960</td>
<td>350</td>
</tr>
<tr>
<td>FGS</td>
<td>“Phase 2016” salvage</td>
<td>1,780</td>
<td>660</td>
<td>880</td>
<td>240</td>
</tr>
<tr>
<td>MCTC</td>
<td>Pipeline</td>
<td>130</td>
<td>10</td>
<td>120</td>
<td>0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>3,710 / 1%</strong></td>
<td><strong>1,160 / 2%</strong></td>
<td><strong>1,960 / 4%</strong></td>
<td><strong>590 / 3%</strong></td>
</tr>
</tbody>
</table>

¹ Acres rounded to the nearest ten. Percent represents acres divided by habitat baseline (from table 4 in section 5 of this BO) or the total action area size of 277,720 acres.

In summary, the cumulative effects include removal of about 1,160 acres of NRF habitat, 1,960 acres of D habitat, 570 acres of PFF habitat, and 20 acres of FANR habitat. At least half of the NSO sites within the Beaver fire area will be impacted by this habitat removal.

Happy Camp Complex Fire Area

Based on FWS’s GIS analysis, private lands account for about 5,300 acres in this portion of the action area. The BA states, “The private lands in these project areas [Happy Camp complex and White fire] were also affected by the 2014 fires in varying amounts and may be harvested, but currently do not have any timber harvest plans filed” (p. 100). FWS determined one of the THPs identified in the BA (table 21, page 100) as a potential cumulative effect is in fact located within this fire area. This THP is located just east of Curley Jack Creek adjacent to the town of Happy Camp (CAL FIRE 2015). It appears this THP is still pending final approval and that CAL FIRE has asked Northwest Skyline Logging Company to submit additional information. The THP may remove about 45 acres of NRF habitat and 15 acres of D habitat. No PFF habitat or FANR habitat are located in THP units. About half of the harvest occurs within the home range of KL9992 and could adversely affect this NSO site.

There have been 10-15 emergency exemption notices for private land within the Happy Camp complex and Whites fire areas collectively. Spatial locations of this salvage harvest and status towards completion are not available at this time. From discussion with a local CAL FIRE forester, the majority are located along Scott River road on the northeastern edge of this fire area (pers. comm. Damon Denman). Based on FWS GIS analysis, across the entire Happy Camp complex fire area, only 1,990 acres of the 5,300 acres of private contain NSO habitat (580 acres NRF habitat, 5 acres FANR habitat, 35 acres PFF habitat, and 1364 acres of D habitat). Since neither spatial locations nor status of the emergency exemptions are known, we assume all NSO habitat on private land could be removed. This is likely an overestimate of cumulative effects in this fire area.

The table below summarizes total NSO habitat affected by emergency exemptions and THP’s in the Happy Camp Complex fire area.
Table 13. Summary of estimated cumulative effects in the Happy Camp complex fire area.

<table>
<thead>
<tr>
<th>Landowner</th>
<th>THP name or other description</th>
<th>Total within action area (acres)</th>
<th>NRF removed within action area¹</th>
<th>D removed within action area¹</th>
<th>PFF or FANR removed within action area¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>Northwest Skyline Logging Company</td>
<td>Forcher / Curley Jack Creek THP</td>
<td>60</td>
<td>50</td>
<td>20</td>
<td>0</td>
</tr>
<tr>
<td>Unknown</td>
<td>Potential harvest under ongoing or future emergency exemptions</td>
<td>5,300</td>
<td>580</td>
<td>1,360</td>
<td>40</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>5,360 / 2%</strong></td>
<td><strong>630 / &lt;1%</strong></td>
<td><strong>1,380 / 3%</strong></td>
<td><strong>40 / &lt; 1%</strong></td>
<td></td>
</tr>
</tbody>
</table>

¹ Acres rounded to the nearest ten. Percent represents acres divided by habitat baseline (from table 4 in section 5 of this BO) or the total action area size of 277,720 acres.

Whites Fire Area

The BA did not identify THP 2-13-SIS-075, referred to as Etna/French Creek, located on MCTC land, as a potential cumulative effect. However, FWS determined that harvest associated with this plan was still pending and a small portion of the THP was located within the action area (CAL FIRE 2015). This THP is located in the Lunch Creek area in the Whites Fire portion of the action area. However, FWS was able to confirm with MCTC that all units except the ones in section 33 (T41N R09W) located outside of the action area have already been harvested (pers. comm. B. Douglas). This harvest may have removed up to 20 acres of NRF habitat in section 15 (T41N R10W), but does not constitute a cumulative effect since the action is already complete. This habitat removal occurred outside of any home ranges of NSO sites identified by KNF as occurring within the action area.

There have been 10-15 emergency exemption notices for private land within the Happy Camp complex and Whites fire areas collectively. Spatial locations of this salvage harvest and status towards completion are not available at this time. From discussion with a local CAL FIRE forester the majority are within the Happy Camp complex (pers. comm. Damon Denman). Based on FWS GIS analysis, across the entire Whites fire area, only 880 acres of the 1280 acres of private land contain NSO habitat (540 acres NRF habitat, 3 acres FANR habitat, 98 acres PFF habitat, and 226 acres D habitat). Since neither, spatial locations nor status, of the emergency exemptions are known, we assume all NSO habitat on private land could be removed. This is likely an overestimate of cumulative effects in this fire area.
Table 14. Summary of all estimated cumulative effects in the Whites fire area.

<table>
<thead>
<tr>
<th>Land-owner</th>
<th>THP name or other description</th>
<th>Total within action area (acres)</th>
<th>NRF removed within action area(^1)</th>
<th>D removed within action area(^1)</th>
<th>PFF or FANR removed within action area(^1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unknown</td>
<td>Potential harvest under ongoing or future emergency exemptions</td>
<td>1,280</td>
<td>540</td>
<td>230</td>
<td>100</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>1,280 / &lt;1%</strong></td>
<td><strong>540 / &lt;1%</strong></td>
<td><strong>230 / &lt;1%</strong></td>
<td><strong>100 / &lt;1%</strong></td>
</tr>
</tbody>
</table>

\(^1\) Acres rounded to the nearest ten. Percent represents acres divided by habitat baseline (from table 4 in section 5 of this BO) or the total action area size of 277,720 acres.

**Outside of fire areas but within the action area**
Two THPs identified in the BA (table 21, pp. 100-101) are located just south of the Beaver fire boundary (THP 87 is numbered 2-12-087-SIS and referred to as McKinney Creek, and THP 85 is numbered 2-11-85-SIS and referred to as Collins Creek). About 330 acres of NRF habitat near NSO site KL2124 is located within these two THP clear-cut units. Based upon internal records and past correspondence with MCTC, FWS was able to confirm that the units within this NSO home range and within the action area have already been harvested. Therefore, habitat removal associated with this THP does not constitute a cumulative effect. These acres were not adjusted in the baseline habitat estimates listed in table 4 in section 5 of this BO, and constitute a change of less than 0.5 percent of NRF habitat estimated within the action area.

**Effects to NSO Sites**

**Table 15. NRF removal by NSO site from FGS planned 2016 phase salvage harvest (possible future emergency exemptions), THPs, and emergency exemptions for which harvest may be ongoing.**

<table>
<thead>
<tr>
<th>Fire / NSO Sites Affected</th>
<th>NRF removal across core and home range (acres)(^1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beaver Fire</td>
<td></td>
</tr>
<tr>
<td>KL0283</td>
<td>110</td>
</tr>
<tr>
<td>KL0315</td>
<td>80</td>
</tr>
<tr>
<td>KL0346</td>
<td>60</td>
</tr>
<tr>
<td>KL0499</td>
<td>10</td>
</tr>
<tr>
<td>KL4143</td>
<td>30</td>
</tr>
<tr>
<td>KL99513</td>
<td>200</td>
</tr>
<tr>
<td>KL99514</td>
<td>60</td>
</tr>
<tr>
<td>KL99515</td>
<td>200</td>
</tr>
<tr>
<td><strong>Sub-total</strong></td>
<td><strong>750 (across 8 NSO sites)</strong></td>
</tr>
<tr>
<td>Happy Camp complex</td>
<td></td>
</tr>
</tbody>
</table>
### Fire / NSO Sites Affected

<table>
<thead>
<tr>
<th>Cores and home range of: KL0276A, KL0276B, KL1119, KLNew7A, and KLNew7B.</th>
<th>NRF removal across core and home range (acres)(^1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sub-total</td>
<td>610 (across 22 NSO sites)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Whites Fire</th>
</tr>
</thead>
<tbody>
<tr>
<td>No private occurs in cores of NSO sites.</td>
</tr>
<tr>
<td>Home range only of: KL0365, 1027, 1039, 1040, 1041, 1046, 1047B, and 99912.</td>
</tr>
</tbody>
</table>

\(^1\) All acres are rounded to the nearest ten.

\(^2\) Total harvest in NSO home range in Beaver fire is 750; however, slightly less (660 acres) occurs within the action area.

The spatial locations for all cumulative effects are only known for the Beaver fire area. The following paragraph pertains only to the NSO sites within the Beaver fire. At the core scale, the proportional habitat removal across all habitat types (NRF, FANR, D, and PFF) ranges from zero to 70 percent and KL99913 will have the greatest proportional reduction in habitat. At the home range scale, the proportional habitat removal across all habitat types (NRF, FANR, D, and PFF) ranges from ten to 35 percent. KL0346 / KL4146 (one NSO pair was using two nest stands) will have the greatest proportional reductions in habitat in the home range, but this site is not likely to be occupied (see section 6.3.2).

Within NSO sites in the Whites fire area, cumulative effects were not quantified by NSO site, but the total proportion of private land within the home range varies from one to nine percent (40 to 300 acres). The NSO sites with the greatest potential cumulative effects are KL1046 and KL1047B, which each contain over 140 acres of private land.

Within NSO sites in the Happy Camp complex fire area, cumulative effects were not quantified by NSO site, but the total proportion of private land within the home range varies from less than one percent to 17 percent (10 to 560 acres). The NSO sites with the greatest potential cumulative effects are KL0255, KL0293, and KL9992.

### Summary

Across all fire areas, we have identified cumulative effects associated with removal of about 6,630 acres across all NSO habitat types (NRF, FANR, PFF and Dispersal habitat). Across all NSO habitat types cumulative effects may reduce habitat by five percent (6,630 of 143,420 acres) across the action area. Cumulative effects may reduce NRF habitat by three percent (2,330 acres).
of 74,070 acres) across the action area. The habitat reductions are not evenly distributed across the action area. They are expected to be widely scattered in Happy Camp complex and Whites fire areas and more concentrated in the Beaver fire area due to the distribution of private lands and ownership by large timber companies. Up to 38 NSO sites have cumulative effects that may remove habitat in the core or home range.

8. NORTHERN SPOTTED OWL CRITICAL HABITAT

8.1 Status of Northern Spotted Owl Critical Habitat
The final rule designating critical habitat for the NSO was published on December 4, 2012 (USDI FWS 2012a; Final Rule), and became effective on January 3, 2013. Designated critical habitat now includes approximately 9,577,969 acres in 11 critical habitat units (CHUs) and 60 subunits in California, Oregon, and Washington.

Critical habitat identifies specific areas within the geographical area occupied by the species at the time of listing that contain the physical or biological features essential to the conservation of the species and may require special management or protection. It also includes areas outside of the geographical area occupied at time of listing that are determined essential to the conservation of the species. Many areas of critical habitat do not require active management, and active forest management within such areas could negatively impact NSOs. FWS does not encourage land managers to consider active management in areas of high-quality NSO habitat or occupied NSO sites; rather, FWS encourages management actions that will maintain and restore ecological function where appropriate.

In developing the critical habitat rule, FWS relied on the recovery criteria in the Revised Recovery Plan for the Northern Spotted Owl (USFWS 2011a) to determine what is essential to the conservation of the species; therefore, we have identified a habitat network that meets the following criteria:

- Ensures sufficient habitat to support stable, healthy populations across the range, and also within each of the 11 recovery units;
- Ensures distribution of NSO populations across the range of habitat conditions used by the species;
- Incorporates uncertainty, including potential effects of barred owls, climate change, and wildfire disturbance risk; and
- Recognizes that these protections are meant to work in concert with other recovery actions, such as barred owl management (USDI FWS 2012).

When designating critical habitat, FWS considers the physical or biological features (PBFs) essential to the conservation of the species, and which may require special management considerations or protection (50 CFR §424.12; USDI FWS 2012a). These PBFs include, but are not limited to: 1) space for individual and population growth and for normal behavior; 2) food, water, air, light, minerals, or other nutritional or physiological requirements; 3) cover or shelter; 4) sites for breeding, reproduction, or rearing (or development) of offspring; and 5) habitats that are protected from disturbance or are representative of the historical, geographical, and ecological distributions of a species” (USDI FWS 2012). The final rule for NSO critical habitat
defined the PBFs essential to the conservation of the NSO as forested areas that are used or likely to be used for nesting, roosting, foraging, or dispersing”. The final rule also provides an in-depth discussion of the PBFs; that discussion is herein incorporated by reference (USDI FWS 2012a).

The primary constituent elements (PCEs) of NSO critical habitat are the specific elements of the PBFs that are considered essential to the conservation of the NSO and are those elements that make areas suitable as NSO nesting, roosting, foraging, and dispersal habitat. The PCEs should be arranged spatially such that it is favorable to the persistence of NSO populations by promoting the survival and reproductive success of resident pairs, and the survival of dispersing juvenile NSO until they are able to recruit into a breeding population (USDI FWS 2012a).

Within the areas considered essential for the 2012 rule has defined the PCEs of NSO critical habitat as:

PCE1) Forest types that may be in early-, mid-, or late-seral stages and that support the NSO across its geographic range;
PCE2) Habitat that provides for nesting and roosting;
PCE3) Habitat that provides for foraging;
PCE4) Habitat to support the transient and colonization phases of NSO dispersal, which in all cases would optimally be composed of nesting, roosting, or foraging habitat (PCE2 or 3), but which may also be composed of other forest types that occur between larger blocks of nesting, roosting, or foraging habitat.

For the purposes of this analysis, we refer to nesting/roosting habitat as PCE2, foraging habitat as PCE3, and dispersal habitat as PCE4. In general, NSO critical habitat is intended to protect and restore high quality NRF habitat and good quality dispersal habitat to promote viable/persistent populations of the NSO throughout its historic range. See appendix D for a detailed description of NSO critical habitat and a detailed discussion of the rangewide status of that critical habitat.

Because of potential NSO use, especially in the first few years after a fire, we consider here whether post fire-foraging habitat may act as PCE3. While this habitat may lack several key components of unburned PCEs 2 and 3 (dense canopy cover and multi-layer forest structure), the best available information indicates that NSO do make limited foraging use of NRF habitat that burned at moderate to high severity (=PFF habitat), and it may play an important role in supporting NSO fitness in the short-term (see appendix B). However, some information indicates a decrease in NSO survival and occupancy in moderate to high severity post-fire environments depending on the extent of change to habitat. Because of the role PFF habitat may play in NSO foraging behavior, and for the purposes of this analysis, we are considering it to contain PCE3 (foraging habitat). This includes what FWS and KNF biologists identified as PFF1 and PFF2, as described in section 5.1.2. Proportional use (primarily PFF1) is influenced by factors such as adjacency to remaining NRF habitat or topographic position in the landscape as described in appendix B. We display them separately in the following tables to illustrate their relative availability. As more information becomes available on NSO use of post-fire landscapes, this type of analysis may not be appropriate in the future or contemporaneously on similar projects elsewhere.
8.2 Analytical Framework for the Adverse Modification Determination

The following analysis for the adverse modification determination places an emphasis on using the intended rangewide NSO recovery function of critical habitat, and the role of the action area, as the context for evaluating the significance of the effects of the proposed action. The rule designating critical habitat for the NSO describes a step wise, multi scale approach, for the adverse modification analysis. On February 11, 2016, a revision to the regulatory definition of destruction and adverse modification was published in the Federal Register (USDI USDC 2016). The revisions can be summarized as follows (see page 7216):

“...direct or indirect alteration that appreciably diminishes the value of critical habitat for the conservation of a listed species. Such alterations may include, but are not limited to, those that alter the physical or biological features essential to the conservation of a species or that preclude or significantly delay development of such features.”

“Specifically, the Services will generally conclude that a Federal action is likely to “destroy or adversely modify” designated critical habitat if the action results in an alteration of the quantity or quality of the essential physical or biological features of designated critical habitat, or that precludes or significantly delays the capacity of that habitat to develop those features over time, and if the effect of the alteration is to appreciably diminish the value of critical habitat for the conservation of the species.”

Specific to NSOs the process of assessing the conservation role of the action area, the sub unit, the unit, and then finally the entire rangewide designation establishes a “sensitive analytical framework for informing the determination of whether the proposed action is likely to appreciably reduce the conservation role of the critical habitat overall” (USDA FWS 2012a). If at any of the scales of analysis (proposed action, subunit, or unit) the conclusion is reached that the critical habitat will continue to provide the function for which it was designated then an adverse modification determination may not be warranted. For the entire list of specific factors that the FWS considers when evaluating whether proposed activities are likely to destroy or adversely modify NSO critical habitat see pp. 71940-71941 of the critical habitat designation (USDI FWS 2012a).

8.3 Current Condition of Northern Spotted Owl Critical Habitat

See appendix D for detailed information on the conservation role of critical habitat, PBFs and PCEs, the rangewide critical habitat baseline, zones of habitat associations used by NSO, and climate change. See appendix E for the methods used to update critical habitat subunits and units affected by the proposed action.

The proposed action overlaps two CHUs and four critical habitat subunits (Unit 9 – K LW7 and KLW8; and Unit 10; KLE6 and KLE7). To evaluate the current condition of the four affected subunits, we rely primarily on the critical habitat “expert” modeling data set for the East and West Klamath modeling regions updated with the most recent Gradient Nearest Neighbor (GNN) vegetation data (appendix E) and fires that burned within those boundaries from 2012-2014. Second, to estimate the current critical habitat network baseline, our analysis utilizes the habitat layer associated with the 20-year NWFP monitoring report clipped to Unit and subunit boundaries (Davis et al., 2015, Davis pers. comm. 2015). Appendix E also describes methods and assumptions for our critical habitat analysis.
An estimated 85 percent of the critical habitat network was within the home ranges known to occur at time of listing (USDI FWS 2012a). Other than quantifying habitat, the current condition of the critical habitat network is difficult to assess; however, data from demographic study areas may be extrapolated to generally assess potential demographic contributions or expectations of critical habitat. With regard to occupancy, occupied NSO sites represent resident pairs of NSOs that are likely breeding and contributing to future generations. They are the most important group of NSOs for assessing the status of the species because they are producing the majority of young NSOs (and they are also relatively easy to detect). Occupied sites do not comprise the entire NSO population, because there are also “floaters” (NSOs currently without a territory) and other NSOs that are not detected or not currently breeding (but may do so in the future).

Population changes over time have been documented in NSO demographic study areas (DSAs) throughout the range. Since the population studies were initiated in the late 1980s and early 1990s, declines in realized population change in California have ranged from 32-55 percent in California, 31-68 percent in Oregon, and 55-77 percent in Washington (Dugger et al. 2015a). Population declines within the DSAs generally are found to increase on a south to north gradient (Dugger et al. 2015a). Three of these DSAs are adjacent to or overlapping the critical habitat units affected by the proposed action Oregon Klamath Mountains, Southern Cascades, and Northwest California [Willow Creek]. Since 1990, all three DSAs have had significant declines in occupied NSO sites (averaging about 60-70 percent) (Hollen et al. 2015, Dugger et al. 2015b and Franklin et al. 2015). Figures 7.2, 7.3, and 7.4 in appendix A show annual occupancy estimates. Annual rate of decline for NSOs on the three study areas closest to the Oregon and California Klamath Province, which largely encompasses CHUs 9 and 10, appear to be declining less than NSO populations in 5 of 11 provinces (Dugger et al 2015a). Overall, the occupancy of the NSO critical habitat network does not appear to be stable based on recent data.

The environmental baseline for the two affected critical habitat units (CHU 9 and CHU 10) and four affected critical habitat subunits (KLE6, KLE7, KLW7, and KLW8) affected by the action are described below. We use estimated 2015 habitat amounts to inform the current condition of CHU 9 and CHU 10.

**8.3.1 Environmental Baseline for Spotted Owl Critical Habitat in the Action Area**

The action area for the proposed action overlaps two CHUs and four critical habitat subunits (*Unit 9 – KLW7 and KLW8; and Unit 10; KLE6 and KLE7*). Figure 2 illustrates the affected subunits in the context of the Klamath Ecological Province and surrounding subunits. All four affected subunits are intended to function for demographic support. KLE6 and KLE7 are also intended to provide connectivity between adjacent subunits (USDI FWS 2012). The location of KLE6 and KLE7 between the Interior California Coastal and Eastern California Cascade provinces is critical to their function to provide connectivity and linking areas with relatively higher NSO density to those with lesser NSO density. In addition, KLE6 and KLE7 are themselves a key population source to adjacent CHUs. The connectivity function KLE6 and KLE7 provide is also critical to help maintain the ability of NSOs to disperse west to east into the Eastern California Cascades CHU. One of the Eastern California Cascades CHU critical functions is to provide genetic exchange between NSOs and California Spotted Owls (USDI FWS 2012, pp. 71933-71935).
The acreages of each affected critical habitat unit and subunit, as well as the acreage of NRF habitat in each subunit, are given in table 16. After the 2014 fires, the amount of NRF habitat in the four affected subunits is about 262,400 acres.

Table 16. Available habitat within the two affected critical habitat units (CHU 9 and CHU 10) and four affected critical habitat subunits.

<table>
<thead>
<tr>
<th>CH Unitᵃ</th>
<th>Total Acres in Unitᵇ</th>
<th>Total NRF in Unitᵇ</th>
<th>CH Subunit</th>
<th>Total Acres of Subunit</th>
<th>Total NRF in Subunitᶜ</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 Klamath East</td>
<td>1,052,730</td>
<td>567,090</td>
<td>KLE6</td>
<td>167,850</td>
<td>85,800</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>KLE7</td>
<td>66,080</td>
<td>22,530</td>
</tr>
<tr>
<td>9 Klamath West</td>
<td>1,197,390</td>
<td>791,900</td>
<td>K LW7</td>
<td>255,780</td>
<td>107,300</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>KLW8</td>
<td>114,290</td>
<td>46,770</td>
</tr>
<tr>
<td>TOTAL</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>262,400</td>
</tr>
</tbody>
</table>

ᵃUSDI FWS 2012.
ᵇUSFWS internal analysis (results in appendix E) based on habitat layer associated with the 20 year NWFP monitoring report (Davis et al. 2015 and pers.comm R. Davis).
ᶜApproximate acres based on critical habitat modeling NRF (2012 image, incorporating change in vegetation from fires-2014). Based on NRF habitat models and the relative habitat suitability (RHS) values that were developed for the Eastern Klamath and Western Klamath modeling regions. Models also identified areas not meeting NRF as “other” vegetation types, which includes dispersal and areas not meeting any NSO habitat classification criteria. FWS assumes some of that may be suitable for dispersal, but it is not evaluated for the purpose of this analysis.
Table 17. Approximate acres of pre- and post-fire NSO critical habitat (action area acres derived from BA Table 22)

<table>
<thead>
<tr>
<th>CH Subunit</th>
<th>Pre fire 2012 NRF in subunit</th>
<th>Post Fire 2015 NRF in subunit</th>
<th>Acres of subunit in action area</th>
<th>Percentage of action area in subunit&lt;sup&gt;c&lt;/sup&gt;</th>
<th>Pre-Fire NRFD (PCEs 2,3,4) in action area</th>
<th>% of PCEs 2,3,4 in action area burned at mod/high severity&lt;sup&gt;d&lt;/sup&gt;</th>
<th>Post-Fire NRFD (PCEs 2,3,4) in action area&lt;sup&gt;1&lt;/sup&gt;</th>
<th>PFF1</th>
<th>PFF2</th>
</tr>
</thead>
<tbody>
<tr>
<td>KLE6</td>
<td>85,900</td>
<td>85,800</td>
<td>4,918</td>
<td>3%</td>
<td>3,217</td>
<td>13</td>
<td>2,804</td>
<td>118</td>
<td>99</td>
</tr>
<tr>
<td>KLE7</td>
<td>31,160</td>
<td>22,530</td>
<td>34,860</td>
<td>53%</td>
<td>28,361</td>
<td>33</td>
<td>19,083</td>
<td>3,552</td>
<td>2,744</td>
</tr>
<tr>
<td>KLW7</td>
<td>112,360</td>
<td>107,300</td>
<td>26,754</td>
<td>10%</td>
<td>17,900</td>
<td>8</td>
<td>16,534</td>
<td>643</td>
<td>123</td>
</tr>
<tr>
<td>KLW8</td>
<td>41,710</td>
<td>46,770</td>
<td>27,601</td>
<td>24%</td>
<td>22,228</td>
<td>16</td>
<td>18,642</td>
<td>1,598</td>
<td>402</td>
</tr>
<tr>
<td>TOTAL</td>
<td>271,130</td>
<td>262,400</td>
<td>94,133</td>
<td>24%</td>
<td>71,706</td>
<td>21%</td>
<td>57,063</td>
<td>5,911</td>
<td>3,368</td>
</tr>
</tbody>
</table>

<sup>a</sup>USDI FWS 2012.

<sup>b</sup>Approximate acres based on revised critical habitat modeling with 2012 GNN image (see methods in appendix E). Habitat models were developed specifically for the Klamath east (KLE) and Klamath west (KLW) modeling regions and identified NRF (PCEs 2 and 3) only. Models do not identify dispersal habitat, they are included in a third class of “other” vegetation types. FWS assumes some of the “other” vegetation types may be suitable for dispersal, but it is not evaluated for the purpose of this analysis.

<sup>c</sup>acres of subunit in action area/total acres in subunit from table 16.

<sup>d</sup>Pre-fire PCEs-post-fire PCEs/pre-fire PCE.

Note: PCE 3 Includes Fire-affected nesting/roosting. Also PFF1 and 2 are displayed here although it is likely the majority of potential use by NSOs would occur in PFF1, which represents the majority of these two combined types.
The 2014 wildfires variably affected the quality, quantity, and distribution of NRFD habitat (PCEs 2, 3, and 4) within the action area. Estimates of availability and distribution of NFRD habitat (PCEs) within the action area are derived from data displayed in the BA, table 22 and from review of post-fire habitat maps. To determine an accurate baseline within designated critical habitat, we adjusted both CHUs and subunit estimates of current NSO habitat containing PCEs after accounting for habitat change from harvest and fire. We evaluated fire severity data and considered relative habitat suitability models to understand how NSOs may respond at the landscape scale. The intent was to gauge changes in critical habitat value prior to the proposed impacts to determine the action’s impact on the designated function of the critical habitats’ contribution to range wide recovery. Appendix E contains a detailed discussion of the data sets used, methods, results, and caveats of our analysis.

The amount of pre- and post-fire NRFD habitat (PCEs 2, 3, and 4) in the action area and its distribution among subunits is given in table 17. Table 17 also shows the reduction in NRFD habitat (PCEs 2, 3 and 4) as a result of the 2014 fire. Some portions of the action area burned under extreme conditions that resulted in high severity patches ranging in size from 100 acres to over 1,000 acres, particularly in subunit KLE7. While the percentage reduction in NRFD habitat varied among subunits, on average, about 21 percent of the NRFD habitat (PCEs 2, 3 and 4) within the action area burned at moderate or high severity. The BA tracks habitat change from moderate and high severity fire within NRFD habitat to FANR, PFF1, or PFF2 (BA table 22). Each unit is discussed specifically below.
Figure 2. Affected subunits in context of Klamath Province
Klamath West Critical Habitat Unit (CHU 9)

CHU 9 encompasses approximately 1.2 million acres. A long north-south trending system of mountains within this unit creates a rain-shadow effect and more xeric conditions in the eastern portion of the unit and more mesic conditions in the western portion of the unit. The region containing CHU 9 is characterized by climatic and vegetative diversity resulting from steep gradients of elevation, dissected topography, and the influence of marine air. These conditions support a highly diverse mix of mesic forest communities dominated by Douglas-fir, Douglas-fir and tanoak, and mixed evergreen forest interspersed with more xeric forest types. The diet of the NSO in this portion of the range is dominated primarily by woodrats and flying squirrels (USDI FWS 2012a).

Approximately 66 percent of this unit (about 792,000 acres) is currently NRF habitat (see table 16). Between 2012 and 2015, approximately 15,370 acres burned at moderate and high severity within this unit. Effects to dispersal habitat only (PCE 4) were not available for this analysis (Davis pers. comm. 2015).

**Subunit KLW7** – The KLW7 subunit consists of approximately 255,779 acres in Del Norte, Humboldt, and Siskiyou counties, California, all of which are Federal lands managed by the BLM and Forest Service as directed by the NWFP (USDA and USDI 1994, entire). Special management considerations or protection are required in this subunit to address threats to the essential or physical features from current and past timber harvest, losses due to wildfire and the effects on vegetation from fire exclusion, and competition with barred owls. This subunit is expected to function for demographic support. In the 2012 critical habitat rule, FWS’s evaluation indicated that approximately 91 percent of the area of KLW7 was covered by verified NSO home ranges at the time of listing (USDI FWS 2012a).

Current baseline conditions for KLW7 consist of about 107,300 acres of NRF habitat out of the 255,780 acres in the subunit (about 42 percent) (see table 16). About 26,754 acres of the subunit overlap the action area (approximately 10 percent of the subunit). Impacts from the 2014 fires were moderate (very little high severity fire), dispersed, and relatively small in scale in this subunit compared to some other critical habitat subunits. About 1,370 acres of NRFD burned at high and moderate severity, or about eight percent of the NRFD in the action area. The impacts from the fires are not likely to significantly affect the expected demographic function of this subunit. The post-fire acreage of KLW7 NRFD habitat in the action area is about 16,530, with an additional 770 acres of PFF habitats (see table 17).

**Subunit KLW8** – The KLW8 subunit consists of approximately 114,290 acres in Siskiyou and Trinity counties, California, all of which are Federal lands managed by the BLM and USFS as directed by the NWFP (USDA and USDI 1994, entire). Special management considerations or protection are required in this subunit to address threats to the essential physical or biological features from current and past timber harvest, losses due to effects on vegetation from fire exclusion, and competition with barred owls. This subunit is expected to function for demographic support. In the 2012 critical habitat rule,
FWS’s evaluation indicated that approximately 85 percent of the area of KLW8 was covered by verified NSO home ranges at the time of listing (USDI FWS 2012a).

Current baseline conditions for KLW8 consist of 46,770 acres of NRF habitat out of the 114,290 acres in the subunit (about 41 percent) (see table 16). About 27,601 acres of the subunit overlap the action area (approximately 25 percent of the subunit). This subunit experienced a few high severity burn patches scattered broadly across the action area. In sum, these reduced NRFD by about 16 percent in the action area (see table 17). The size and distribution of the fires in this subunit are within the historical pattern found in the California Klamath Province; high quality habitats remain distributed within this subunit. While NRFD habitat was reduced in this subunit, the designated function is not likely to be impaired from the fire effects. The post-fire acreage of KLW8 NRFD habitats in the action area is about 18,640, with an additional 2,000 acres of PFF habitats (see table 17).

**Klamath East Critical Habitat Unit (CHU 10)**

Unit 10 contains 1,052,731 acres and seven subunits. This unit consists of the eastern portion of the Klamath Mountains Ecological Section M261A, based on section descriptions of forest types from Ecological Subregions of the United States (McNab and Avers 1994), and portions of the Southern Cascades Ecological Section M261D in Oregon. This region is characterized by a Mediterranean climate, greatly reduced influence of marine air, and steep, dissected terrain. Franklin and Dyrness (1988) differentiate the mixed-conifer forest occurring on the “Cascade side of the Klamath from the more mesic mixed evergreen forests on the western portion (Siskiyou Mountains),” and Kuchler (1977) separates out the eastern Klamath based on increased occurrence of ponderosa pine. The mixed-conifer/evergreen hardwood forest types typical of the Klamath region extend into the southern Cascades in the vicinity of Roseburg and the North Umpqua River, where they grade into the western hemlock forest typical of the Cascades. High summer temperatures and a mosaic of open forest conditions and Oregon white oak (*Quercus garryana*) woodlands act to influence NSO distribution in this region. NSOs occur at elevations up to 1,768 meters. Dwarf mistletoe (*Arceuthobium spp.*) provides an important component of nesting habitat, providing additional structure and enabling NSOs to occasionally nest within stands of relatively younger, smaller trees (USDI FWS 2012).

Post fire, approximately 54 percent of this unit (567,090 acres) is composed of NRF (PCE 2 and 3) (see table 16). Between 2012 and 2015, about 17,000 acres burned at moderate and high severity within this unit. Effects to dispersal habitat (PCE 4) were not available for this analysis (Davis pers. comm. 2015).

Subunit KLE6 - The KLE6 subunit consists of approximately 167,849 acres in Jackson County, Oregon, and Siskiyou County, California, all of which are Federal lands managed by the BLM and USFS per the NWFP (USDA and USDI 1994, entire). Special management considerations or protection are required in this subunit to address threats to the essential physical or biological features from current and past timber harvest, losses due to wildfire and the effects on vegetation from fire exclusion, and competition with barred owls. This subunit is expected to function primarily for north-south connectivity between subunits, but also for demographic support. In the 2012 critical habitat rule, FWS’s evaluation indicated that approximately 97 percent of the area of KLE6 was covered by verified NSO home ranges at the time of listing (USDI FWS 2012a).
Current conditions for KLE6 consist of 85,800 acres of NRF habitat out of the 167,850 acres in the subunit (about 51 percent) (see table 16). NSO within the action area is limited and dispersed. The portion overlapping the action area is configured in a checkerboard ownership pattern consisting of federal and industrial timberlands. There are about 4,920 acres of the subunit that overlap the action area (approximately three percent of the subunit). About 413 acres of NRFD burned at moderate and high severity fire, or about thirteen percent of NRFD within the action area (see table 8.3) compared to 47 percent burned moderate to high severity within the Beaver fire area as a whole. Proportionally, dispersal habitat (PCE 4) was affected more (BA table 22). The northern portion of subunit was not affected by fires and is largely in LSR land allocation. The reduction in NRFD habitats in this subunit is relatively small. Post-fire, there are about 2,804 acres of NRFD habitat in the action area, with an additional 217 acres of PFF habitat (see table 17).

Subunit KLE7 - The KLE7 subunit consists of approximately 66,080 acres in Siskiyou County, California, all of which are Federal lands managed by the BLM and USFS per the NWFP (USDA and USDI 1994, entire). This is one of the smallest subunits. The eastern portion of the subunit outside of the action area and not affected by fires, and is dominated by checkerboard ownership. Special management considerations or protection are required in this subunit to address threats to the essential physical or biological features from current and past timber harvest, losses due to wildfire and the effects on vegetation from fire exclusion, and competition with barred owls. This subunit is expected to function for demographic support and also for connectivity across the landscape. In the 2012 critical habitat rule, FWS’s evaluation indicated that approximately 96 percent of the area of KLE7 was covered by verified NSO home ranges at the time of listing (USDI FWS 2012a).

Current conditions for KLE7 consist of 22,530 acres NRF out of the 66,080 acres in the subunit (about 34 percent) (see table 16). About 34,860 acres of the subunit overlap the action area (approximately 52 percent of the subunit). High and moderate severity fires in 2014 fires burned about of 9,280 acres of NRFD habitat in the action area portion of the subunit, affecting about a third of the available NRFD in the action area. Post-fire, there are about 19,080 acres of NRFD habitat in the action area, with an additional 6,300 acres of PFF habitat (see table 17).

Numerous large patches of high severity fire were concentrated within two major drainage systems of the western portion of this subunit, including high quality habitat and lower slope positions which are associated with NSO use. The location, amount, and large patch size of high severity fire reduced the quality, quantity, and distribution of NRFD habitat, reducing nesting, roosting, foraging, and dispersal opportunities in the action area. The amount and distribution of fire effects will diminish the action area portion of KLE7’s ability to function for demographic support and connectivity; however, within the subunit we estimate there are about 22,530 acres of NRF remaining post fire.
In summary, the impacts from the fires are not likely to significantly affect the function of the three subunits, (KLW7, KLW8, and KLE6) as described in the 2012 critical habitat rule. As a result of the 2014 fires, KLE7’s intended conservation functions have been substantially reduced.

8.4 Effects of the Westside Recovery Project to Spotted Owl Critical Habitat

This section evaluates how the proposed action is likely to affect the capability of critical habitat to support NSO life history requirements by considering how the proposed action affects the PCEs of NSO nesting, roosting, foraging, and dispersal habitat. Designated critical habitat in the action area is considered in this analysis regardless of the species’ current presence or absence in the affected critical habitat (77 FR 233).

The amount of NRFD habitat (PCEs 2, 3, and 4) remaining post-fire in the action area is 57,063 acres and an additional 9,279 acres of PFF habitat (PCE3) (see table 17). Acreages of remaining critical habitat that are affected by each treatment type are shown in table 18. Some of the effects will result in degradation of habitat (‘degrade’ in table; totaling 7,970 acres across treatment types) and are considered short-term effects (table 18). Other treatments will result in downgrade or removal of habitat (totaling 4,408 acres across treatment types) and are considered long-term (table 18). Combining these effects, the proposed action will degrade and downgrade or remove approximately 19 percent (12,378 acres of 66,342) of remaining NRFD habitat and PFF habitat (PCEs 2, 3, and 4) within the critical habitat overlapping the action area (table 19). As described previously, we assume PFF is utilized at least in the short term for foraging, with more emphasis likely on the burned habitats in closer proximity to existing suitable habitat (PFF1). Effects to individual habitat types by treatment are discussed in section 6.1.2.

Table 18. Summary of Treatments in Critical Habitat by general treatment type¹.

<table>
<thead>
<tr>
<th>Treatment type</th>
<th>Treat and Maintain or Degrade (short-term effects)</th>
<th>Downgrade or Remove (long-term effects)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Salvage Only²</td>
<td>0</td>
<td>1,417</td>
</tr>
<tr>
<td>Roadside and all other treatments³</td>
<td>3,930</td>
<td>2,991</td>
</tr>
<tr>
<td>Prescribed Fire</td>
<td>4,040</td>
<td>0</td>
</tr>
<tr>
<td>Totals by effect type (acres and proportion of available)</td>
<td>7,970 12% of available degraded</td>
<td>4,408 7% of available downgraded or removed</td>
</tr>
<tr>
<td>Total of short and long term effects</td>
<td>12,378 19% of NRFD habitat (PCEs) degraded, downgraded, or removed.</td>
<td></td>
</tr>
</tbody>
</table>

¹Includes acres classified as NRFD, PFF, and FANR.
²Acres of salvage within 200 feet of road are accounted for in Roadside Treatments
³Includes temporary road and landing construction.
Table 19. Action area PCEs affected (derived from BA table 22 & 23); PFF displayed separately.

<table>
<thead>
<tr>
<th>CH Subunit</th>
<th>Post-fire acres of NRFD (PCEs 2,3,4) habitat in action area¹</th>
<th>Acres of available PFF 1 and 2 (PCE3) in action area</th>
<th>Acres of habitat NRFD (PCE 2,3,4) Degraded ¹,³</th>
<th>Acres of habitat NRFD (PCE 2,3,4) Downgraded/Remediated ¹,³</th>
<th>PFF 1 Rem (PCE3)</th>
<th>PFF2 Rem (PCE3)</th>
<th>Subtotal and percent¹ of all PCEs (NRFD, PFF 1 &amp; 2) Deg/Down/Rem (acres)</th>
<th>Total and percent of all PCEs (NRFD, PFF 1 &amp; 2) Deg/Down/Rem (acres)</th>
<th>% PFF 1 and PFF2 in action area removed⁴</th>
</tr>
</thead>
<tbody>
<tr>
<td>K LW7</td>
<td>16,534</td>
<td>766</td>
<td>1,525</td>
<td>834</td>
<td>226</td>
<td>64</td>
<td>1,124 / 6%</td>
<td>2,649 / 15%</td>
<td>38%</td>
</tr>
<tr>
<td>K LW8</td>
<td>18,642</td>
<td>2,000</td>
<td>4,894</td>
<td>547</td>
<td>168</td>
<td>69</td>
<td>784 / 4%</td>
<td>5,678 / 28%</td>
<td>12%</td>
</tr>
<tr>
<td>Subtotal in Unit 9</td>
<td>35,176</td>
<td>2,766</td>
<td>6,419</td>
<td>1,381</td>
<td>394</td>
<td>133</td>
<td>1,908 / 5%</td>
<td>8,327 / 14%</td>
<td>20%</td>
</tr>
<tr>
<td>K LE6</td>
<td>2,804</td>
<td>217</td>
<td>286</td>
<td>130</td>
<td>52</td>
<td>31</td>
<td>213 / 7%</td>
<td>499 / 17%</td>
<td>38%</td>
</tr>
<tr>
<td>K LE7</td>
<td>19,083</td>
<td>6,296</td>
<td>1,265</td>
<td>553</td>
<td>835</td>
<td>899</td>
<td>2,287 / 9%</td>
<td>3,552 / 14%</td>
<td>28%</td>
</tr>
<tr>
<td>Subtotal in Unit 10</td>
<td>21,887</td>
<td>6,573</td>
<td>1,551</td>
<td>683</td>
<td>887</td>
<td>930</td>
<td>2,500 / 9%</td>
<td>4,051 / 22%</td>
<td>28%</td>
</tr>
<tr>
<td>TOTAL within affected subunits</td>
<td>57,063</td>
<td>9,276</td>
<td>7,970</td>
<td>2,064</td>
<td>1,281</td>
<td>1,063</td>
<td>4,408 / 7%</td>
<td>12,378 / 19%</td>
<td>25%</td>
</tr>
</tbody>
</table>

¹ PCE3 includes FANR; this figure does not include PFF1 or PFF2.
² Percentage = total acres all PCEs (NRFD, FANR, PFF1, and PFF2) degraded, downgraded, removed / total post-fire acres of NRFD+PFF1 and 2.
³ USFWS internal analysis (see appendix E).
⁴ Includes prescribed fire (treat and maintain).
⁵ Percentage removed = PFF1+ PFF2 removed / total acres of PFF1 + PFF2 available.
Removal and Downgrade of Habitat

All treatment types except prescribed fire (underburning) will result in some downgrade and removal of critical habitat (table 18). About one third of the habitat proposed for removal/downgrade within critical habitat will result from commercial salvage operations (1,417 acres of the total 4,408 total acres downgraded or removed). The remainder of habitat that will be downgraded or removed is from roadside commercial salvage and other treatments (2,991 acres). Operations resulting in downgrade and removal of habitat will be focused primarily within moderate and high severity burned areas.

The removal/downgrading of NRF habitat (PCEs 2 and 3) will reduce NSO nesting, roosting, and foraging opportunities. NSO prey species are affected by fires in various ways and the additive impacts of habitat reduction from the action complicates or exacerbates those effects. Where actions are proposed to remove or downgrade unburned or were burned at low severity, actions may decrease northern flying squirrel abundance. This is most likely to occur where roadside treatments intersect moderately burned habitats, rather than in large patches of high severity burned areas. Please see effects to habitat (section 6.1.2) for detailed discussion.

The demographic rates of both northern and California spotted owls in post-burn environments indicate a decrease in spotted owl survival and occupancy, though this finding is somewhat confounded by the influence of salvage harvest. As described above in the prey section, the landscape condition as a result of the fire and then salvage harvest is likely to provide abundant edge type habitat for woodrats (and deer mice) that are associated with both early and late seral forests (Sakai and Noon 1993). Multiple studies have shown that NSOs make use of edge habitat (Folliard 1993, Clark 2007, Irwin et al. 2013, and Comfort 2014).

As proposed, treatments will remove habitat structures and will create large openings in the canopy that will persist and will not function as habitat for decades. Habitat attributes associated with these forests typically do not develop until 150-200 years of age (Thomas et al. 1990). Thomas et al. (1990) notes that intensively used areas and roosting sites on the KNF contain trees with a mean age range of 73-367 years. Areas of salvage harvest or concentrated roadside hazard, in particular, will create large openings in the canopy that will persist and will not function as habitat for decades. The removal of habitat structures will delay the development of late-successional habitat, in this case the development of NRF habitat (PCEs) within treated areas that would otherwise occur if there were minimal intervention with post fire ecological processes. It will take several decades for the attainment of dispersal habitat (PCE 4) and longer for NRF habitat (PCEs 2 and 3). Attainment of the PCEs will be ameliorated to an extent through the project design features and forest replanting efforts. Commercial salvage units generally include the retention of large snags and down wood, green trees, and trees within riparian reserves (or inner gorges). However, thirty seven units containing about 900 acres of the 5,760 acres of proposed salvage do not contain any retention (BA, table 6, p. 36); the majority of these units occur in critical habitat.

The variable effects of salvage logging are debated in the literature. At landscape scale, salvage has the potential to facilitate the heterogeneity in potential fuel loadings, fuel succession stages, and influence the frequency and spatial distribution of mixed severity fire effects of future fires.
(Peterson et al. 2015). These authors found that the removal of fuels (including habitat structures such as down wood and snags that support NSO prey species habitat) can increase fuel loadings in the short term by increasing surface fuels that otherwise may have remained standing for some time. However, removal of fuels as proposed may result over time in more moderate fire severity or behavior (Dunn and Bailey 2015, Peterson et al. 2015). The removal of habitat structures will delay the development of late-successional habitat, in this case the development of PCEs within treated areas that would otherwise occur if there were minimal intervention with post fire ecological processes. Areas of salvage harvest or concentrated roadside hazard, in particular, will create large openings in the canopy that will persist over the long term. Where this occurs the treated areas will not function as habitat for decades. The removal and downgrading of PCEs 2 and 3 in roadside complete treatments will reduce NSO foraging opportunities and decrease northern flying squirrel abundance. This is most likely to occur where roadside treatments intersect moderately burned habitats, rather than in large patches of high severity burned areas and the effects will be linear in nature.

Habitat removal and downgrade along linear features, such as roads, may have fewer impacts than treatments which create large openings since roadside treatments tend to be narrower in scale and increase edge habitat important for many NSO prey species. However where numerous linear features are adjacent, or in close proximity, the habitat removal and downgrade can overlap and collectively the treatments remove or reduce the habitat quality due to forest simplification and reductions of prey cover (Roberts et al. 2015) over a much larger patch size. Where treatments occur along primary ridges they often have limited nesting, roosting or foraging function (PCEs 2 and 3) and lower relative habitat suitability based on critical habitat modeling (Dunk et al. 2012; USDI FWS 2011a and 2012a). These areas are known to receive less use by NSO, particularly for nesting, due to abiotic factors. The negative effect of habitat reduction in these areas is less than when similar reductions occur on the lower 2/3 of slopes.

**Habitat Degradation or Maintenance**

Actions that “degrade” or “treat and maintain” PCEs (as defined in section 6.1 and BA p. 63) may reduce or modify the availability of habitat elements, but not to the extent that the existing function of the habitat is lost. Such impacts are considered short-term. The majority of habitat maintenance consists of prescribed underburning, primarily in subunit K LW8 (BA, table 23). The effects of underburning will be minor, dispersed over time, and are expected to have positive effects on NSO habitat over the long term.

The majority of habitat degradation is due to the removal of roadside fuels (roadside complete and roadside modified) and roadside hazard tree removal (BA table 23, p. 107 and effects of treatment type discussed in section 6.1 above). For the most part, critical habitat function is expected to be retained in these areas (see Effects to NSO Habitat, section 6.1).

**Effects to Critical Habitat by Subunit**

We discuss impacts to all PCEs, however, when evaluating proportional impacts to subunits and units, we focus on NRF habitats (PCEs 2 and 3) as these represent the highest quality habitat and are most critical to NSO survival, fitness, and reproduction.
Table 20. Effects to NRF Habitat (PCEs 2 and 3) by Subunit and Unit (treatment acres derived from BA table 23)

<table>
<thead>
<tr>
<th>CH Subunit</th>
<th>Total Acres</th>
<th>Total Acres NRF</th>
<th>Acres NRF affected by proposed action / percent of total NRF in subunit</th>
<th>Acres NRF removed or downgraded by proposed action / percent of total NRF</th>
</tr>
</thead>
<tbody>
<tr>
<td>KLW7</td>
<td>255,780</td>
<td>107,300</td>
<td>1,462 / 1%</td>
<td>420 / 0.4% of subunit</td>
</tr>
<tr>
<td>KLW8</td>
<td>114,290</td>
<td>46,770</td>
<td>3,560 / 8%</td>
<td>362 / 0.8% of subunit</td>
</tr>
<tr>
<td>Unit 9 Total Acres²</td>
<td>1,197,390</td>
<td>791,900</td>
<td>5,028 / &lt;1%</td>
<td>782 / 0.1% of unit</td>
</tr>
<tr>
<td>KLE6</td>
<td>167,850</td>
<td>85,800</td>
<td>326 / &lt;1%</td>
<td>130 / 0.2% of subunit</td>
</tr>
<tr>
<td>KLE7</td>
<td>66,080</td>
<td>22,530</td>
<td>1,258 / 6%</td>
<td>420 / 2% of subunit</td>
</tr>
<tr>
<td>Unit 10 Total Acres¹</td>
<td>1,052,730</td>
<td>567,090</td>
<td>1,584 / &lt;1%</td>
<td>550 / 0.1% of unit</td>
</tr>
</tbody>
</table>

¹Includes NRF for all seven subunits
²Includes NRF for all nine subunits

**KLE6**: Within KLE6, 499 acres of NRFD and PFF (PCEs 2, 3, and 4) will be affected by the proposed treatments; this represents about 17 percent (499 of 3,020 acres) of the post-fire NRFD (PCEs 2, 3, and 4) and PFF (PCE3) habitat in the action area. This includes about 326 acres of NRF (PCE2 and 3) habitats which represents less than one percent of available NRF habitat in the subunit (table 20). The affected acreage is scattered and linear in nature (primarily roads) and dispersed over five alternating sections. Of the 499 acres of affected NRFD and PFF, the majority will be degraded (286 acres). An additional 130 acres of NRFD (PCEs 2, 3, and 4) habitat will be downgraded or removed and 83 acres of PFF1 and PFF2 (PCE3) will be removed. Due to the size of the subunit and the dispersed nature of these impacts, the action is not likely to impair the demographic support function of this subunit.

**KLE7**: About 3,550 acres of NRFD and PFF (PCEs 2, 3, and 4) will be affected by the proposed treatments; this is 14 percent (3,550 of 25,380 acres) of the post-fire NRFD (PCEs 2, 3, and 4) and PFF (PCE3) habitat in the action area. The bulk of effects are from commercial salvage and roadside salvage (BA table 23). Of the 3,550 acres of PCEs affected, about 2,290 acres will be removed or downgraded (about nine percent of available PCEs in action area, table 19).

Specific to NRF habitat (PCE 2 and 3), about 1,258 acres will be affected (about six percent of the available NRF habitat in the subunit (table 20). Of these, about 420 acres will be removed or downgraded, representing about two percent of the NRF (PCEs 2 and 3) available in the subunit. Specifically for PFF1, the type of post-fire foraging habitat more likely to be used by NSO, about 835 of 3,552 available PFF1 will be removed (BA table 23).
Proposed treatments are concentrated within two watersheds that were occupied by NSOs prior to the fire. Proposed habitat removal (largely commercial salvage) will reduce the spatial arrangement of habitat and is likely to delay the development of structurally complex habitats within the portion of this subunit in the action area. Long term impacts of the implementation of the proposed action may preclude or delay the ability of the area to provide habitat that supports NSO occupancy for about 80 to 300 years (see section 4.3). While some of these impacted acres are located on topographic features where NSO use is likely to be low, the action proposes to further reduce suitable habitat in locations that are important to NSO prey and foraging NSOs, such as the lower third of the slope.

Occupied sites do not comprise the entire NSO population, because there are also floaters (NSOs currently without a territory) and other NSOs that are not detected or not currently breeding. Occupied NSO sites represent resident pairs of NSOs that are likely breeding and contributing to recovery. They are the most important group of NSOs for assessing the demographic support function of subunits because they are producing the majority of young NSOs. Project treatments that result in adverse effects, resulting in take of resident NSO pairs, diminish the critical habitats subunits’ ability to function for demographic support.

One of the recovery support functions of KLE7 is for NSO demographic support and may be best approximated by assessing the NSO demographic parameters such as site occupancy and fitness. The majority of NSO sites in the portion of subunit KLE7 which overlaps the action area will have significant impacts that will negatively influence their long-term demographic support function.

- About 18 of 22 NSO sites in the action area (with the majority of the NSO core in critical habitat) of subunit KLE7 will be adversely affected by significant habitat reductions or small habitat reductions combined with extensive degradation as the result of the proposed action.
- Across the subunit 18 NSO sites represents about 37 percent of known NSO sites (49 sites).
- 20 percent of the NSO sites in subunit KLE7 will be affected to the extent that take is likely to occur (nine pairs associated with ten of the 49 NSO sites).

Critical habitat in KLE7 was substantially altered by the fires as noted above in the baseline for critical habitat section and in results and discussion in section II of appendix E. The combination of fire effects (reduction of NRF habitat by 31 percent) and the effects of the proposed action resulting in take of nine pairs of NSOs associated with ten NSO sites will negatively affect the demographic support function of the subunit.

The other function of this subunit is for connectivity. Thomas et al. (1990) suggested that landscapes having more than 50 percent NSO habitat most likely provide adequate conditions supporting NSO dispersal. Forest landscapes traversed by dispersing NSO typically include a fragmented mosaic of clear-cuts, non-forested area, and a variety of forest age classes (Forsman et al. 2002). Within the action area, the proposed action will affect about 3,552 acres of NRFD and PFF1 and PPF2 or about 14 percent of what is available (table 19). Of this, 2,287 acres (nine
percent) will be removed or downgraded. Impacts at this scope and scale are likely to have adverse effects to connectivity at the action area scale, due to either removal, or downgrade PCEs 2, 3, and 4). Approximately 34 percent of the subunit is NRF habitat post fire (22,530 / 66,080), representing a condition that may not provide adequate conditions for connectivity at the subunit scale; however, additional “dispersal only” habitat could supplement the distribution and amount of habitat that could be used for dispersal and connectivity. At this subunit scale, the proposed action will affect about 1,258 acres, or six percent of the available NRF in the subunit; of this, about 420 acres (< one percent) will be removed or downgraded. An additional 1,700 acres of PFF habitat is proposed for removal (table 19). Due to the lack of protective cover, this reduction in PFF is not anticipated to significantly alter the connectivity between subunits; however, it is likely to preclude the development of future forested stands due to the removal of large woody structures. The importance of these future stands is dependent upon the location and connectivity of these treated stands. Stepping up to the unit scale, Unit 10 is comprised of about 54 percent NRF habitat. Additional “dispersal” habitat does occur, and is not included in our calculation of D habitat. Removal of 550 acres or about 0.1 percent of NRF (PCEs 2 and 3) habitat by the proposed action represents a small additional reduction in habitat connectivity within the unit. Overall, the FWS anticipates that habitat connectivity within subunit KLE7 and between CH subunits will continue to adequately function post-implementation of the proposed action.

KLW7: Within KLW7, about 2,650 acres of PCEs will be affected. This includes 1,460 acres of NRF (PCEs 2 and 3), 290 acres PFF1 and 2 (PCE 3) and 900 acres of D habitat (PCE 4), representing 15 percent (2,650 of 17,300 acres) of the post-fire NRFD and PFF habitat in the action area (tables 19 and 20). Based on data provided in table 23 of the BA and our analysis in appendix E less than one percent of the NRF habitat in the subunit will be affected (1,460 of 152, 050 acres).

Of the 2,650 acres affected, 834 acres of NRFD habitat (PCEs 2, 3, and 4) will be downgraded or removed (about six percent of available NRFD in action area), in addition to 290 acres of PFF1 and PFF2 (PCE3) (about 38 percent of available PFF1 and 2 in action area). The acreage proposed for removal or downgrade is primarily from roadside hazard tree removal with overlapping fuels treatments. Approximately 190 acres of removal are from roadside hazard tree removal with overlapping fuels treatments and an additional 100 acres will be salvaged. Although the demographic support function of critical habitat in this subunit may be affected by the proposed action, due to the amount of habitat affected and the size and condition of the subunit all suggest that the overall function of the subunit is likely to be maintained.

KLW8: About 5,678 acres of all PCEs will be affected by the proposed treatments; this represents about 28 percent (5,920 of 20,640 acres) of the post-fire NRFD and PFF (PCEs 2, 3, and 4) in the action area. Based on data provided in table 23 of the BA and our analysis in appendix E, about eight percent of the NRF habitat (PCE 2 and 3) in the subunit will be affected (3,560 of 46,770 acres).

Of the 5,678 acres affected, the majority will be degraded and/or ‘treat and maintain’ (4,890 acres). About 547 acres of NRFD habitat (PCEs 2, 3, and 4) will be downgraded or removed, and 237 acres of PFF1 and PFF2 (PCE 3), 118 of which is salvage, will be removed. The acreage
proposed for removal or downgrade is primarily through roadside hazard tree removal with overlapping fuels treatments. The demographic support function of critical habitat in this subunit may be affected by the proposed action. However, the majority of the habitat affected is “treat and maintain” and degrade and only short term effects to habitat are anticipated. In addition, the size and condition of the subunit and existing NRF habitat suggest that the overall function of the subunit is likely to be maintained.

In summary, for all of the affected subunits;

- It is a likely that impacts to NRFD habitat (PCEs 2, 3, and 4) and PFF (PCE 3) from the proposed action reduce the likelihood of NSOs successfully surviving, reproducing and dispersing within some portions of critical habitat within the action area. The impacts are likely to adversely affect critical habitat, but due to the combined factors of the scope, scale, and timing of the proposed action, the designated functions of the CH units are minimally affected.

- The majority of habitat change in critical habitat would occur within the first three years of the project and have long lasting impacts.

- With the exception of prescribed underburning, the FWS does not anticipate any immediate beneficial effects to NSO critical habitat resulting from the implementation of the proposed action. The KNF fire modeling suggests treatments will reduce fire behavior and severity if fires were to occur within treated stands, but it is unclear at the landscape scale, if the proposed action will have a positive influence on retaining NSO NRFD habitat (PCEs 2, 3, and 4) in the long-term.

- The CH units are expected to continue to provide demographic support due to the overall amount of existing NRF habitat (PCEs 2 and 3) relative to the proportion treated. In CH unit 9, the project affects about three percent of the NRF habitat (about 5,030 of 791,900 acres) and in CH unit 10, the project affects less than 2 percent (about 1,584 of 567,090 acres) of available NRF habitat (PCE 2 and 3). At the unit scale, there is a relatively limited degree of change in habitat amounts as result of the proposed action.

- We expect an insignificant change in connectivity function for 3 of the 4 subunits (KLE6, K LW7, and K LW8). We expect localized effects on connectivity within the action area portion of KLE7. However, sufficient amounts of habitat remain in subunit KLE7 and unit (CHU10) so habitat connectivity between subunits I not expected to be precluded.

8.5 Cumulative Effects on Spotted Owl Critical Habitat

Cumulative effects include the effects of future State, tribal, local or private actions that are reasonably certain to occur within the action area considered in this Opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to Section 7 of the ESA.

Critical habitat for the spotted owl is not designated on non-Federal lands in the action area, although non-Federal does occur adjacent to critical habitat. Actions on private lands may
indirectly affect the demographic support function of adjacent critical habitat subunits due to the scale at which NSOs utilize the landscape. NSOs in the California Klamath Province have home ranges several thousand acres in size. Critical habitat subunits often have portions of checkerboard ownership (640 acre legal sections of Federal ownership juxtaposed within sections of non-Federal ownership). Adjacent to KLE 6 within the Beaver fire area nearly all the ownership is managed for timber production. In some instances entire private lands sections have been clearcut post-fire, thus removing any remaining NSO habitat (see figure 7.1 in appendix A). Adjacent to the other three subunits, a relatively small proportion of non-Federal ownership is managed for timber production. The three figures below (8.5.1, 8.5.2, and 8.5.3) illustrate the distribution of private adjacent to each subunit.

**Figure 8.5.1. Non-federal lands adjacent to subunit KLE6.**

![Image of non-federal lands adjacent to KLE 6 critical habitat in the action area](image-url)
Figure 8.5.2. Non-Federal lands adjacent to subunit KLE7 and KLW7.

Figure 8.5.3. Non-Federal lands adjacent to subunit KLW8.
KLE6
The majority of NRF and PFF habitat (PCEs 2 and 3) that existed on non-Federal lands adjacent to KLE 6 was removed in 2014 and 2015 by salvage harvest in the Beaver fire area (see BA p. 100 and Section 7) under 50 to 55 completed emergency exemptions (pers. comm. D. Denman)). Harvest in the next year may remove additional NSO habitat (see section 7 discussion of FGS planned operations in 2016). Locally, we expect reductions in demographic support while the subunit will still provide for connectivity within the Beaver fire area. Areas to the west and north of Beaver fire in KLE6 have been less impacted by recent fires and provide more contiguous NRF. These areas continue to provide NSO demographic support to the rangewide NSO population. At the scale of the subunit (167,850 acres) the indirect effects will be minimal because FWS GIS analysis indicates less than four percent of the subunit overlaps the action area (6,070 of 167,850) and the subunit currently contains about 85,800 acres of NRF.

KLE7
There have been 10-15 emergency exemption notices for private land within the Happy Camp complex and Whites fire areas. Spatial locations of this salvage harvest and status towards completion were not available; however, the majority is along Scott River road adjacent to this subunit. Small parcels of non-federal land salvage harvest are also occurring in Grider Creek and between Tom Martin Peak and Hamburg. The harvest along Grider overlaps an area with an existing NTMP and effects to date have been minimal, largely just select harvest of small clumps of dead trees. Effects near Hamburg are likely greater as it appear some low severity burned areas are being cleared (pers. comm. D. Denman). Effects from completed or future harvest are unknown at this time. The subunit is 66,080 acres in size and contains 22,530 acres of NRF (PCE 2 and 3). Across the entire Happy Camp complex fire area, which encompasses both KLE7 and KLW 7, only 1,990 acres of the 5,300 acres of private contain NSO habitat (NRF, FANR, PFF or D). We expect that at the subunit scale, indirect effects to critical habitat will be minimal.

KLW7
There have been 10-15 emergency exemption notices for private land within the Happy Camp complex and Whites fire areas. These exemptions indicate salvage harvest has occurred or will occur in the near future. This type of harvest typically remove NSO habitat. Spatial locations of this salvage harvest and status towards completion were not available. CAL FIRE was aware of only emergency exemption west of Grider ridge in the Wols Creek area near China point (pers.comm. D. Denman). These are the northeastern most private inholdings within KLW 7 (see figure 8.5.2 above). These inholdings total about 500 acres in size. Potential impacts to NRF are not known at this time. There is also one THP immediately south of Happy Camp (see section 7)(CAL FIRE 2015). As stated above, across the entire Happy Camp complex fire area which encompasses both KLE7 and KLW 7 only 1,990 acres of the 5,300 acres of private contain NSO habitat (NRF, FANR, PFF or D). The subunit is 255,780 acres in size and contains 107,310 acres of NRF (PCEs 2 and 3). Additionally, only ten percent of the subunit is within the action area (26,750 acres). Therefore, indirect effects to critical habitat in this subunit will be minimal.

KLW8
There have been 10-15 emergency exemption notices for private land within the Happy Camp complex and Whites fire areas. It appears the majority are within Happy Camp complex from site specifics descriptions from CAL FIRE (pers. comm. D. Denman); however, there may be
some salvage occurring in Whites fire area. Spatial locations of this salvage harvest and status towards completion were not available. Within the Whites fire about 880 acres of the 1,280 acres of non-Federal lands contain NSO habitat (NRF, FANR, PFF, or D). There may be localized reductions in the demographic support function of this subunit in the northeastern portion (see figure 8.5.3 above). The subunit is 114,290 acres in size and contains 46,770 acres of NRF (PCEs 2 and 3). Therefore, indirect effects to critical habitat in this subunit will be minimal.

8.6 Effects of the Action on Rangewide Critical Habitat
The proposed action will remove or downgrade 4,408 acres of NRFD habitat (PCEs 2, 3, and 4) and PFF (PCE3) (Table 19). In CH unit 9 the project affects less than one percent (1,908 of 791,900 acres) and in CH unit 10 the project affects less than one percent (2,500 of 567,090 acres) of available NRF habitat (PCE 2 and 3).

The adverse modification determination for the NSO is made at the scale of the entire designated critical habitat, with consideration given to the need to conserve viable populations within each of the recovery units identified in the Recovery Plan (USDI FWS). There will be minimal impacts to designated functions (demographic support or connectivity) of KLE6, KLE7, and KLW8 due to the limited proportion of NRF habitat affected by the proposed action. The function of critical habitat in KLE7 was substantially altered by the fires as noted above. The combination of fire effects (reduction of NRF habitat by 30 percent) and the effects of the proposed action on NRF and PFF (reduction of ten percent) (PCE 2 and 3) resulting in the take of 11 NSO sites will negatively affect the demographic support function of the subunit. However, surrounding subunits within Unit 9 contain sufficient habitats that will facilitate connectivity and demographic support.

Given the information described above the proposed action would not represent an appreciable reduction in the conservation value of the entire designated critical habitat at the rangewide scale.

9.0 CONCLUSION
After reviewing the current status of the NSO, NSO critical habitat, the environmental baseline for the action area, the effects of the proposed action and cumulative effects, it is the FWS's biological opinion that the proposed action is not likely to jeopardize the continued existence of the NSO and is not likely to adversely modify NSO critical habitat.

The FWS reached these findings for the NSO and NSO critical habitat based on the following reasons:

KNF and FWS worked together to identify high and moderate priority NSO sites in accordance with RA10. The proposed action would avoid and minimize, to the extent practical as determined by the purpose and need, actions within NSO core use areas. Of the 73 sites within the action area identified as high and moderate priority, the implementation of the proposed action is not likely to result in take of 33 pairs of the NSOs associated with high and moderate priority sites.

The proposed action would result in take of 74 adults and 12-29 juvenile NSO (through harm). The proposed action is located within the California Klamath Province, which is an important
stronghold for NSOs. NSOs in this Province are noted to be currently in decline. Across the KLE and K LW modeling regions, modeling for the critical habitat rule indicated up to 2,680 NSO may be present (Dunk et al. 2012). Using the state database (CNDDDB 2015) and the average rate of population change in California, FWS estimated 1,642 NSO. The proposed action will take five percent of the NSOs estimated to be present in the province. This means that, despite the proposed action, 95 percent of the NSOs will remain. Impacts from barred owls may not be as heightened in the California Klamath Province as they are elsewhere in the range. There is no long term study area within the province, but it is assumed to have similar population trends as the three adjacent study areas, which collectively are more demographically robust than four of the 11 total provinces (Oregon coast and the three study areas in Washington). The Oregon Klamath Province study area which is the most similar of the three based on vegetation characteristics to the California Klamath province is one of very few potentially stable populations across the NSO range (Dugger et al. 2015a).

Based on our estimates of the rangewide population of NSOs, as described in section 4.1, we anticipate the proposed action will take 1 percent of the NSOs estimated to exist today. This means that 99 percent of the NSOs in the rangewide population remain unaffected by the proposed action. Given the caveats described in section 4.1 our range wide population figure could overestimate NSO numbers by up to 50 percent. If we did overestimate NSO populations by up to 50 percent this proposed action would still only take up to 2 percent of the rangewide NSO population. We have determined that removing such a small percentage from an estimated population of over 6,600 NSOs will not result in an appreciable reduction of survival and recovery of the species.

The proposed action is located on both LSR and Matrix lands under the NWFP. The proposed action will affect areas generally managed for NSO conservation (LSR and critical habitat however, there are PDFs that retain some proportion of snags, down wood and legacy green trees within units. The KNF determined the proposed action will protect or promote late seral habitat in the long term (USFS 2015a, chapter 3, pp. 178-213) to benefit a myriad of native species, including the NSO. Specifically, the salvage proposed in LSRs was designed to increase the effectiveness of the other fuels treatments, by reducing future fuel loading (that could result in future high severity fires) and accelerate the redevelopment of late successional habitat (USFS 2015a, appendix E).

The interagency LSR Work Group review concluded that the proposed salvage meet LSR objectives and standards and guidelines and concurred the salvage portion of the proposed action was consistent with the KNF LSR assessments and the NWFP. This conclusion was reached for the following reasons:

• Snag retention areas have been designated within the salvage units, usually on the lower slopes that have historically burned with lower severity.
• The project includes treatments designed to enable restoration of low-intensity fire regimes to reduce the incidence of future catastrophic events and protect existing late-successional forests as described in standard and guidelines C-12 and C-13).
• No coarse woody debris existing prior to the fire would be removed, and coarse woody debris within patches of standing trees would not be removed.
• Six percent and two percent of the moderate and high severity fire would have risk reduction salvage, in the Seiad and Eddy Gulch LSRs respectively.
The proposed action includes some of the recommendations in the Recovery Plan consistent with RA12 and RA32. Within the action area, approximately 80 percent of NSO NRF and dispersal habitat (about 101,000 acres) burned at low severity. Less than 2,500 acres of low severity NRF habitat will be downgraded or removed by harvest. About 4,500 acres NRF and dispersal were removed by salvage harvest on private lands. Therefore 93 percent of the NSO NRF and dispersal habitat that burned at low severity will remain after the proposed action, including those areas characterized as RA32 habitat. Approximately 20 percent of NRF and dispersal habitat (approximately 32,000 acres) within the action area burned at medium to high severity and 12 percent of these acres (3,740 acres) will be removed or downgraded. Additional habitat effects will occur from treatments that degrade habitat resulting in overall effects to about 14 percent (about 19,700 of 140,770 acres) of NRFD and PFF habitat. In most places PDFs will provide for retention of snags and down wood, both green tree and burned legacy features important to NSOs. Retention of snags, down wood and legacy features will be provided at broad scale in the action area, implementing some of the habitat retention concepts described in RA12.

The proposed action will downgrade, remove, or degrade less than one percent of the estimated two million acres of habitat in the California Klamath Province, and will downgrade, remove, or degrade less than 0.17 percent of the 12 million acres of habitat rangewide. The species will continue to have sufficient amounts of habitat available in which to reproduce, and their reproductive output will not be appreciably harmed (though it will be reduced for a time). We also believe there will be sufficient habitat within the action area so the local NSO population can continue to recover over time. Therefore, we do not believe that affecting such a minor percentage of the 12 million acres of NSO habitat range wide will result in an appreciable reduction of the survival and recovery of the species.

In summary, while we believe this action will have a substantive effect on a number of individual NSOs and their reproduction at a time when their population is declining, we do not believe the impact will accelerate the NSO’s population decline in an appreciable manner since the impact is occurring to such a small proportion of the population. Harm to 37 pairs of NSOs occupying 40 NSO sites and their young at 29 of those NSO sites is likely to have a substantive effect on a number of individual NSOs and their reproduction. The proposed action will impair but not preclude the capability of the action area to fulfill its conservation role, which is to contribute demographic and dispersal support to the NSO population within the California Klamath Province, which is also designated as a recovery unit. We do not believe these impacts will accelerate the NSO’s population decline in an appreciable manner since the impact is occurring to such a small proportion of the population. We do not believe impacts to the provincial baseline due to the proposed action constitute an appreciable reduction in the recovery support function of the recovery unit (as defined in USDI FWS 2011a). The proposed action affects less than 1 percent of NRF habitat (see appendix C). For these reasons, we conclude that the proposed action will not jeopardize the continued existence of the NSO.

**Cumulative Effects**

Across all fire areas, we have identified cumulative effects which may reduce NRF habitat by three percent (2,330 of 74,070 acres) across the action area. Up to 38 NSO sites have cumulative effects that may remove habitat in the core or home range.
Spotted Owl Critical Habitat
In the 2012 CH rule, we designated 9,577,969 acres in 11 units and 60 subunits in California, Oregon and Washington. The primary constituent elements (PCEs) include nesting, roosting, foraging, and dispersal habitat. The final critical habitat rule (p. 71877) identifies the CH network that ensures sufficient habitat to support populations across the range; ensures distribution across the range; and incorporates uncertainty, including effects from barred owls, climate change, and wildfire disturbance risk. The fact that uncertainty associated with impacts to critical habitat by various causes was considered in the designation of critical habitat provides a degree of buffer that allows the critical habitat to still maintain its function.

Approximately a third of the action area overlaps with two CHUs (Klamath East and Klamath West). Within those two units, four subunits of CH are involved. These subunits were designated to provide demographic support to the species and dispersal and connectivity habitat between nearby CHUs. A relatively minor proportion of three of the subunits burned at moderate or high severity in 2014. For the remaining subunit (KLE7), about 30 percent NRF habitat (PCE 2 and 3) was burned in 2014, and an additional 10 percent will be downgraded or removed by the proposed action.

In total, this proposed action will affect about three percent of the NRF in CHU9 and less than two percent of the NRF in CHU 10 (table 20), and less than 0.1 percent of the available nesting, roosting, and foraging habitat in critical habitat rangewide. Direct cumulative effects will not occur within NSO critical habitat, but cumulative effects adjacent to critical habitat on private lands may cause indirect effects. We determined that the cumulative effects on private land adjacent to CH to be insignificant at the subunit scale for KLE6, KLE7, KLW7, and KLW8 (section 8.4).

While the proposed action would substantially alter and delay the ability, it will not preclude the ability, of subunit KLE7 to fulfill its conservation role. Critical habitat in subunits KLE6, KLW7, and KLW8 will continue to serve their intended recovery support role by providing habitat which is necessary to support essential life history functions such as reproduction and dispersal. The percentage of critical habitat that will be removed or downgraded does not appreciably reduce the ability of the designated critical habitat at the unit or rangewide scale to provide the recovery support functions for which it was designated. This is crucial because critical habitat in this Province is disproportionally important to the species. For these reasons, we conclude that that the proposed action will not destroy or adversely modify critical habitat.
INCIDENTAL TAKE STATEMENT

Introduction

Section 9 of the ESA and Federal regulation pursuant to section 4(d) of the ESA prohibit the taking of endangered and threatened species, respectively, without special exemption. Take is defined as harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or attempt to engage in any such conduct. Harm is defined as an act which actually kills or injures wildlife, and was further defined (50 CFR 17.3) by FWS to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing behavioral patterns such as breeding, feeding, or sheltering. Harassment is defined by FWS (50 CFR 17.3) as actions that create the likelihood of injury to a listed species by annoying it to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of Section 7(b)(4) and Section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the ESA provided that such taking is in compliance with this Incidental Take Statement.

The measures described below are non-discretionary, and must be undertaken by KNF so that they become binding conditions of any grant or permit issued to KNF, as appropriate, in order for the exemption in Section 7(o)(2) to apply. KNF has a continuing duty to regulate the activity covered by this incidental take statement. If KNF (1) fails to assume and implement the terms and conditions, or (2) fails to require any contractors to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, the protective coverage of Section 7(o)(2) may lapse. In order to monitor the effect of incidental take, KNF must report the progress of the action and its effects on the species to FWS as specified in the incidental take statement [50CFR§402.14(I)(3)].

Amount or Extent of Take Anticipated

Based on the findings presented in the Effects of the Action on the Spotted Owl (Section 6.0) above, FWS concludes that the proposed action is likely to result in the incidental take of 74 adult and up to 12-29 juvenile NSOs. The take is in the form of harm caused by habitat removal, downgrade, or degradation by implementation of the proposed action that affects approximately 19,700 acres of NRFD and PFF habitat. This change in habitat condition is likely to significantly disrupt the breeding, feeding, and sheltering behavior of these NSOs to an extent that causes injury or death. Take of 12-29 juvenile NSOs is due to breeding season operations that may remove undetected nest trees. If this occurs, juvenile NSOs would likely either be crushed by the impact, or would fall out of the nest and be subject to predation or would die from exposure or starvation. Extensive noise disturbance during the breeding season may cause an increased flushing response or reduced feeding of juveniles by adult NSOs increasing the likelihood of exposure/predation, or starvation of juvenile NSOs.

Although we are able to quantify the take in terms of the likely number of affected individuals, it is not practical to monitor NSO for purposes of verifying that take has occurred and determining
if the take limit has been reached or exceeded for two reasons. First, there is a low likelihood of finding an injured or dead NSO because their home ranges are large (about 3,000 acres on average) and there is a high rate of removal of injured or dead individuals by predators and scavengers. Second, the anticipated take from habitat changes within NSO sites is primarily in the form of reduced fitness of the affected adult and juvenile owls caused by reduced habitat conditions and associated impacts on NSO prey populations as a result of the proposed action. That reduced fitness is likely to cause reduced survival and reproduction of the affected NSOs as discussed under section 6.3 above. Documenting this reduction is very difficult, and doing so may take months or years at considerable expense.

The amount or extent of take exempted herein is caused by habitat removal, downgrade, or degradation of approximately 19,700 acres of NRFD and PFF habitat that is proposed to occur within known or historical NSO sites. The take associated with operations during the breeding season can be closely monitored based on timing and duration of operations in nesting, roosting, and foraging habitat and the amount of take can be estimated and reported during the years of action implementation. Based on information provided in monitoring reports, the take estimated within this analysis may be adjusted accordingly.

Effect of the Take

In the accompanying BO, FWS determined that this level of anticipated take is not likely to result in jeopardy to the species or destruction or adverse modification of critical habitat.

**Reasonable and Prudent Measures**

Pursuant to 50 CFR §402.14 (i) (I) (ii) and (iv), reasonable and prudent measures (RPMs) are those FWS considers necessary or appropriate to minimize the effects of the incidental taking; terms and conditions (T&Cs) are the actions required by the Federal agency or applicant that will implement the measures described in the RPMs. In order to be exempt from the prohibitions of section 9 of the ESA, KNF must comply with the T&Cs, which implement the RPMs and outline required reporting/monitoring requirements. As part of the Project design, KNF has taken some steps to avoid and minimize impacts to NSOs through the incorporation of PDFs (as set out in appendix A tables 1.1 and 1.2 of the BO) as part of the proposed action. FWS's evaluation includes consideration of the PDFs that reduce the adverse effects of the Project on the NSO. Any subsequent changes in the PDFs or project design proposed by KNF or in the conditions under which these activities currently occur may constitute a modification of the proposed action and may warrant reinitiating formal consultation, as specified at 50 CFR § 402.16. The following RPMs and corresponding T&Cs are intended to supplement or clarify the protective measures that were proposed by KNF as part of the Project, or are required under the ESA and implementing regulations. Both are necessary and appropriate to minimize the impact of the taking on the NSO.

Upon our review of the BA, we have determined that despite the adopted recommendations, the effects of the proposed action would result in the taking of a total of 37 pairs (74 NSOs and 12-29 young), all of which were determined to be in high and moderate RA 10 value sites (sites most likely to contribute to long-term persistence of NSO at the province and rangewide scales). During the development of these reasonable and prudent measures, we kept our recommendations narrowly focused to select areas with high probability of use by NSOs. We
also focused on and to remaining within the scope of the minor change rule. Although current habitat configurations indicate that there are 37 pairs associated within 40 NSO sites where take has been determined to occur as a result of the proposed action, we are restricting the reasonable and prudent measures to minimize the impact of the taking at 24 sites that have been surveyed and had positive detections of NSOs between 2011 and 2015. We assume 21 pairs of owls likely occupy these 24 sites due to use of alternate core areas from year to year. About half of these sites also have take of young that will be minimized or avoided through this RPM. Terms and conditions described below represent treatments that:

- Occur in NRF habitat as identified by EVeg (Roadside Hazard - Roadside Complete and Fuel Management Zones)
- Occur in PFF1 or NRF habitat based on post-fire imagery (Google Earth and Landsat 8 website) (commercial salvage units)
- Intersect with areas the critical habitat modeling (modeling) identifies as “selected for” (RHS ≥32)

The majority of impacts to NSOs occurs during the first three years of implementation and represents long term impacts to NSO habitat. **These measures described below are necessary or appropriate actions to minimize the impacts of the incidental taking.**

1. Reduce likelihood of harm due to removing, downgrading, and degrading NRF habitat by modifying treatments in select areas with high probability of use by NSOs. Treatment modification would include only removing trees identified as posing imminent hazards to public and forest workers;

2. Reduce likelihood of harm by modifying Hazardous Fuel Treatments-Roadside Complete units due to removing, downgrading, and degrading NRF habitat by modifying treatments in select areas with high probability of use by NSOs. Modification of treatments would ensure that NRF habitat is not removed or downgraded;

3. Reduce likelihood of harm due to removing, downgrading, and degrading NRF, fire-affected NR habitat and PFF1 habitat by modifying or excluding treatments in commercial salvage units within fire-affected NR and/or PFF1 in areas of high relative habitat suitability or NSO cores profoundly affected by high severity fire. Harm will be minimized by increasing areas that facilitate habitat connectivity and the retention of diffuse edges in areas of likely NSO use;

4. The Project has minimized but not avoided the taking of NSO due to harm during the breeding season prior to the completion of surveys. Impacts to habitat of the 2014 fires are likely to cause movements or shifts in some NSO locations. Ensure project implementation does not occur between February 1 and September 15 within unsurveyed suitable NRF habitat in unburned or low severity burned areas] or currently known or historical nest stands;

5. Reduce likelihood of harm due to removing, downgrading, and degrading fire affected NR and PFF habitat by adding retention in commercial salvage units in select areas with
high probability of use by NSOs. Retention is intended to provide diffuse edge to support NSO foraging opportunities, to maintain habitat components for prey that support NSOs, and to minimize the ecological impacts from salvage logging in areas that provide important demographic support to NSO populations.

**Terms and Conditions**

1. To maximize retention of suitable habitat, within roadside hazard tree removal units along maintenance level one and two roads not identified as ‘ingress/egress routes,’ only remove trees that are identified as imminent hazards where they occur in NRF habitat, where they intersect with areas the modeling identifies as “selected for” (RHS ≥32), and where they occur in contiguous segments (six units, see map). Relates to RPM 1.

2. To reduce the likelihood of direct harm to NSOs and their young by felling trees in potential nesting areas, ensure NSOs are not breeding within the core area during timber harvest. Within NSO core use areas (0.5 mile) of ten NSO sites (0383, 1041 1047, 1109, 1110, 1130, 9991, 9998, New7a, and New7b) conduct three survey visits, according to the NSO survey protocol prior to start of operations (USDI FWS 2011b). If NSOs are found nesting during those survey visits, avoid timber harvest until after the breeding season is over (Sept 15th). This applies to all ingress/egress roadside hazard tree removal in NRF habitat except those trees identified as an imminent hazard. In addition, visually inspect trees >24 inches dbh for characteristics that NSOs use for nesting. Such structures include mistletoe brooms, deformed branches and broken tops. If trees contain these characteristics, postpone falling and removing those trees until September 15 or until six visits per the survey protocol have been completed and it has been determined that NSOs are not nesting. Relates to RPM 4.

3. Modify prescriptions to maintain existing habitat function and avoid removing and downgrading NRF habitat in roadside complete units and FMZs where they occur in NRF habitat and where they occur in contiguous blocks where they intersect with areas the modeling identifies as “selected for” (RHS ≥32) (eight units, see map). Relates to RPM 2.

4. In the following five commercial salvage units greater than 30 acres in size that have little to no retention, 005-12, 058-1, 212, 262, and 423, add or supplement existing aggregates of snags within NRF and/or PFF within areas the modeling identifies as “selected for” (RHS ≥32). Retention areas should be clumped to the extent practical and represent about 20 percent of the commercial salvage unit. See map identifying areas of high probability of use. Relates to RPM 5.

5. In commercial salvage units in NSO home ranges 0383, New 3A/3B, and 4133, modify the units to further incorporate and substantially increase retention in areas identified as “selected for” (RHS ≥32). Retention will be in the following priority order; NRF, fire affected NR, PFF1 and PFF2. This term and condition does not apply to areas that overlap roadside hazard tree removal units. See map. Relates to RPM 3 and RPM 5.

   a. In NSO site 0383, this includes additional retention in unit 243.
b. In NSO site 4133, this includes additional retention in units; 005-12*, 022, and 21. These retention areas are to support PFF in the area where the NSOs associated with site 4133 are most likely to shift their core use area post fire. (*Note: Retention measures described for 005-12 will be met by T&C #4).

c. In NSO site New 3A/3B where one pair of NSOs alternates between use of the two sites, add additional retention acres in unit 23-2 to augment retention areas already established for the core use area at NSO site New 3B.

6. In a sample of commercial salvage units, conduct field review with FWS staff to confirm that on the ground layout of salvage units has excluded areas previously identified in the BA as lower burn severity areas. Ensure that live trees that do not meet the 60 percent probability of mortality standard are clearly marked so they will not be cut, unless they pose a safety hazard. Modification of unit boundaries does not apply to areas that overlap roadside hazard tree removal units (see map). Relates to RPM 3 and RPM 5.

7. Prior to implementation of prescribed fire activity, KNF and FWS representative should discuss timing and location of activities relative to known NSO core and home ranges and suitable habitat in order to avoid direct harm to NSO. Relates to RPM 4.

8. Conduct pre-season survey strategy coordination meetings in years 3-10 to identify areas of remaining treatments and to maximize efficiency of survey efforts in order to avoid direct harm to NSO. Relates to RPM 4.

9. Conduct one activity center search following the NSO survey protocol in NSO sites 9995 and 1214 prior to activities if activities are going to occur between February 1 and September 15 and if NSOs are determined to be nesting (USDI FWS 2011b). If protocol surveys determine NSOs are not nesting or fail to locate NSOs the breeding season operating restriction does not apply. Relates to RPM 4.

**Reporting Requirements**

Prior to January 31st of each year for the duration of project implementation, KNF will provide annual monitoring reports of the estimated take that may have occurred in relation to the amount of take that is identified in this Incidental Take Statement. The report must specify whether pre-project surveys were conducted and the results of those surveys. FWS will subtract from the habitat baselines all acres of NSO habitat identified to be removed in this BO, unless formally adjusted by KNF in conjunction with FWS at a later date.

The monitoring report should contain at a minimum the following information:

1. Progress and status of the proposed action,
2. Amount and type of habitat removed or modified,
3. Changes to Project implementation not discussed in the BA,
4. Monitor and report the size and amount of snag retention aggregates in commercial salvage units post-harvest,
5. KNF and FWS representatives monitor and report estimated effects from roadside salvage and fuels treatments to validate assumptions of degree of change to habitat,

6. Prior to operations in 2017, complete and submit to FWS a monitoring report for the activities completed and the timing of treatments within NSO sites where take was anticipated in order to assess the take associated with activities,

**Disposition of Sick, Injured, or Dead Specimens**

Any dead or injured NSOs must be reported to FWS’s Law Enforcement Division (916-414-6660) or the Yreka Fish and Wildlife Office as soon as possible, and turned over to the Law Enforcement Division or to a game warden or biologist of the California Department of Fish and Wildlife for care or analysis. FWS is to be notified in writing within three working days of the accidental death of, or injury to, an NSO or of the finding of any dead or injured NSOs during implementation of the proposed action. Notification must include the date, time, and location (including GPS location information in UTM, NAD 83) of the incident or discovery of a dead or injured NSO, as well as any pertinent information on circumstances surrounding the incident or discovery. FWS contact for this written information is the Field Supervisor for the Yreka Fish and Wildlife Office at 1829 South Oregon Street, Yreka, California, 96097 or by telephone at (530) 842-5763.

**Conservation Recommendations**

Sections 2(c) and 7(a)(1) of the ESA direct Federal agencies to utilize their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of endangered and threatened species and the ecosystems upon which they depend. Regulations in 50 CFR S.402.02 define conservation recommendations as FWS suggestions regarding discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, or regarding development of information.

FWS proposes the following conservation recommendations:

1. To validate or refine assumptions made in post-fire NSO habitat suitability during this consultation, and to assist in similar future analyses, the Level One Team should conduct field reviews to assess the conditions of habitats burned at moderate severity.

2. Little information exists on the short or long-term effects of salvage and fuels reduction and habitat restoration treatments on NSOs. For this reason, FWS encourages KNF to continue monitoring the location and reproductive status of all NSO activity centers associated with this proposed project.

3. In order to obtain information for use in future project planning and consultation on projects of this type, the interagency Level One Team should conduct post-treatment field reviews of portions of this project that represent the variety of actions proposed. This will assist both agencies in evaluating post-treatment habitat and to review assumptions made for post-treatment habitat determinations during this consultation.
4. Submit any survey data identifying occurrences of NSOs and barred owls to FWS and the California Department of Fish and Wildlife’s BIOS database.

**REINITIATION – CLOSING STATEMENT**

This concludes formal consultation on this action. As provided in 50 CFR § 402.16, reinitiation of formal consultation is required when discretionary Federal agency involvement or control over the action has been maintained (or is authorized by law) and if:

1. the amount or extent of incidental take is exceeded;
2. new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion;
3. the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in this opinion; or
4. a new species is listed or critical habitat designated that may be affected by the action.

In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.
LITERATURE CITED
Andersen, M.C., and D. Mahato. 1995 Demographic Models and Reserve Designs for the
Rocky Mountains: Consequences of fire exclusion and options for the future. In: Cole, David N.;
McCool, Stephen F.; Borrie, William T.; O’Loughlin, Jennifer, comps. 2000. Wilderness science in a
time of change conference. Volume 5: Wilderness ecosystems, threats, and management; 1999 May 23–27;
Research Station.
Beschta, R.L., J. J. Rhodes, B. Kaufman, R.E. Gresswell, G.W. Minshall, J.R. Karr, D.A. Perry,
F.R. Hauer, and C.A. Frissell. 2004. Post-fire management on forested public lands of
the western United States. Conservation Biology, V.18, No. 4. pp. 957-967.
Indian Reservation. Proceedings-Fire Effects on Rare and Endangered Species and
Short-term effects of wildfires on spotted owl survival, site fidelity, mate fidelity, and
California spotted owls in a post-fire landscape. Journal of Wildlife Management
73:1116-1124.
59(2):301.
CALFIRE 2015. Website. ftp://thp.fire.ca.gov/THPLibrary/Cascade_Region/
Carey, A.B. and M.L. Johnson. 1995. Small mammals in managed, naturally young, and old-
Carsia, R.V. and S. Harvey 2000 Chapter 19 Adrenals in Sturkie’s Avian Physiology 5th
Edition
Post-fire salvage logging alters a key plant-animal interaction for forest regeneration.
Ecosphere. October 2012, Vol. 3(10), Article 90.


Comfort, E.J. 2014. Trade-offs between management for fire risk reduction and northern spotted owl habitat protection in the dry conifer forests of Southern Oregon. PhD. Dissertation; Oregon State University, Corvallis, OR.


Eyes, S. 2014. The effects of fire severity on California spotted owl habitat use patterns. M.S. Thesis. Humboldt State University. 62 pp


Hollen, B., R. Horn, P. Caldwell, R. Cruthchley, K. Fukuda, T. Kaufmann, C. Larson, and H. Wise. 2015. Demographic characteristics of northern spotted owls (*Strix occidentalis*


USDA FS [US Forest Service] and USDI Bureau of Land Management. 1994. Record of decision for amendments to Forest Service and Bureau of Land Management planning documents within the range of the northern spotted owl; standards and guidelines for management of habitat for late-successional and old-growth forest related species within the range of the northern spotted owl. Portland, Oregon.


Zabel, C. J., K.M. McKelvey, and J.P. Ward, Jr. 1995. Influence of primary prey on home-


Personal Communications


Appendix A

Table 1.1 Table of Contents:

<table>
<thead>
<tr>
<th>Section I</th>
<th>Supplemental information to the BA provided by KNF August 18, 2015.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Section II</td>
<td>Tables and figures referred to in the body of this biological opinion that are not part of ‘Supplemental information to the BA’ (Section I). In general tables and figures that comprise over half a page long are in this appendix rather than the body of the document.</td>
</tr>
</tbody>
</table>

Section I: Supplemental information to the BA (received August 18, 2015).

This information came directly from KNF, so wording and abbreviations may not match other portions of the biological opinion (BO). We have added in brackets the meaning of the term when necessary. This information is essential to the analysis in Sections 5, 6 and 8 of this. Throughout the BO this is referred to as ‘supplemental information to the BA’ or instead the reader is directed to a specific table within this appendix.

Summary 1.1
In response to the final version of the BA, received from KNF July 23, 2015, FWS requested clarification on a number of issues. FWS request for clarification resulted from the differences in information provided in the final BA (July 27, 2015) and subsequent meetings and requests. The following summary was taken from a tracking document sent by KNF:

Purpose
The following information is intended to keep a written record of addressing FWS comments on the Westside Fire Recovery Project [proposed action] – Biological Assessment. The Forest [KNF] received comments from FWS on August 4, 2015 and additional requests in subsequent meeting on August 5 and 11 concerning the BA submitted to FWS on July 27, 2015.

The revised PDF [project design features] table [table 1.2] at the end of this document provides more clarity on the application of LOPs and the survey strategy for each treatment type and addresses comments made regarding PDFs. The revised PDFs will be incorporated into the PDFs within the Record of Decision.

FWS Comment 1: FWS needs clarification on the LOPs [limited operating periods] and survey strategy.

KNF Response: On pages 56 to 58 of the BA, the survey strategy is described. The basic purpose of the surveys is to reduce the likelihood that project activities [breeding season operations] may harm owls [NSOs] or disrupt nesting behavior. The survey strategy is broken into three basic components: 1) AC [NSO site] searches, 2) night time call route, and 3) stand searches (pg. 57 of the BA). AC searches were completed in 2015 and will be completed each
year for each AC that contains treatment in core or home range. The night time call routes were completed in 2015 (6 rounds of surveys) and will be completed in 2016 (6 rounds of surveys) using the same call routes as used in 2015. In 2017 and subsequent years, call routes will likely be reduced to focus on areas with remaining treatment, but surveys will follow survey protocol. Stand searches were completed in 2015 for areas that were not covered by night time call routes because of a lack of roads or surveyor safety. Despite these three types of surveys, there are a couple places in the project [action area] that likely do not have complete survey coverage, but these areas have no proposed treatment and topographical features reduce the likelihood that treatments would affect the ACs occurring in these areas (see BA p. 58).

The Project [proposed action’s] survey strategy does deviate from the NSO survey protocol (see Wildlife PDF1 below). First, the survey protocol requires six surveys for two consecutive years before dropping down to 3 surveys in the third and fourth years. The Westside Project has six rounds of nighttime surveys, NSO site searches, and stand searches completed in 2015 and will complete 6 surveys in 2016, but in 2016, three surveys will be completed prior to implementation and three surveys will be completed during implementation1 (there are exceptions; see below). The level of potential NSO effects from this survey approach is dependent on the amount of treatment remaining in 2016. We expect most of the salvage and roadside hazard to be completed in 2015 thus reducing the area where treatment could occur in 2016 and consequently reducing the potential number of owls [NSOs] affected. Second, because the roadside hazard treatment [tree removal] along major ingress/egress roads needs to be completed as soon as possible, implementation may occur before surveys are complete and outside of LOP timing. Most of the ingress/egress roadside hazard treatment will likely be completed in 2015 and therefore the treatment will avoid the NSO reproductive period, but any remaining treatment in 2016 may occur during the NSO reproductive period (there are exceptions, see below).

LOPs were designed to reduce the effects to nesting NSO by limiting the timing of activities occurring within NSO habitat and limiting the timing of noise resulting from project activities within 0.25 mile of NSO habitat. For the Westside Project, disturbance to NSO resulting from noise would mostly result from vehicle traffic on roads and is expected to occur over a large area. However, due to the proximity of the treatment units to suitable [NRF] habitat, most of the project activities that affect habitat or create noise above ambient levels adjacent to habitat will have an LOP from February 1 to July 9, unless surveys are completed as described in PDF Wildlife -1 which may result in lifting the LOPs (there are exceptions, see below). If any survey detects an NSO that year, then treatments within 0.5 mile3 [of NSO detections or associated AC / NSO site] will have an LOP from February 1 to July 9. Given the timeline of surveys completed in 2015, we expect to have at least 5 surveys completed prior to July 9th, thus possibly giving us [KNF] enough information to determine nesting status. If nesting is confirmed or suspected, then a 0.5 mile LOP from February 1 to September 15 will be applied to the known or suspected nest.

1 Although the project is divided into multiple sales which could increase the amount of implementation that could occur during the spring (after 3 surveys but before completing 6 surveys), it is highly unlikely that all the salvage and roadside hazard units will be harvested prior to all 6 surveys being completed in 2016. A portion of the salvage units will be completed during the summer/fall of 2015 and the remaining units will be implemented in 2016.

2 The center of the 0.5 mile buffer will likely be placed on the area that is mostly likely used for nesting. In most situations, the center of the buffer will be placed in the nearest patch of suitable habitat. However, the center of the buffer can be adjusted as new data is gathered, especially if a nest is located.
This survey strategy does have **exceptions** as identified in PDF Wildlife - 1 (BA pg. 19).

1) After review of the pre-fire habitat, fire severity, proximity to suitable habitat, survey data, topography, disturbance factors (i.e. haul routes, landings, helicopter flight paths) and elevation plus additional field visits, we identified 20 salvage harvest units that have a low potential to contain a NSO nest and are less likely to be used by NSOs. Although small patches (<10 acres) of suitable habitat do exist near the salvage units, the salvage units are generally located in areas that experienced more contiguous moderate and high fire severity, were mostly located on upper slope positions, and were typically not adjacent to suitable habitat, thus reducing the potential for disturbance. However, Unit 58 is within 0.25 mile of larger patches of suitable habitat, however due to the unit’s position on a prominent ridgeline and after consideration of the harvest system and landing locations, it was determined that there is a low likelihood of noise disturbance to nesting owls [NSOs]. In addition, these units and the habitat surrounding the units was reviewed for suitability and likelihood of occupancy using field validation, habitat data and burn severity data that further informed the potential effect.

2) The [scattered] roadside hazard [tree removal] that occurs along major ingress/egress roads contains segments that are near recent owl [NSO] detections. Even though the 2015 surveys did not locate a nest within the roadside hazard treatment units along ingress/egress roads, there is habitat [NRF] that could provide a nesting site within close proximity to the treatment. In order to lessen the potential effects of this treatment to NSO, a February 1 to July 9 LOP will be applied to the occupied cores as determined by the most recent surveys. If surveys detect an NSO outside these known occupied cores, then a February 1 to July 9 LOP will apply to treatments within 0.5 miles² of these sites too. Any of these sites with NSO activity may have the LOP extended to September 15, if nesting is confirmed or suspected. Therefore, the segments of ingress/egress roads with roadside hazard treatment in occupied cores (known or newly discovered NSO sites) or suspected new NSO site core will have a LOP of February 1 to July 9 and if nesting is suspected or confirmed, then the LOP will be extended to September 15 (see BA p. 121-122).

**FWS Comment 2:** Discrepancy of retention acres between text and table 6.

**KNF Response:** On page 15 of the BA, the section describing proposed treatment states that the project will retain 495 acres of snag retention patches and 643 acres of riparian reserves in the [commercial] salvage harvest units. Table 6 (pg. 36) describes the snag retention patches and riparian reserves retention areas within each salvage harvest unit. Table 6 shows a total of 530 acres of snag retention patches and 556 acres of riparian reserves. Table 6 is correct; there are about 530 acres of snag retention patches and about 556 acres of riparian reserves that will not be salvage harvested even though these areas occur in a [commercial] salvage harvest unit.

**FWS Comment 3:** PDF 2 does not specify a time of year the prescribed fire is planned to occur.

**KNF Response:** PDF 2 (BA, pg. 20) is describing the need to limit spatial underburning occurring in a year within an NSO site, but not the timing of the underburn unless protocol
surveys detect site occupancy. The intent of this PDF is to balance the need to treat the fuels occurring within an NSO site while minimizing disturbance to an occupied NSO site and moderating the amount of habitat affected by the underburn within a given year regardless of occupancy.

The timing of the underburn is dependent on meeting the prescribed site conditions (e.g. wind speed). The prescribed underburning conditions could occur in the spring, fall, and sometimes the winter months, but from a fuels perspective, there are no specific underburning timing restrictions or prescriptions that would limit a particular season or month. Typically, an underburn occurs whenever the prescribed conditions occur and the area of with a prescribed underburn doesn’t conflict with the spatial or temporal restrictions resulting from other resource concerns like PDF-2. In other words, underburns are largely restricted in time and space by meeting the prescribed site conditions and other resource concerns. Areas of suitable NRF that are either within or within .25 miles of underburning units would be surveyed to protocol prior to implementation. In addition, a pre-implementation coordination meeting would be conducted with FS and FWS biologists and fuels/fire specialists in order to review NSO concerns and minimization measures that may be incorporated into the burn plan.

**FWS Comment 4:** Clarify the statement under the heading of assumptions in the BA that begins with “Level One biologists reviewed the most current NSO observation data”.

**KNF Response:** This statement does not imply that we only used the most recent NSO data for placement of the NSO sites, or for any part of the NSO analysis; rather, the statement on pages 22-23 highlights the fact that we used the most recent observation data in a hierarchical process so that the most recent nests or groupings of detections are given more weight than historical detections, but that all NSO data within the CNDDB and NRIS databases were reviewed for the analysis and during the planning of this project, including the placement of NSO sites.

In addition, it is also important to recognize that any NSO survey data collected during the life of the project will be used to minimize effects on NSO by identifying NSO nesting activity that could result in the application of additional LOPs. A description of the process used to place the center of the NSO site for analysis is on page 22 of the BA.

**FWS Comment 5:** FWS would like clarification on the table 8 footnote

**KNF Response:** Table 8 on page 54 of the BA displays the acres of NSO habitat before and after the 2014 fires and the acres of habitat affected by each fire severity in the analysis area. The footnote is simply attempting to point out that the acres of habitat affected by the fire do not add up to the total acres within the analysis area. The analysis area is defined by creating a 1.3 mile buffer around all treatment units which results in the analysis area extending beyond the fire perimeter. Therefore, the analysis area contains a portion that has fire effects and a portion that has no fire effects resulting from the 2014 fires. For example, there are 33,485 acres of pre-fire Nesting/Roosting, but only 24,272 acres of the 33,485 Nesting/Roosting occurred in the fire perimeter.
FWS Comment 6: There are two tables identified as “table 10”. Is there an error in the number of NSO sites in the analysis?

KNF Response: There are two “table 10” in the BA. One table 10 is located on page 54 (“table 10a”) and the other on page 66 (“table 10b”). Table 10a displays the 85 ACs that are analyzed in the BA. These 85 ACs represent the sites that were occupied at some time in the 30+ years as identified in the NSO survey data (a complete description of identifying ACs for the analysis is available starting on page 22 of the BA). However, some of these ACs [NSO sites] were likely occupied on different years by the same NSO pair. This scenario is important to include in the analysis in order to estimate the number of owls [NSOs] potentially affected by the project; the AC analysis evaluated each AC individually regardless of which owls may have used the site. The approach of including all the known NSO sites provides an estimate that more closely matches an estimated maximum level of effects; thus, we expect our estimated effects to be more of an overestimate.

FWS Comment 7: Table 9 on page 60 of the BA displays the NSO sites New3A and New3B together and New3A/3B row contains the statement “No NSO detections occurred within the core area of either ACs” under the column heading “did AC shift in 2015 from originally analyzed location”.

KNF Response: The statement in table 9 is incorrect as presented. The statement was intended to point out that, despite NSO detections within both cores, the data didn’t display a “shift” for either NSO site [KLNew3A or KLNew3B]. The NSO detections were close to or within the known nest stands.

FWS Comment 8: Does table 11 on page 68 include Fire-affected Nesting/Roosting (FANR)?

KNF Response: Table 11 only includes nesting/roosting and foraging [NRF] as described in the methods on pages 24 to 33 of the BA. Fire-affected Nesting/Roosting is not included in table 11. This is also true for table 12 which only displays the nesting/roosting and foraging habitat acres for each AC.

FWS Comment 9: Contradiction between the ACs [NSO sites] identified as ‘occupied’ between table 9 and table 12. [In BA the term occupied is only applied to NSO sites with detections in 2015; FWS considers numerous other likely to be occupied by a resident NSO pair, see section 6.3.2: Effects to Individual NSO sites]

KNF Response: Table 9 starting on page 60 of the BA displays a summary of the 2015 NSO surveys and this table correctly displays the survey results. Table 12 on page 69 describes the table as “NSO habitat [NRF] within cores that overlap Ingress/Egress roadside hazard treatment with the potential to be affected by noise disturbance (0.25 mile buffer) within occupied core areas (as of 2015 surveys).” This table description is partly incorrect; it should read “within core areas, noting which are occupied as of 2015 surveys”. Only 11 of the ACs [NSO sites] displayed in table 12 had NSO detections in 2015. A list of the 16 ACs in the project with 2015 NSO detections is available in table 9 starting on page 60 of the BA.
FWS Comment 10: There are two tables identified as “table 14” and there is a contradiction between these tables.

KNF Response: There are two tables identified as “table 14”; one of the tables is located on page 71 (table 14a) and the other (table 14b) is on page 80. Table 14b (page 80) is correct. Table 14a was not updated. [The statement above that ‘Table 14a was not updated,’ refers to no adjustment being made to the baseline habitat estimates so that numbers in the table would reflect the assumption in the BA that all acres of habitat on private lands within the Beaver fire area had likely been removed].

FWS Comment 11: What treatment occurs in AC 1265 nest stand?

KNF Response: Table 16 displays the ACs that are assigned an “intensity factor”. For AC 1265, the table displays a ‘C’ and ‘F’. The ‘F’ signifies that the actions consulted on are estimated to result in downgrading or removing suitable habitat within the nest stand. However, this is an error because AC 1265 survey data does not indicate any reproduction occurring at this NSO site thus no known nest site was available for 2015 in order to identify a nest stand.

FWS Comment 12: Will the road and landing work have an LOP?

KNF Response: A portion of the road and landing work will have a February 1 to July 9 LOP that can be lifted after three NSO surveys. The major ingress/egress roads with roadside hazard treatment outside occupied cores will not have a LOP and the 20 salvage harvest units and associated roads and landings will not have an LOP (see response to comment 15 below). The following identifies the roads and landings associated with the salvage units without LOPs.

New Temporary Roads: 11, 15, 19, 21, 26, and 27
Temporary Road with Existing Roadbed: 26 and 34
Reopen Decommissioned Road: 45N90Y

FWS Comment 13: Figure 7 is missing a size class.

KNF Response: Figure 7 on page 35 of the BA has a missing size class 26-32in DBH. The table below displays the corrected figure.
FWS Comment 14: How many acres of private versus public land occur in the analysis area?

KNF Response: The entire analysis area is about 277,720 acres; about 50,090 acres (18 percent) private land and 227,630 acres (82 percent) KNF land.

FWS Comment 15: The last paragraph on page 83 is misleading.

KNF Response: The BA identifies salvage harvest units that do not have LOPs. This means that implementation could occur in the spring prior to the completion of 3 surveys in these salvage units. However, surveys will be completed for these units concurrently with implementation along with all the other treatments units that will receive surveys prior to implementation as described in the BA in the section discussing survey strategy.

After review of the pre-fire habitat, fire severity, proximity to suitable habitat, survey data, topography, disturbance factors (i.e. haul routes, landings, helicopter flight paths) and elevation plus additional field visits, we identified salvage harvest units that have a low potential to contain a NSO nest and are less likely to be used by NSO. It is for these reasons that the statement on page 83 described the effects from salvage harvesting these 20 units without the application of an LOP as being minimal. [FWS determined all salvage units unlikely to contain a nest, but several of these units are within 0.25 miles of NRF that may contain nesting NSO which would be subject to disturbance].

FWS Comment 16: For Whites fire and Happy Camp complex KNF made an assumption related to private land that reduced estimates of the amount of habitat available on private lands.
Please describe why this approach was taken if no timber harvest plans have been filed in these areas.

**KNF Response:** The BA assumed that the private land owners within the Happy Camp complex and Whites fire perimeters may salvage harvest the pre-fire habitat that burned at moderate and high fire severity. Using the criteria used to classify the various habitat types in the BA, the potential private land salvage in the Happy Camp and Whites area would only include about 135 acres of PFF and about 10 acres of FANR, spread over thousands of acres. The home ranges of ACs 1046 and 1041 contain the largest amount of potential salvage on private land in the Happy Camp and Whites fire areas. Both of these ACs are identified in the BA as having “high” fitness potential, which the assumption of private land salvage harvest did not affect, due to the otherwise available suitable habitat in the ACs.

Although no THPs appear to have been filed for salvage on the private land in Happy Camp and Whites, the private land owners could still salvage harvest. The trees on the private land likely have monetary value. Depending on site conditions, these trees could potentially retain monetary value for another year. Therefore, we think the potential for harvesting this habitat still exists and we therefore want to capture these potential effects within the analysis. However, if the private land owners choose not to salvage, then the BA has only overestimated the amount of PFF and FANR by 145 acres across the entire action area.

**FWS Comment 17:** How many legacy trees/snags occur in the [commercial] salvage units?

**KNF Response:** The Wildlife PDF -11 on page 20 of the BA describes the retention of legacy components which are typically in the form of live or dead trees and large coarse woody debris. These components represent the biological features that take many years to develop. The trees/snags that display the physical features of a legacy component are marked as “leave tree” so these tree/snags will not be removed from the treatment unit. Although we make every attempt to retain these identified trees/snags standing, these trees/snags may present a safety issue; if needed to reduce the safety concern these trees/snags may be felled but retained in the unit as woody debris.

Even though these legacy components are not common in the project area, these components will be retained where they occur. We don’t have an exact number of legacy components identified in the project area, but after field review of the units, the number of legacy trees/snags is relatively few. Based on a visual estimate during field review, the legacy components were generally located in the riparian reserves while the area outside of the riparian reserves contained isolated, infrequent legacy components. However, these observations did not completely cover all [commercial salvage] units so it is possible that these general observations are not completely accurate for all units.

**FWS Comment 18:** How many miles of ingress/egress with roadside hazard treatment [concentrated or scattered roadside hazard tree removal] occur in the project [proposed action]?

**KNF Response:** The project contains about 118 miles of ingress/egress roads with roadside hazard treatment that is split between the Happy Camp (about 90 miles) and Whites (about 28
miles) project areas. No ingress/egress roads were identified for the purposes of this project in the Beaver project area.

Note added by FWS after receipt of information supplemental to the BA: The maps that accompanied this email do indicate several ingress/egress roads in Beaver fire area and within the core of NSO site KL0283. These roads also show in the GIS spatial data that accompanied the BA. Map and GIS were assumed to be correct rather than the statement above.

FWS Comment 19: What is the general timing of each treatment?

**KNF Response:** Although we do not know the exact timing of implementation for each proposed treatment, there is a general timing and order of the treatments that can be roughly estimated. The timing of the proposed treatments will span about eight years. The first two years (2015 and 2016) will focus on the salvage harvest and roadside hazard [concentrated and scattered roadside hazard tree removal]. Fuels treatments (e.g. piling of fuels) [treatment of activity fuels] within the salvage harvest units will closely follow salvage harvest implementation, but the prescribed burning of the activity generated fuels in the salvage units may extend into 2020. The Fuel Management Zones (FMZ) and Wildland Urban Interface (WUI) are mostly maintenance of existing fuels treatments so the timing for most of these treatments will start after the first 3-7 years of implementation. The roadside fuels treatments [roadside complete and roadside modified] will likely start soon after the roadside hazard tree removal is completed and treatment will require 3-5 years (or more) to complete. The underburning treatment will be implemented in relatively small portions of the delineated treatment unit and are determined by the current fuel conditions, prescription, and burn plan so the resulting burn pattern could resemble a patchwork of underburns that spans multiple years (about 2018 to 2023).

Based on the description of areas where LOPs are applied, there are areas proposed for fuels treatment that don’t meet the criteria for an LOP (presented below). These fuels treatments occur outside of suitable [NRF] habitat and/or occur more than 0.25 miles from suitable [NRF] habitat; these treatments are mostly within the Beaver project area, but Happy Camp project area contains a few units. All fuels treatments in the Whites project area require LOPs [to July 9th unless 3 visits fail to detect NSO].

Many of the fuels treatment (portion or entire unit) units in the Beaver Project area do not have an LOP because the unit doesn’t contain suitable NSO habitat [NRF] or is greater than 0.25 miles from suitable [NRF] habitat. Twenty fuels treatment (portion or entire unit) units in the Happy Camp complex fire area do not have an LOP because the unit doesn’t contain [NRF] habitat or is greater than 0.25 miles from suitable [NRF] habitat.

FWS Comment 20: The table (“table 21”) referenced on page 75 of the BA doesn’t appear to be the correct table.
**KNF Response:** On page 75 of the BA, the discussion of effects references table 21 which is not the correct table number. The correct table is table 20. Table 20 displays the acres of habitat affected by the proposed treatment for each NSO site.

**FWS Comment 21:** Appendix C is missing some NSO sites

**KNF Response 21:** Appendix C - “Survey Information” (starting on page 134) is missing five NSO sites (0229, 0365, 0380, 0383, and 1164). AC 0383 [KL0383] was established in 2015 and Appendix C didn’t include 2015 data so the data presented here for 0383 is a placeholder. AC 0383 survey information can be found in table 9 on page 60 of the BA.

**Additions to Appendix C in the BA:**

<table>
<thead>
<tr>
<th>Site Name</th>
<th>Site #1</th>
<th>Basis</th>
<th>Last Year of Detection</th>
<th>Best Status for Site</th>
<th>Last Nest</th>
<th>Status in 2013/2014</th>
<th>Barred Owl Detected</th>
<th>NRIS Data</th>
<th>CNDDB Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sulphur Springs</td>
<td>0229</td>
<td>Pair</td>
<td>1982</td>
<td>Repro 1986</td>
<td>1986</td>
<td>Not Surveyed</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Eddy Gulch</td>
<td>0365</td>
<td>Pair</td>
<td>1998</td>
<td>Repro 2002</td>
<td>2002</td>
<td>No Response</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Copper Creek</td>
<td>0380</td>
<td>Pair</td>
<td>1998</td>
<td>Pair 2003</td>
<td>None</td>
<td>Not Surveyed</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Little Elk Creek</td>
<td>0383</td>
<td>New AC</td>
<td>2015</td>
<td>Pair 2015</td>
<td>2015</td>
<td>Not Surveyed</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Ladds Creek</td>
<td>1164</td>
<td>Single</td>
<td>2012</td>
<td>Single 2012</td>
<td>None</td>
<td>Not Surveyed</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>

1KNF KL not SIS state master owl number from CNDDB 2015.

**FWS Comment 22:** Table 17 and Table 20 appear to conflict for level of effects to NSO site KL 1040.

**KNF Response 22:** Table 17 (starting on page 85 of the BA) describes the effects and determination for individual NSO sites that did not receive an “intensity factor”. For NSO site 1040, table 17 (page 87) describes the correct estimated effects, but table 20 displays the incorrect acres for this NSO site. After further review of table 20, we found that NSO sites 1039, 1040, 1041, and 1046 are incorrect. There appears to be a copying error in table 20, but table 17 provides an accurate assessment.

**FWS Comment 23:** Table 16 displays an intensity factor “C” for NSO site 1046 [KL1046] that appears to be inconsistent with table 20.

**KNF Response 23:** Table 16, on page 83 of the BA, displays the intensity factor(s) for each NSO site based on the criteria described in table 15 (page 82). This also stems from the errors in table 20, as described above (in the response to comment 21). For NSO site 1046, table 20 displays 0 acres of habitat affected by the proposed activities which is inconsistent with the
criteria and is an error. After review of the effects, we discovered that table 20 displays the incorrect acres for NSO site 1046, but the acres used in the calculations to generate table 16 and the determinations were correct, and intensity factor “C” is correct as displayed in Table 16 in the BA.

FWS Comment 24: Table 16 doesn’t display NSO site 9991 [KL9991] with an intensity factor “F” despite the documented reproduction in Appendix C (starting on page 134).

KNF Response 24: NSO site 9991 does have known nesting activity as documented from the past years of surveys; these data were used in the determination process through the use of the “intensity factors”. Intensity factor “F”, as defined on table 15, is designed to identify NSO sites where treatment would result in downgrading or removal of suitable habitat in the nest stand (100 acre circle around all known nest location(s)) and does not reflect all activities that may occur in the nest stand [excludes degrade of NRF which may still remove undetected nest trees NSOs are using]. NSO site 9991 “nest stand” contains roadside hazard treatment [scattered roadside hazard tree removal (without roadside fuels) and site preparation and planting. Since most the trees in the roadside hazard that meet this probability of mortality level within suitable habitat are infrequent and only occur sporadically across the project, roadside hazard is not expected to result in a downgrade or removal of suitable habitat (described effects starting on page 65). Although site preparation and planting units may contain small pockets of suitable habitat, treatment will only occur in the plantation portion of the unit; the plantations proposed for treatment are not considered suitable habitat (described effects on page 79). Therefore, table 16 correctly displays the intensity factors for NSO site 9991; the proposed treatments that overlap the nest stand(s) of the NSO site will not downgrade or remove suitable habitat, therefore intensity factor F is not indicated.

FWS Comment 25: Table 16 doesn’t display NSO site 9995 [KL9995] with an intensity factor “F” despite the documented reproduction in Appendix C (starting on page 134).

KNF Response 25: NSO site 9995 contains a similar situation as described above for NSO site 9991, but there are some differences. NSO site 9995 is not displayed in table 16 (page 83) because the proposed treatments did not result in meeting the criteria for any of the possible intensity factors (page 82). No treatment would result in downgrading or removing suitable habitat in the “nest stand”. Roadside hazard (without fuels treatment) and site preparation and planting are not expected to result in a downgrade or removal of suitable habitat, therefore intensity factor F is not indicated and the effects determination for NSO site 9995 is correct as described in the BA (page 89).

FWS Comment 26: Table 17 describes possible helicopter disturbance as a contributing factor in the determination for KL1100. FWS only noted salvage units on the very far edges of the home range. Is this description of disturbance accurate?

KNF Response 26: Table 17 on page 87 describes the determination for each NSO site that did not receive an “intensity factor”. For NSO site 1100, the determination of a “likely to adversely affect” was based on several factors including helicopter noise disturbance. The salvage units
proposed for helicopter harvest occur in the outer portion of the home range on the upper slope position which would reduce the possibility of disturbing a nest.

The noise created by roadside hazard along ingress/egress roads and concentrated haul route are more likely to create noise that may disturb a nest. The amount of noise created along the possible concentrated haul routes within NSO site 1100 is unknown at this time because it will depend on which roads the purchaser selects as the haul route. There are two routes that are most likely to be used but each route has its challenges. If the haul route that runs through NSO site 1100 is used, then the noise disturbance resulting from truck travel will exceed the ambient noise level and the noise could last for several weeks. We estimated disturbance based on the route with the highest level of noise, in order to err on the side of caution.

FWS Comment 27: Table 20 appears to be displaying incorrect acres of affected habitat for NSO site 0381 based on the proposed activities.

KNF Response 27: The project proposes about 15 acres of roadside hazard with complete fuels treatment in the core area of NSO site 0381. Of these 15 acres, 5 acres of this treatment occurs in suitable habitat. Therefore, table 20 displays 5 acres of suitable habitat in the core area that is downgraded as a result of the proposed activities. Other treatments are proposed within the core and home range, but the roadside hazard with fuels treatment is the only treatment in the core area that is estimated to down grade suitable habitat.

FWS Comment 28: Table 7 and Table 14b are presenting different acres of habitat for the same area.

KNF Response 28: Table 7 on page 53 provides all the acres of each habitat type as defined in the methods section on page 26, but these acres do not account for any salvage harvest on private land. Table 7 is intended to simply present the acres of habitat affected by the fire and display the acres of habitat that experienced moderate and high fire severity as presented in the column called “change in habitat acres resulting from 2014 fires”. Table 14b on page 80 of the BA presents the acres of habitat within each habitat type in the analysis area, but this table shows fewer acres of habitat because the calculations were made based on the assumption that all private land in the Beaver fire perimeter will be salvage harvested and that just the portions of Whites and Happy Camp private land that experienced moderate and high fire severity will be salvage harvested. Therefore, the assumed salvage harvest of private land resulted in reduced acres of all habitat types in our analysis (comparing table 7 and table 14b). As acknowledged in the BA, this may be an over estimate of effects on private land salvage, particularly in the Happy Camp and Whites fire areas, but was assumed in the analysis in order to account for the potential loss of habitat.
Table 1.2 Revised wildlife project design features (PDFs) relevant to the analysis in this biological opinion. These revised PDFs replace PDFs in table 4 of the final BA (P.19).

<table>
<thead>
<tr>
<th>Wildlife PDF1</th>
<th>Description</th>
<th>Applicable Units</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

A survey strategy has been developed in coordination with FWS. Some treatments may occur before NSO surveys are complete, as described below. However, following the second year of protocol surveys and implementation, remaining treatment areas will be surveyed to protocol each year of implementation for the life of the project unless otherwise agreed upon with FWS. **Roadside fuels treatment, WUI, FMZ, prescribed burning, site preparation and planting, and roadside hazard tree removal within occupied core areas** will not be implemented between **February 1 to July 9** unless the suitable nesting/roosting or foraging habitat (NRF) within 0.25 miles of the treatment units has been surveyed to protocol and no owls have been detected. If surveys result in suspected or confirmed nesting, then implementation is restricted until September 15.

Salvage and roadside hazard tree removal along roads that are not ingress/egress access roads and are located **within occupied core areas** will not be implemented between **February 1 to July 9** or until the suitable NRF within 0.25 miles of treatment units has received at least 3 surveys prior to implementation and 3 additional surveys are done concurrently with implementation, for the 2016 survey season (each subsequent year will receive protocol surveys) and no owls have been detected. Treatment will not be implemented until after July 9 if an owl is detected during surveys 4, 5 and 6 (during 2016 surveys). If surveys result in suspected or confirmed nesting, then no implementation will occur until after September 15. If these salvage and roadside hazard removal treatments are not completed in 2016, survey protocol will be completed prior to implementation in subsequent years.

**Note added by FWS after receipt of information supplemental to the BA:** 56-1-1 and 56-2 do not exist in GIS spatial data provided along with the final BA. Based on the map provided (see Figure 1.2 below) as part of the “supplemental vto the BA” FWS concluded these refer to the two commercial salvage units attributed in the GIS as 56 (skyline harvest) and 056 (helicopter).

<table>
<thead>
<tr>
<th>Description</th>
<th>Applicable Units</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>All units <strong>EXCEPT</strong> the following: S005-9-1, 22, 23, 23-15, 23-16, 23-17, 23-18, 23-19, 23-30, 51, 52, 56-1-1, 56-2, 58, 059, 520, 523, 524, 525-1, and 525-2</td>
</tr>
</tbody>
</table>

**Wildlife PDF 1 Continued.**
The following activities **do not require surveys** prior to implementation (though surveys will be conducted throughout implementation) and do not have an LOP:

Roadside hazard treatments occurring along roads that are indicated as major ingress/egress access roads located *outside occupied core areas* (as determined by the most recent surveys).

If surveys result in a **positive** detection of NSO, then:

No treatment will occur within the occupied core area from February 1 to July 9; however, if nesting is confirmed or suspected, then no treatment would occur within the occupied core area until after September 15.

<table>
<thead>
<tr>
<th>Wildlife PDF2</th>
<th>Description</th>
<th>Applicable Units</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No more than 50 percent of the suitable nesting/roosting and foraging habitat within an occupied NSO core area and no more than 50 percent of the nesting/roosting and foraging suitable habitat within an occupied NSO home range will be underburned annually. Underburning will not occur within occupied core areas from February 1 to September 15.</td>
<td>All units where applicable</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Wildlife PDF7</th>
<th>Description</th>
<th>Applicable Units</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No roadside treatment between March 1 and June 15 to avoid disturbance of denning fisher.</td>
<td>Maintenance level1 roads only</td>
</tr>
</tbody>
</table>

**Note added by FWS after receipt of information supplemental to the BA provided by KNF:** Several places in the final BA refer the reader to appendix XI to view maps of where LOPs would and would not be applied for commercial salvage and roadside hazard tree removal units. However, there was no appendix XI included the final BA. The maps that were intended to comprise appendix XI were emailed to FWS August 18, 2015 and are displayed in the figures below (figures 1.1 to 1.4).
Legacy Components Retention for Late Successional Habitat

Retain all legacy component trees and snags in treatment units were feasible. These legacy components will be identified using physical characteristics.

Legacy trees or snag size will vary depending on site condition, but are usually disproportionately large diameter trees that are often remnants of the previous stand on a given site. They are old standing trees that have persisted on the landscape after man-made and/or natural disturbances. For example, large trees containing one or more of the following characteristics: split or broken tops, heavy decadent branching, large mistletoe brooms, otherwise damaged to the degree that a cavity may form such as basal fire or lightning scars, or other features that indicate decay or defect.

<table>
<thead>
<tr>
<th>Wildlife PDF12</th>
<th>Description</th>
<th>Applicable Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Snags or dying trees that contain cat faces, broken or forked tops, hollows or cavities, burned out cavities, or those that are otherwise damaged to the degree that a cavity may form will be favored for retention. Retain all large hardwood snags or live trees where practicable, particularly those with cavities, broken or split tops, or large broken branches.</td>
<td>All units where applicable</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Wildlife PDF13</th>
<th>Description</th>
<th>Applicable Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Retain pre-existing (existing prior to the wildfire) conifer and hardwood snags (greater than 14 inches in diameter at breast height) and pre-existing coarse woody debris in the salvage units. If any pre-existing snags must be felled for safety reasons, these will be left on landscape whole as coarse wood.</td>
<td>All units where applicable</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Wildlife PDF14</th>
<th>Description</th>
<th>Applicable Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Avoid placing cable corridors through retention patches or any actions that would potentially damage retention areas whenever possible.</td>
<td>All units where applicable</td>
<td></td>
</tr>
<tr>
<td>Wildlife PDF15</td>
<td>Applicable Units</td>
<td></td>
</tr>
<tr>
<td>---------------------------------------------------</td>
<td>-----------------------------------</td>
<td></td>
</tr>
<tr>
<td><strong>Description</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Leave cull trees (greater than or equal to 20 inches in diameter) in roadside units where possible. Leave as whole logs where practicable.</td>
<td>All units where applicable</td>
<td></td>
</tr>
<tr>
<td><strong>Wildlife PDF16</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Description</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Avoid all salvage harvest within delineated retention patches.</td>
<td>All units where applicable</td>
<td></td>
</tr>
<tr>
<td><strong>Wildlife PDF19</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Description</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trees without fire damage will not be removed from within roadside hazard tree units unless they are an immediate hazard</td>
<td>All Roadside Hazard Tree Removal units</td>
<td></td>
</tr>
</tbody>
</table>
Figure 1.1 Close up of legend for the Figures 1.2, 1.3, and 1.4 below.
Figure 1.2 ‘Westside Fire Recovery Project NSO LOPs for Salvage and I/E Roadside Hazard’ in the Happy Camp complex fire area. “I/E” in legend refers to units along ingress and egress roads. This map is part of the information supplemental to the BA’ received August 18th, 2015. 1See footnote below.

1 Eighteen NSO sites (associated with 16 NSO pairs) have Roadside Hazard Tree Removal units within 0.25 miles of NRF in the core (KL0241, KL0380, KL0383, KL1100, KL1109, KL1110, KL1122, KL1130, KL1213, KL1214 / KL9995, KL4133, KL9992, KL9996, KL9998, KLN3A / KLN3B, and KLN7B) based on BA (Table 12, p. 69). Based on the map above or the GIS spatial layers that accompanied the BA, two additional NSO sites also have roadside hazard tree removal units along ingress/egress within 0.25 miles of NRF in the core (KLN7A and KL0381).
Figure 1.3 ‘Westside Fire Recovery Project NSO LOPs for Salvage and I/E Roadside Hazard’ in the Whites fire area. “I/E” in the legend refers to Roadside Hazard Tree Removal units along ingress and egress roads. This map is part of the information supplemental to the BA’ received August 18th, 2015. \(^1\)See footnote below.

\(^1\)Nine NSO sites have Roadside Hazard Tree Removal units within 0.25 miles of NRF in the core (KL1027, KL1039, KL1040, KL1041, KL1046, KL1047B, KL1258, KL99912) based on BA (Table 12, p. 69).
Figure 1.4. ‘Westside Fire Recovery Project NSO LOPs for I/E Roadside Hazard’ in the Beaver fire area. This map is part of the information supplemental to the BA received August 18th, 2015. “I/E” refers to units along ingress and egress roads. There is no salvage occurring in this fire area. ¹See footnote below.

¹No NSO sites have roadside hazard tree removal prior to the completion of any NSO survey visits (ingress/egress). KL0283 has roadside hazard that is not along ingress/egress and will be subject to LOP restrictions.
Section II: Tables and figures referred to in the body of this biological opinion that are not part of ‘supplemental information to the BA’ (Section I above).

A. Tables cited first in Section 1: Description of the Proposed Action.

Table 1.3 Definitions of Northern Spotted Owl (NSO) site, core, and home range

| NSO site (“NSO site”) | Generally an area of concentrated activity by an NSO pair (male and female), occasionally a single territorial NSO, represented by a mapped location at the most biologically relevant point available that occurs within the "Core" defined below. In order of preference, the point will be a nest, daytime detection of a pair of NSOs, daytime detection of a single NSO, NSO roost tree found near nighttime NSO detections, nighttime detection of a pair of NSOs, nighttime detection of a single NSO, etc.) |
| NSO Core | Core, as the term is used in this document, refers to the area around the nest tree that receives disproportionate use (Bingham and Noon 1997). In the California Klamath Province, this is approximated by a circle with a 0.5 mile radius (~500 acre). Cores represent the areas that are defended by territorial NSOs and generally do not overlap the core areas of other pairs of NSO (Anthony and Wagner 1999, Dugger et al. 2005, Zabel et al. 2003, Bingham and Noon 1997). Research has indicated that the quantity and configuration of older forest within the core provides a valid inference into the likelihood of occupancy (Hunter et al 1995), survival, and reproduction of NSOs (Franklin et al 2000, Zabel et al 2003, Olson et al 2004, Dugger et al., 2005, Dugger et al 2011). Generally survival and reproduction of NSOs are supported when there is between 40 and 60 percent older forest (NRF) within the core (Dugger et al 2005), but local conditions and possibly pair experience, contribute to large variance in actual amounts of NRF for individual NSO or pair of NSOs. |
| NSO Home-range | Home range as defined an approximation of the median annual home range size used by NSOs. For the California Klamath Province, this is represented by a circle with a radius of 1.3 miles. The circle provides a coarse but useful analogue of the median home range for NSOs (Lehmkuhl and Raphael, 1993, Raphael et al 1996). Although it provides an imprecise estimate of actual home range shape and size, stand age/structure, patch size, and configuration of NRF habitat within the circle has been shown to influence the likelihood of occupancy. When less than 40 percent of the circle is in NRF habitat, the likelihood of NSO/s presence is lower, and survival and reproduction of NSO/s may be reduced (Thomas et al. 1990, Bart and Forsman 1992, Bart 1995, and Dugger et al. 2005). Therefore, the home range circle is a useful analytical scale for the purpose of quantifying habitat and the impact to NSO sites from proposed habitat modification. The home ranges of several NSO pairs may overlap. |

B. Tables cited first in section 3 (NSO Ecology and Resource Use), section 5 (Environmental Baseline), or section 6 (Direct and Indirect Effects of the Westside Project on Habitat and NSO).

Table 6.1: NSO sites by recovery action 10 value (RA 10 value).

<table>
<thead>
<tr>
<th>NSO site number</th>
<th>RA 10 value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0229</td>
</tr>
<tr>
<td>2</td>
<td>0239³</td>
</tr>
<tr>
<td>3</td>
<td>0241</td>
</tr>
<tr>
<td>4</td>
<td>0245</td>
</tr>
<tr>
<td>5</td>
<td>0247</td>
</tr>
<tr>
<td>6</td>
<td>0252</td>
</tr>
<tr>
<td>7</td>
<td>0254³</td>
</tr>
<tr>
<td>NSO site number</td>
<td>RA 10 value</td>
</tr>
<tr>
<td>----------------</td>
<td>-------------</td>
</tr>
<tr>
<td>8</td>
<td>0255</td>
</tr>
<tr>
<td>9</td>
<td>0257</td>
</tr>
<tr>
<td>10</td>
<td>0272</td>
</tr>
<tr>
<td>11</td>
<td>0277</td>
</tr>
<tr>
<td>12</td>
<td>0283^2</td>
</tr>
<tr>
<td>13</td>
<td>0284^3</td>
</tr>
<tr>
<td>14</td>
<td>0293</td>
</tr>
<tr>
<td>15</td>
<td>0315^3</td>
</tr>
<tr>
<td>16</td>
<td>0322</td>
</tr>
<tr>
<td>17/18</td>
<td>0346 / 4146^3</td>
</tr>
<tr>
<td>19</td>
<td>0365</td>
</tr>
<tr>
<td>20</td>
<td>0380</td>
</tr>
<tr>
<td>21</td>
<td>0381</td>
</tr>
<tr>
<td>22</td>
<td>0383</td>
</tr>
<tr>
<td>23</td>
<td>0499^3</td>
</tr>
<tr>
<td>24</td>
<td>0567</td>
</tr>
<tr>
<td>25</td>
<td>1027</td>
</tr>
<tr>
<td>26</td>
<td>1028</td>
</tr>
<tr>
<td>27</td>
<td>1029</td>
</tr>
<tr>
<td>28</td>
<td>1030B</td>
</tr>
<tr>
<td>29</td>
<td>1039</td>
</tr>
<tr>
<td>30</td>
<td>1040</td>
</tr>
<tr>
<td>31</td>
<td>1041</td>
</tr>
<tr>
<td>32</td>
<td>1046</td>
</tr>
<tr>
<td>33</td>
<td>1047B</td>
</tr>
<tr>
<td>34</td>
<td>1100</td>
</tr>
<tr>
<td>35</td>
<td>1101</td>
</tr>
<tr>
<td>36</td>
<td>1109</td>
</tr>
<tr>
<td>37</td>
<td>1110</td>
</tr>
<tr>
<td>38</td>
<td>1111</td>
</tr>
<tr>
<td>39</td>
<td>1112B</td>
</tr>
<tr>
<td>40</td>
<td>1116</td>
</tr>
<tr>
<td>41</td>
<td>1117</td>
</tr>
<tr>
<td>42</td>
<td>1119</td>
</tr>
<tr>
<td>43</td>
<td>1121</td>
</tr>
<tr>
<td>44</td>
<td>1122</td>
</tr>
<tr>
<td>45</td>
<td>1130</td>
</tr>
<tr>
<td>46</td>
<td>1164</td>
</tr>
<tr>
<td>47</td>
<td>1202</td>
</tr>
<tr>
<td>48/49</td>
<td>1212 / 9991</td>
</tr>
<tr>
<td>50</td>
<td>1213</td>
</tr>
<tr>
<td>51/52</td>
<td>1214 / 9995</td>
</tr>
<tr>
<td>53</td>
<td>1258</td>
</tr>
<tr>
<td>54</td>
<td>1265</td>
</tr>
<tr>
<td>55</td>
<td>1266</td>
</tr>
<tr>
<td>56</td>
<td>2124</td>
</tr>
<tr>
<td>57</td>
<td>4026</td>
</tr>
<tr>
<td>NSO site number</td>
<td>RA 10 value¹</td>
</tr>
<tr>
<td>-----------------</td>
<td>--------------</td>
</tr>
<tr>
<td>58</td>
<td>4099 High</td>
</tr>
<tr>
<td>59</td>
<td>41283 Moderate</td>
</tr>
<tr>
<td>60</td>
<td>41293 Low</td>
</tr>
<tr>
<td>61</td>
<td>4133 Moderate</td>
</tr>
<tr>
<td>62</td>
<td>41433 Moderate</td>
</tr>
<tr>
<td>63</td>
<td>41443 Low</td>
</tr>
<tr>
<td>64</td>
<td>41453 Low</td>
</tr>
<tr>
<td>65</td>
<td>9990 Low</td>
</tr>
<tr>
<td>66</td>
<td>9992 High</td>
</tr>
<tr>
<td>67</td>
<td>9993 Low</td>
</tr>
<tr>
<td>68</td>
<td>9994 Moderate</td>
</tr>
<tr>
<td>69</td>
<td>9996 Moderate</td>
</tr>
<tr>
<td>70</td>
<td>9998 High</td>
</tr>
<tr>
<td>71</td>
<td>9999 Moderate</td>
</tr>
<tr>
<td>72</td>
<td>99910 High</td>
</tr>
<tr>
<td>73</td>
<td>99912 High</td>
</tr>
<tr>
<td>74</td>
<td>999132 Moderate</td>
</tr>
<tr>
<td>75</td>
<td>999143 Low</td>
</tr>
<tr>
<td>76</td>
<td>999153 Moderate</td>
</tr>
<tr>
<td>77</td>
<td>0096A High</td>
</tr>
<tr>
<td>78</td>
<td>0276A Moderate</td>
</tr>
<tr>
<td>79</td>
<td>0276B Moderate</td>
</tr>
<tr>
<td>80</td>
<td>0278A High</td>
</tr>
<tr>
<td>81</td>
<td>0278B Moderate</td>
</tr>
<tr>
<td>82/83</td>
<td>New3A/New3B Moderate</td>
</tr>
<tr>
<td>84</td>
<td>New7A Moderate</td>
</tr>
<tr>
<td>85</td>
<td>New7B Moderate</td>
</tr>
</tbody>
</table>

¹ NSO sites were ranked as follows:

**High RA10** – The NSO site is relatively intact post fire with no shift or home range expansion of the NSO site anticipated. These NSO sites are reasonably likely to be occupied by resident NSO pairs and are expected to provide short-and long-term demographic support to the NSO population in the action area.

**Moderate RA10** - These NSO sites were subjected to fire that reduced the quality, availability and, or, distribution of NRF habitat such that a shift of the NSO core or home range expansion could occur. We assume that these sites are reasonably likely to be occupied by a pair of resident NSO and would continue to provide short-and long-term demographic support to the NSO population in the action area.

**Low RA10** – The “reasonable likelihood” of occupancy for some of the sites identified as “low” may be difficult to determine. Based on the available information, for some NSO sites, we can conclude a site is unlikely to support occupancy of NSOs at the historical NSO site during the proposed action due to insufficient amounts of NRF habitat. In those cases NRF habitat has been reduced from past actions, the amount, extent and severity of the 2014 fires, or a combination of fire and recent salvage harvest of NRF, FANR, and PFF on private land. Due to limited amounts of NRF habitat these NSO sites are not likely to provide demographic support to the NSO population in the action area. In a few instances, adverse effects determinations were made if there was insufficient information to conclude that impacts were insignificant or discountable, or if there was more uncertainty whether “low” sites could be occupied in the short term (e.g. the NSO site had 2015 detection/s of NSO/s).

² For these NSO sites, FWS review of completed private timber harvest indicated slightly more NRF habitat was available than baseline presented in table 20 of the BA and an adjustment from Low to Moderate RA 10 value (BA table 10a) was determined to be appropriate.

³ FWS review of completed and planned private timber harvest indicated these NSO sites may have slightly more NRF habitat than presented in table 20 of the BA; however, FWS review of this additional habitat did not indicate there was enough to change the RA 10 value due to the majority of proposed private lands salvage already completed as of Dec 31, 2015.
Table 6.2: NSO Sites within the action area with 2015 detections and subsequent changes KNF applied to the proposed action because of the NSO detections.

Note: This table is slightly modified from a table provided in the BA (table 9, p. 60-61), called “Summary of active NSO activity centers within the analysis area and the subsequent measures applied during project development.”

<table>
<thead>
<tr>
<th>NSO Site</th>
<th>Status in 2015 (nest, pair, or single)</th>
<th>Best Status</th>
<th>Units dropped in this project alternative as a result of new survey information</th>
<th>Units retained in core but assigned September 15 LOP(^2,4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>KL0283</td>
<td>Single</td>
<td>Nest 2002, Pair 2010</td>
<td>SPP96-1/SPP97-1 and multiple salvage units were dropped in the core early in project as a result of RA 10 value.</td>
<td>none</td>
</tr>
<tr>
<td>KL0278B</td>
<td>Single</td>
<td>Nest 1992</td>
<td>No salvage units were proposed in the core.</td>
<td>none</td>
</tr>
<tr>
<td>KL0381</td>
<td>Single</td>
<td>Nest 2011</td>
<td>SPP220, SPP278, and SPP354 dropped.</td>
<td>none</td>
</tr>
<tr>
<td>KL0383</td>
<td>Pair</td>
<td>N/A</td>
<td>S242 and S243-2; S243 –Retention patches incorporate portions of the unit that occur in the core.</td>
<td>none</td>
</tr>
<tr>
<td>KL1030B</td>
<td>Nest</td>
<td>N/A</td>
<td>No salvage units were proposed in the core.</td>
<td>none</td>
</tr>
<tr>
<td>KL1041</td>
<td>Pair</td>
<td>Nest 2013</td>
<td>SPP031-1 and multiple salvage units were dropped in the core early in project as a result of RA 10 value.</td>
<td>none</td>
</tr>
<tr>
<td>KL1047B</td>
<td>Nest</td>
<td>N/A</td>
<td>S426 dropped.</td>
<td>roadside fuels (roadside modified treatment)</td>
</tr>
<tr>
<td>KL1109</td>
<td>Single</td>
<td>Pair 1997</td>
<td>SPP051-1 and multiple salvage units were dropped in the core early in project as a result of RA 10 value.</td>
<td>none</td>
</tr>
<tr>
<td>KL1110</td>
<td>Pair</td>
<td>Nest 1988, Pair 1991</td>
<td>Salvage units were dropped in the core early in project as a result of RA 10 value.</td>
<td>none</td>
</tr>
<tr>
<td>KL1112B</td>
<td>Pair</td>
<td>Nest 1988</td>
<td>SPP003-2 dropped.</td>
<td>none</td>
</tr>
<tr>
<td>KL1130</td>
<td>Pair</td>
<td>Nest 2012</td>
<td>S005, S005-8, and S23-34 and multiple salvage units were dropped in the core early in project as a result of RA 10 value.</td>
<td>none</td>
</tr>
<tr>
<td>KL1212 / KL9991</td>
<td>Single</td>
<td>Nest 2014</td>
<td>SPP352, SPP351 and multiple salvage units were dropped in the core early in project as a result of RA 10 value.</td>
<td>none</td>
</tr>
<tr>
<td>KL9996</td>
<td>Single</td>
<td>N/A</td>
<td>S240 dropped.</td>
<td>none</td>
</tr>
<tr>
<td>KL9998</td>
<td>Pair</td>
<td>N/A</td>
<td>No salvage units were proposed in the core.</td>
<td>none</td>
</tr>
</tbody>
</table>

\(^1\) This table was modified slightly from table 9 in the BA (page 60-63) by retitling the second column ‘Status in 2015’ and the addition of the third column. The information in the 3\(^{rd}\) column “best status” is based on information provided in Appendix C of the BA, NRIS data provided in GIS spatial format by KNF to FWS, or information contained in California Natural Diversity Database (CNDDB) December 2015 monthly download of NSO data.

\(^2\) “S” before a number indicates salvage while “SPP” indicates a site preparation and plant unit.

\(^3\) KNF’s initial analysis assumed only moderate to severely burned NRF would be removed on private land, but later field review noted low severity burned NRF was removed. As a result, KNF adjusted RA 10 value from moderate to low.

\(^4\)This column only indicates if salvage units were retained in core and whether a breeding season (LOP) restriction was applied. The landings, major haul routes, and helicopter flight paths associated with the twenty-one units where no LOP will be applied impact additional NSO sites. Please see section 6.3.2 (Effects to Individual NSO Sites) in the BO.
Table 6.3 Abbreviated definitions of intensity factors which may cause adverse effects to NSO. The same table, titled table 16, is displayed in the BA (page 83).

<table>
<thead>
<tr>
<th>Intensity Factor</th>
<th>Rationale for LAA$^1$ effects determination in BA</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Treatment will result in the core and home range falling below 20% of NRF$^2$ and FANR$^3$.</td>
</tr>
<tr>
<td>B</td>
<td>Treatment will result in the core and home range falling below 40% of NRF and FANR.</td>
</tr>
<tr>
<td>C</td>
<td>For core and home range with 20% – 40% NRF and FANR, treatment will result in a downgrade or removal of NRF and FANR.</td>
</tr>
<tr>
<td>D</td>
<td>Treatment will result in &gt;25% of the existing NRF, FANR, and PFF$^4$ combined in the core and home range to receive treatment that will degrade NRF or remove FANR or PFF.</td>
</tr>
<tr>
<td>E</td>
<td>Treatment will result in cores with &gt;220 acres of NRF falling below 220 acres of NRF.</td>
</tr>
<tr>
<td>F</td>
<td>Treatment will downgrade or remove habitat in the nest stand.</td>
</tr>
</tbody>
</table>

$^1$LAA = Likely to adversely affect  
$^2$NRF = nesting, roosting, and foraging habitat  
$^3$FANR = fire affected nesting and roosting habitat  
$^4$PFF = post-fire foraging habitat
Table 6.4. Baseline habitat levels in the core and home range of each NSO site and the effects to all habitat types except dispersal and PFF 2 by NSO site. All treatment types were analyzed together in the BA. All numbers are in acres.

<table>
<thead>
<tr>
<th>NSO Site</th>
<th>Pre-implementation habitat in core</th>
<th>Pre-implementation habitat in home range</th>
<th>Removed in core&lt;sup&gt;2&lt;/sup&gt;</th>
<th>Removed in home range&lt;sup&gt;2&lt;/sup&gt;</th>
<th>Downgraded in core</th>
<th>Downgraded in home range</th>
<th>Post-implementation habitat in core</th>
<th>Post-implementation habitat in home range</th>
</tr>
</thead>
<tbody>
<tr>
<td>229</td>
<td>181 0 0 714 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 181 0 0 714 0 0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>239&lt;sup&gt;3&lt;/sup&gt;</td>
<td>138 0 0 347 0 0 0 0 0 0 0 3 4 0 0 0 3 136 0 0 342 0 0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>241&lt;sup&gt;2&lt;/sup&gt;</td>
<td>270 3 64 1001 21 137 0 1 16 4 5 80 42 65 13 62 59 136 277 2 48 932 15 57</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>245</td>
<td>48 0 0 679 6 13 0 0 0 0 0 0 0 0 0 0 0 0 0 0 48 0 0 679 6 13</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>247&lt;sup&gt;2&lt;/sup&gt;</td>
<td>299 0 0 678 0 40 0 0 0 0 0 0 0 0 0 0 0 0 0 0 11 299 0 0 678 0 40</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>252</td>
<td>67 0 0 347 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 67 0 0 347 0 0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>254&lt;sup&gt;3&lt;/sup&gt;</td>
<td>214 0 0 166 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 214 0 0 153 0 0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>255&lt;sup&gt;2&lt;/sup&gt;</td>
<td>110 0 0 861 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 110 0 0 861 0 0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>257</td>
<td>445 0 0 1407 0 57 0 0 0 0 0 10 0 31 0 0 43 0 0 445 0 0 1376 0 47</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>272&lt;sup&gt;2&lt;/sup&gt;</td>
<td>202 2 159 1176 81 535 0 0 0 2 0 36 0 0 0 0 0 0 0 0 0 202 32 159 1173 81 499</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>277</td>
<td>261 0 0 857 0 0 0 0 0 0 0 0 24 0 14 0 0 0 0 261 0 0 833 0 0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>283&lt;sup&gt;3&lt;/sup&gt;</td>
<td>143 3 109 199 6 80 0 0 0 13 0 4 28 0 53 0 0 49 42 143 3 96 147 2 52</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>284&lt;sup&gt;3&lt;/sup&gt;</td>
<td>76 0 0 785 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 76 0 0 785 0 0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>293&lt;sup&gt;2&lt;/sup&gt;</td>
<td>138 0 0 983 0 5 0 0 0 0 0 0 0 0 0 0 0 0 0 0 138 0 0 957 0 5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>315&lt;sup&gt;3&lt;/sup&gt;</td>
<td>327 0 1477 0 3 0 0 0 0 0 0 0 0 3 0 3 0 0 0 0 327 0 0 1475 0 0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>322&lt;sup&gt;3&lt;/sup&gt;</td>
<td>0 0 1190 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 356 0 0 1189 0 0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>346&lt;sup&gt;3&lt;/sup&gt;</td>
<td>73 4 54 33 2 30 0 0 1 0 1 7 0 4 0 0 17 11 73 4 53 29 1 23</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>365</td>
<td>151 0 0 1145 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 151 0 0 1,140 0 0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>380</td>
<td>306 3 38 826 21 47 0 0 0 0 0 0 0 65 0 11 1 5 306 3 38 760 21 47</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>381&lt;sup&gt;2&lt;/sup&gt;</td>
<td>175 4 11 820 4 45 0 0 1 0 0 2 5 9 25 43 6 6 169 4 9 811 4 43</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>383&lt;sup&gt;2&lt;/sup&gt;, 5</td>
<td>193 9 29 863 19 126 0 0 0 2 4 35 21 54 0 8 0 13 172 9 29 807 15 91</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>499&lt;sup&gt;3&lt;/sup&gt;</td>
<td>340 0 0 1179 0 0 0 0 0 0 0 0 0 1 0 0 0 0 340 0 0 1,178 0 0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NSO Site</td>
<td>Pre-implementation habitat in core</td>
<td>Pre-implementation habitat in home range</td>
<td>Removed in core</td>
<td>Removed in home range</td>
<td>Downgraded in core</td>
<td>Downgraded in home range</td>
<td>Post-implementation habitat in core</td>
<td>Post-implementation habitat in home range</td>
</tr>
<tr>
<td>----------</td>
<td>----------------------------------</td>
<td>--------------------------------------</td>
<td>----------------</td>
<td>----------------------</td>
<td>-------------------</td>
<td>--------------------------</td>
<td>----------------------------------</td>
<td>-----------------------------------</td>
</tr>
<tr>
<td>567</td>
<td>241 0 0 735 0 0 0 0 0 0 0 2 0 0 0 0 0 241 0 0 733 0 0</td>
<td>117 2 6 1300 33 173 0 2 1 7 55 0 41 15 89 102 874 117 2 5 1,259 27 118</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1027</td>
<td>247 0 0 1269 0 1 0 0 0 0 0 1 0 22 0 3 0 17 247 0 0 1,247 0 0</td>
<td>286 3 36 1649 21 280 0 1 6 0 0 13 0 49 0 5 94 583 286 2 30 1,600 21 267</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1030B 2,4</td>
<td>385 3 18 1003 26 361 0 0 0 0 0 0 1 0 17 0 0 15 293 385 3 18 986 25 347</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10392,6</td>
<td>243 19 66 1481 44 226</td>
<td>Footnote 2 pertains to baseline habitat to left. See footnote 6 below about quantitative treatment effects and post-implementation habitat estimates.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10402,6</td>
<td>278 3 30 1096 7 243</td>
<td>Footnote 2 pertains to baseline habitat to left. See footnote 6 below about quantitative treatment effects and post-implementation habitat estimates.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10412,6</td>
<td>229 8 36 924 18 200</td>
<td>Footnote 2 pertains to baseline habitat to left. See footnote 6 below about quantitative treatment effects and post-implementation habitat estimates.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10462,4,6</td>
<td>181 0 0 714 0 0</td>
<td>Footnote 2 pertains to baseline habitat to left. See footnote 6 below about quantitative treatment effects and post-implementation habitat estimates.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10472,4,6</td>
<td>331 0 0 1,123 7 49 0 0 0 0 0 0 0 0 0 85 153 182 258 331 0 0 1,123 6 48</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1100</td>
<td>199 3 23 634 3 88 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 93 199 3 23 634 1 60</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1101</td>
<td>458 6 8 2,118 25 245 0 0 0 0 2 0 39 0 0 0 0 0 27 458 6 8 2,116 25 206</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1109</td>
<td>282 0 2 898 2 82 0 0 0 0 0 0 0 1 43 0 20 0 0 46 116 282 0 2 878 1 40</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1110</td>
<td>200 0 14 664 4 26 0 0 0 0 4 0 0 2 0 14 0 0 0 29 76 200 0 10 650 4 25</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1111</td>
<td>29 0 9 368 5 25 0 0 0 0 0 0 3 5 15 21 0 29 29 0 9 353 4 22</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1112B 4</td>
<td>189 0 2 698 41 274 0 0 0 0 1 11 105 0 27 0 0 15 68 189 1 5 670 30 169</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1164</td>
<td>283 0 0 1,309 0 0 0 0 0 0 0 0 0 0 1 0 0 0 0 283 0 0 1,308 0 0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1202</td>
<td>14 1 23 639 8 210 0 0 0 20 4 2 69 0 16 0 0 6 62 13 1 3 619 7 141</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12122</td>
<td>197 0 9 1059 0 102 0 0 0 0 0 0 20 0 4 0 9 5 128 197 0 9 1055 0 82</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1213</td>
<td>233 0 4 816 10 210 0 0 0 0 0 0 14 12 35 35 54 13 56 221 0 4 781 10 196</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1214</td>
<td>271 0 12 1019 0 80 0 0 0 0 1 1 0 39 0 5 6 52 82 169 271 0 11 1013 0 41</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1258</td>
<td>211 17 100 1045 66 263 0 2 11 2 10 46 0 44 0 15 5 146 211 16 89 998 56 216</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NSO Site</td>
<td>Pre-implementation habitat in core</td>
<td>Pre-implementation habitat in home range</td>
<td>Removed in core</td>
<td>Removed in home range</td>
<td>Downgraded in core</td>
<td>Downgraded in home range</td>
<td>Post-implementation habitat in core</td>
<td>Post-implementation habitat in home range</td>
</tr>
<tr>
<td>----------</td>
<td>----------------------------------</td>
<td>----------------------------------------</td>
<td>----------------</td>
<td>----------------------</td>
<td>-------------------</td>
<td>------------------------</td>
<td>----------------------------------</td>
<td>---------------------------------</td>
</tr>
<tr>
<td>1265</td>
<td>50 12 115 1025 87 502</td>
<td>2 6 75 3 12 174</td>
<td>0 31 0</td>
<td>0 12 40</td>
<td>48 5 39</td>
<td>991 75 328</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1266</td>
<td>243 35 105 729 10 496 9</td>
<td>0 0 14 0 42 260</td>
<td>0 30 0</td>
<td>3 0 43</td>
<td>243 35 105</td>
<td>685 67 236</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2124</td>
<td>113 0 0 735 0 0</td>
<td>0 0 0 0 0 0 0</td>
<td>0 14 0</td>
<td>0 0 0</td>
<td>113 0 0</td>
<td>721 0 0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4026</td>
<td>150 0 0 1294 0 0</td>
<td>0 0 0 0 0 0 0</td>
<td>0 3 0</td>
<td>0 0 13</td>
<td>150 0 0</td>
<td>1291 0 0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4099</td>
<td>283 0 37 842 12 279</td>
<td>0 0 1 3 2 54</td>
<td>0 7 0</td>
<td>0 50 69</td>
<td>283 0 36</td>
<td>832 11 225</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4129</td>
<td>205 0 0 536 0 0</td>
<td>0 0 0 0 0 0 0</td>
<td>0 0 0</td>
<td>0 0 0</td>
<td>205 0 0</td>
<td>536 0 0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4129</td>
<td>69 0 0 380 0 0</td>
<td>0 0 0 0 0 0 0</td>
<td>0 3 0</td>
<td>0 0 3</td>
<td>69 0 0</td>
<td>377 0 0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4133</td>
<td>24 12 53 563 81 263</td>
<td>1 5 30 3 28 152</td>
<td>4 32 0</td>
<td>48 1 0</td>
<td>20 7 23</td>
<td>528 52 110</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4143</td>
<td>121 3 19 588 4 16</td>
<td>0 1 12 0 0 6</td>
<td>2 23 0</td>
<td>0 24 56</td>
<td>101 2 7</td>
<td>565 3 9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4144</td>
<td>74 0 1 173 6 21</td>
<td>0 0 0 0 0 1</td>
<td>0 17 0</td>
<td>0 0 0</td>
<td>74 0 1</td>
<td>156 6 20</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4145</td>
<td>102 11 51 184 4 15</td>
<td>0 1 7 0 1 2</td>
<td>6 15 10</td>
<td>21 0 1</td>
<td>96 10 44</td>
<td>168 3 12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4146</td>
<td>33 2 22 182 4 118</td>
<td>0 1 3 0 0 18</td>
<td>0 15 0</td>
<td>0 9 39</td>
<td>33 1 18</td>
<td>167 4 101</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9990</td>
<td>151 0 80 415 2 208</td>
<td>0 0 19 1 0 78</td>
<td>0 3 0</td>
<td>0 37 45</td>
<td>151 0 60</td>
<td>411 2 130</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9991</td>
<td>239 0 77 1110 6 77</td>
<td>0 0 12 0 0 12</td>
<td>0 20 0</td>
<td>79 59 86</td>
<td>239 0 65</td>
<td>1090 5 64</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9992</td>
<td>240 0 5 539 1 11</td>
<td>0 0 2 0 1 4</td>
<td>69 121 0</td>
<td>20 140 123</td>
<td>171 0 3</td>
<td>418 0 7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9993</td>
<td>169 0 0 431 1 3</td>
<td>0 0 0 0 0 0</td>
<td>0 23 0</td>
<td>0 0 0</td>
<td>169 0 0</td>
<td>407 1 3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9994</td>
<td>174 1 6 504 5 27</td>
<td>0 0 0 0 0 0</td>
<td>0 10 19</td>
<td>0 0 0</td>
<td>164 1 6</td>
<td>485 5 27</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9995</td>
<td>196 0 42 1225 1 82</td>
<td>0 0 15 1 0 21</td>
<td>0 7 0</td>
<td>47 56 207</td>
<td>196 0 27</td>
<td>1217 1 61</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9996</td>
<td>160 0 4 795 1 64</td>
<td>0 0 1 1 1 31</td>
<td>0 78 12</td>
<td>11 19 94</td>
<td>160 0 3</td>
<td>716 0 33</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9998</td>
<td>269 8 27 737 12 101</td>
<td>0 0 0 0 1 20</td>
<td>0 5 15</td>
<td>54 135 0 36</td>
<td>264 8 27</td>
<td>722 12 82</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9999</td>
<td>100 31 76 1169 43 363</td>
<td>0 0 0 0 0 1</td>
<td>0 0 0</td>
<td>0 0 6</td>
<td>100 31 76</td>
<td>1169 43 362</td>
<td></td>
<td></td>
</tr>
<tr>
<td>99910</td>
<td>328 0 68 1337 6 113</td>
<td>0 0 0 0 0 0</td>
<td>0 1 0</td>
<td>23 0 49</td>
<td>328 0 68</td>
<td>1314 6 112</td>
<td></td>
<td></td>
</tr>
<tr>
<td>99912</td>
<td>278 5 53 1562 10 110</td>
<td>0 1 15 2 5 62</td>
<td>5 89 47</td>
<td>48 227 740</td>
<td>274 4 38</td>
<td>1471 5 48</td>
<td></td>
<td></td>
</tr>
<tr>
<td>99913</td>
<td>33 1 4 377 2 39</td>
<td>0 0 2 0 1 10</td>
<td>0 54 0</td>
<td>0 5 36</td>
<td>33 0 3</td>
<td>323 1 29</td>
<td></td>
<td></td>
</tr>
<tr>
<td>99914</td>
<td>17 1 4 242 7 23</td>
<td>0 0 0 0 0 1</td>
<td>0 25 0</td>
<td>0 0 1</td>
<td>17 1 4</td>
<td>217 7 22</td>
<td></td>
<td></td>
</tr>
<tr>
<td>99915</td>
<td>119 0 0 664 1 11</td>
<td>0 0 0 0 0 0</td>
<td>0 7 0</td>
<td>0 0 9</td>
<td>119 0 0</td>
<td>659 1 4</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Please see all footnotes on the following page.
1 FANR or “fire-affected nesting/roosting” is pre-fire NRF habitat burned at moderate severity. PFF1 or “post-fire foraging” is pre-fire F habitat burned at moderate and high severity and NR habitat that burned at high severity that is located within 500 feet of post-fire NRF. See BA (pp. 25-32) for more details.

2 KNF BA indicates assumption was made that private land that burned at moderate and high severity may be harvested in the Whites and Happy Camp fire areas, and these areas were removed from the existing acres of PFF and FANR. This affected about 150 acres scattered across the cores and home ranges of 17 NSO sites (KL 0241, KL0247, KL0272, KL0293, KL0381, KL0383, KL1030, KL1039, KL1040, KL1041, KL1046, KL1047B, KL1212, KL4133, KL9992, KL9995, and KL99912).

3 Most of the private land that occurs in the Beaver Fire area is owned by commercial timber companies and is currently being harvested. KNF estimates used to create table above assumed that all the FANR and PFF on private land will be removed and all NRFD on private land has been reduced in quality to the point that this NRFD will not likely function as habitat. Based on this assumption and acres provided in table 20 of BA, the table above me have underestimate of pre-implementation habitat (columns 2-7 above) for 16 NSO sites: KL0239, KL0254, KL283, KL0284, KL0315, KL0346, KL0499, KL4128, KL4129, KL4143, KL4144, KL4145, KL4146, KL99913. Two other Beaver fire area NSO sites: KL0322 and KL2124 have correct habitat (see BA page 91).

4 NSO surveys in 2015 have detected a pair in close proximity (overlapping cores) to a known NSO site. Although this pair may or may now be from the adjacent NSO site, it is represented here as a possible “shift” and will be analyzed in its “shifted” location. Pertains to two sites: (KL1112B, 1030B, and 1047B)

5 BA indicated only one entirely new NSO site from 2015 NSO surveys (KL0383).

6 KNF indicated in August 2015 acres of treatment that affect NSO habitat provided in the final BA were incorrect for at least four NSO sites: KL1039, KL1040, KL1041, and KL1046. They indicated that FWS should instead rely on information in table 16 (intensity factors). Additionally, FWS reviewed the GIS spatial layers that accompanied the BA for each of these four NSO sites to qualitatively assess treatments in their cores and home ranges. See Section 6.3.2 of this document for an understanding of treatment effects to the NSO sites. Since FWS analysis was qualitative, there are no updated acres for post-implementation habitat in the core and home range for these NSO sites.

7 BA had this footnote on table 20 (pp. 94-96), which this table was based on with slight modifications, so we felt it was important to include here, “Although salvage harvest is not planned to occur within NRF and dispersal habitat, a combination of implementation and natural effects may degrade NRF habitat features to the point where the habitat may not retain its’ function. To account for these potential effects, 10 percent of the NRF and dispersal habitat occurring in the commercial salvage (outside of riparian reserves) is reported here as a loss of habitat but this is likely an overestimate.” Commercial salvage and associated landings account for all NRF and D removed.
Table 6.5. Summary of 57 NSO sites for which FWS has determined the proposed action is likely to adversely affect NSOs. Take of 37 pairs of NSOs associated with 40 NSO sites is reasonably certain to occur.

Note: There are three pair of NSOs that use alternate nest stands up to a mile apart in the same drainage. For 17 other NSO sites adverse effects will occur, but take is not reasonably certain to occur. See Section 6.3.2 for further discussion.

<table>
<thead>
<tr>
<th>NSO Site Number and Name</th>
<th>Fire Area</th>
<th>Intensity Factor(s)</th>
<th>Take of resident NSO pair</th>
<th>Take of young NSO</th>
</tr>
</thead>
<tbody>
<tr>
<td>0283 West Fork Doggett Creek</td>
<td>Beaver</td>
<td>C</td>
<td>YES</td>
<td>NO</td>
</tr>
<tr>
<td>4143 Fishtrap Creek</td>
<td>Beaver</td>
<td>C</td>
<td>YES</td>
<td>NO</td>
</tr>
<tr>
<td>0499 Dead Cow Creek</td>
<td>Beaver</td>
<td>N/A</td>
<td>NO</td>
<td>NO</td>
</tr>
<tr>
<td>0346 / 4146 Kohl Creek 1 and 2</td>
<td>Beaver</td>
<td>C</td>
<td>NO</td>
<td>NO</td>
</tr>
<tr>
<td>4145 East Doggett Creek</td>
<td>Beaver</td>
<td>C</td>
<td>NO</td>
<td>NO</td>
</tr>
<tr>
<td>99913 Deer Camp Meadows</td>
<td>Beaver</td>
<td>C</td>
<td>YES</td>
<td>NO</td>
</tr>
<tr>
<td>99914 Buckhorn</td>
<td>Beaver</td>
<td>C</td>
<td>NO</td>
<td>NO</td>
</tr>
<tr>
<td>99915 Lumgrey Creek</td>
<td>Beaver</td>
<td>C</td>
<td>YES</td>
<td>NO</td>
</tr>
<tr>
<td>0241 Grider Campground</td>
<td>HCC</td>
<td>C</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>0272 Tom Martin</td>
<td>HCC</td>
<td>N/A</td>
<td>NO</td>
<td>NO</td>
</tr>
<tr>
<td>0276A Malone Creek 1</td>
<td>HCC</td>
<td>C</td>
<td>YES</td>
<td>NO</td>
</tr>
<tr>
<td>0276B Malone Creek 2</td>
<td>HCC</td>
<td>C</td>
<td>YES</td>
<td>NO</td>
</tr>
<tr>
<td>0277 Bishop Creek / Titus Peak</td>
<td>HCC</td>
<td>C</td>
<td>NO</td>
<td>NO</td>
</tr>
<tr>
<td>0278A Doolittle – Elk 1</td>
<td>HCC</td>
<td>N/A</td>
<td>NO</td>
<td>NO</td>
</tr>
<tr>
<td>0278B Doolittle – Elk 2</td>
<td>HCC</td>
<td>N/A</td>
<td>NO</td>
<td>NO</td>
</tr>
<tr>
<td>0293 Stanza Creek</td>
<td>HCC</td>
<td>C</td>
<td>NO</td>
<td>NO</td>
</tr>
<tr>
<td>0380 Copper Creek</td>
<td>HCC</td>
<td>C</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>0381 Cougar Creek</td>
<td>HCC</td>
<td>C</td>
<td>YES</td>
<td>NO</td>
</tr>
<tr>
<td>0383 Little Elk Creek</td>
<td>HCC</td>
<td>C</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>1100 Lower West Fork Tomkins Creek</td>
<td>HCC</td>
<td>N/A</td>
<td>NO</td>
<td>NO</td>
</tr>
<tr>
<td>1109 West Fork Tomkins Creek</td>
<td>HCC</td>
<td>C</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>1110 Tomkins Creek</td>
<td>HCC</td>
<td>N/A</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>1112B Walker Creek</td>
<td>HCC</td>
<td>C</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>1116 Fish Creek – Upper Grider</td>
<td>HCC</td>
<td>N/A</td>
<td>NO</td>
<td>NO</td>
</tr>
<tr>
<td>1121 Bark Shanty Creek</td>
<td>HCC</td>
<td>C</td>
<td>NO</td>
<td>NO</td>
</tr>
<tr>
<td>1122 Limestone Bluffs</td>
<td>HCC</td>
<td>C</td>
<td>NO</td>
<td>NO</td>
</tr>
<tr>
<td>1130 O’Neil Creek</td>
<td>HCC</td>
<td>C</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>1202 Tyler Meadows</td>
<td>HCC</td>
<td>C</td>
<td>NO</td>
<td>NO</td>
</tr>
<tr>
<td>1212/9991 Horse Creek / Happy Horse</td>
<td>HCC</td>
<td>B, C, E</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>NSO Site Number and Name</td>
<td>Fire Area</td>
<td>Intensity Factor(s)</td>
<td>Take of resident NSO pair</td>
<td>Take of young NSO</td>
</tr>
<tr>
<td>----------------------------------</td>
<td>-----------</td>
<td>---------------------</td>
<td>---------------------------</td>
<td>------------------</td>
</tr>
<tr>
<td>1213 Upper Elk Creek</td>
<td>HCC</td>
<td>C, F</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>1214/9995 Three Biscuit Gulch</td>
<td>HCC</td>
<td>C</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>1265 No Name Creek</td>
<td>HCC</td>
<td>C, F</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>1266 Salt Creek - Grider</td>
<td>HCC</td>
<td>C</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>4099 Middle Creek - Scott</td>
<td>HCC</td>
<td>C</td>
<td>YES</td>
<td>NO</td>
</tr>
<tr>
<td>4133 Louie Creek</td>
<td>HCC</td>
<td>C, F</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>9990 McGuffy Creek</td>
<td>HCC</td>
<td>N/A</td>
<td>NO</td>
<td>NO</td>
</tr>
<tr>
<td>9992 Wood Creek</td>
<td>HCC</td>
<td>A, C, E</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>9994 Huckleberry</td>
<td>HCC</td>
<td>A</td>
<td>NO</td>
<td>NO</td>
</tr>
<tr>
<td>9996</td>
<td>HCC</td>
<td>C</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>9998</td>
<td>HCC</td>
<td>C</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>New 3A/3B – East Walker Creek</td>
<td>HCC</td>
<td>A, C, D</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>New 7A China Creek 1</td>
<td>HCC</td>
<td>C</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>New 7B China Creek 2</td>
<td>HCC</td>
<td>C</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>1027 West Whites</td>
<td>Whites</td>
<td>N/A</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>1029 Shadow Creek</td>
<td>Whites</td>
<td>N/A</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>1039 Russian Creek</td>
<td>Whites</td>
<td>N/A</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>1040 Applesauce Gulch</td>
<td>Whites</td>
<td>N/A</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>1041 Music Creek</td>
<td>Whites</td>
<td>N/A</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>1046 Cow Creek</td>
<td>Whites</td>
<td>C</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>1047B Etna Summit</td>
<td>Whites</td>
<td>N/A</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>1258 Hickey Gulch</td>
<td>Whites</td>
<td>B</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>99910 John Meadows Creek</td>
<td>Whites</td>
<td>N/A</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>99912 Eddy Lookout</td>
<td>Whites</td>
<td>N/A</td>
<td>YES</td>
<td>YES</td>
</tr>
</tbody>
</table>

1 HCC = Happy Camp complex
2 See BA (pp. 40-44) for complete definitions and context of intensity factors A, B, C, D, E, and F. See table 6.3 above for abbreviated definitions of intensity factors.
D. Tables and Figures for Section 7 – Cumulative Effects

Table 7.1 Timber Harvest Plan (THP) numbers and summary for THPs with future harvest removing NSO habitat (CAL FIRE 2015).

<table>
<thead>
<tr>
<th>Timber Harvest Plan Number, Name, and Ownership</th>
<th>Plan name and notes from CAL FIRE tracking databases for years 2011-2014</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-14-089-SIS Pipeline THP Timber Products (Michigan-California Timber company – MCTC in BO)</td>
<td>Size: 300 acres. Harvest details: 46% clear-cut, 35% commercial thin, 19% shelterwood logging. Watersheds: Jaynes Canyon, Doggett Creek, Lower Beaver Creek. Legal description is MD: T47N R9W Sec.7, 17, 21. Other details: winter operations, moderate erosion hazard, steep slopes up to 65%, wet area, impaired 303.d watershed, oversized units, herbicides, coho watershed, two NSO sites within 1.3 miles, fisher within two miles, great gray owl within 3.5 miles, and trees up to 150 years old.</td>
</tr>
<tr>
<td>2-14-017-SIS Forcher / Curley Jack Creek THP Northwest Skyline Logging</td>
<td>Size: 60 acres. No details were provided on the type of harvest. Watershed: Little Grider Creek. Legal description is HUM: T16N R8E Sec.10. Other details: winter operations, moderate erosion hazard, slopes up to 50%, 15 acre landslide area, impaired 303.d watershed, adjacent to Happy Camp, coho watershed, three NSO sites within two miles, and scattered large trees.</td>
</tr>
<tr>
<td>2-13-041-SIS Buck Dog THP Fruit Growers Supply Company</td>
<td>Size: 1,275 acres. Harvest details: 60% selection, 38% clear-cut, 2% no-harvest, miscellaneous roadside logging. Watersheds: Marble Creek, Doggett Creek, Lower Beaver Creek. Legal description is MD: T47N R9W Sec. 26, 27, 28, 29, 32, 33, and 35. Other details: winter operations, moderate erosion hazard, steep slopes up to 65%, landslide terrain, road failure sites, 111 road drainage work sites, herbicides, impaired 303.d watershed, coho watershed, four NSO sites within 1.3 miles, and scattered large trees.</td>
</tr>
<tr>
<td>2-12-087-SIS McKinney THP MCTC company</td>
<td>Size: 540 acres. Harvest details: 93% clear-cut, 4% shelterwood, 2% no-harvest, 1% roadside, miscellaneous selection logging. Watersheds: Barkhouse Creek, McKinney Creek, Quigleys Cove, Dona Creek. Legal description is MD: T45N R9W Sec.5; T46N R9W Sec.9, 15, 17, 21, 27, 29, 33. Other details: winter operations, moderate erosion hazard, steep slopes over 65%, steep roads, unstable areas, road failure sites, 20 road drainage work sites, impaired 303.d watershed, coho watershed, six NSO sites within 1.3 miles, goshawk within .25 miles, four osprey nests within .25miles, fisher sightings, and scattered large trees.</td>
</tr>
<tr>
<td>2-11-085-SIS Collins THP MCTC company</td>
<td>Size: 298 acres. Harvest details: 92% clearcut, 7% shelterwood, 1% roadside logging. Watersheds: McKinney Creek, Collins Creek, Kingsman Creek, Dona Creek. Legal description is MD: T46N R9W Sec.19, 31; T46N R10W Sec.23, 25, 27. Other details: wet weather operations, high erosion hazard, impaired 303.d watershed, steep slopes up to 65%, coho watershed, eight NSO sites within 1.3 miles, one osprey nest within .25 miles, and scattered large trees.</td>
</tr>
<tr>
<td>2-11-027-SIS Dutch Beaver THP Fruit Growers Supply Company</td>
<td>Size: 543 acres. Harvest details: 81% selection, 12% clearcut, 7% no-harvest logging. Watersheds: Lower Beaver Creek. Legal description is MD: T47N R9W Sec.14, 15, 16, 21. Other details: winter operations, moderate erosion hazard, steep slopes up to 65%, 9 unstable areas, 7 active erosion sites, 42 road-crossing repair sites, impaired 303.d watershed, coho watershed, 3 spotted owls within 1.3mi, trees up to 26” dbh. Estimated public comment deadline: 09/29/11.</td>
</tr>
</tbody>
</table>
Figure 7.1 The map above displays recently completed harvest and cumulative effects in the Beaver fire portion of the action area based on Timber Harvest Plans (THPs) and emergency exemptions available for download at the CAL FIRE Forest Practices GIS data download portal (CAL FIRE 2015).

Note: There has been additional completed harvest (based on maps Fruitgrowers Supply Company provided to FWS in July 2015) in the eastern portion within NSO sites KL4143, KL99915, KL99914, and KL4144 that is not available from CAL FIRE Forest Practices GIS (CAL FIRE 2015).
Figure 8.2 Oregon Klamath Mountains study area adult NSO detections per one-hundred NSO sites based on data in Hollen et al. (2015).

Note: In order to compare relative changes in NSOs’ numbers over time across study areas of different sizes, research teams often report or compare the number of NSOs detected per one-hundred sites surveyed rather than the total number of NSO detected on each study area for each year.
Figure 8.3 Southern Cascades demographic study area (DSA) adult NSO detections per 100 sites based on data in Dugger et al. (2015b).
Figure 8.4 Willow Creek study area adult NSO detections. Numbers of NSOs detected each year are from Franklin et al. (2015).

Note: These data points are not adjusted per one-hundred NSO sites like the two study areas in figure 8.3 and figure 8.4 above. However, the number of NSO sites surveyed annually remained relatively constant and was about one-hundred NSO sites surveyed per year (ranged between 93 and 95 NSO sites).
Literature Cited


Appendix B

CONSIDERATIONS FOR EVALUATING EFFECTS OF WILDFIRE TO NSOs AND NSO HABITAT

In order to fully evaluate the effects of projects proposed following wildfires we must evaluate several influences in combination. The factors we generally consider are the effects of the fire to the species and its habitat, how spotted owls may use the post-fire landscape, and the likely or expected response to post-fire management activities.

This approach necessitates a three step process: 1) Establish a baseline of pre-fire NSO use and occupancy in the Action Area based on the best available data; 2) Use existing literature to aid in evaluating the effects of fire to the pre-fire NSO baseline to provide a post-fire NSO baseline; and 3) Evaluate the effects of the project on the established post-fire baseline habitat conditions and NSO occupancy and habitat use. This framework establishes the assumptions on which we base our analysis of the effects.

Pre-fire NSO Baseline
The pre-fire baseline for NSO is comprised of the following available data in the Action Area: 1) known Activity Centers (AC), 2) nest core areas, or home ranges, 3) other observations of NSOs from federal, state, or private databases, 4) survey history, and 5) habitat suitability (nesting/roosting, foraging, and dispersal).

NSO
The Biological Assessment (BA) prepared for the project should compile data regarding all surveys and develop a record of historical use by NSOs within the Action Area. NSOs often exhibit strong site fidelity so where current survey information is lacking, historically occupied sites are presumed to be occupied unless some environmental change has occurred that precludes occupancy.

The presence of barred owls within the Action Area should also be investigated because spotted owl survey results may be influenced by the presence of barred owls, particularly if a 3 visit survey protocol was used (current protocol requires 6 visits to compensate for reduced NSO response rates when barred owls coexist in the landscape).

Habitat
The BA should delineate habitat based on the best available pre-fire data. Often, each National Forest (or Management Unit) has an existing NSO habitat base layer (GIS). This layer may be less accurate at fine scales because it often relies on remotely sensed data and may or may not have been ground-truthed or field verified recently. Nonetheless the broad scale habitat assessments used by the U.S. Fish and Wildlife Service (FWS) may also be used to try to develop the most robust assessment of pre-fire habitat as possible (e.g. VMS Enterprise Team’s preliminary NSO habitat layer, NAIP imagery, and other sources may be evaluated separately to develop a composite understanding of the habitat conditions that existed before the fire. A
review of project records within the Action Area can also be used to provide a finer scale interpretation where such information is available. Both Forest Service and FWS personnel who work in the area can provide detailed and accurate information that can help validate modeled or remotely sensed habitat typing. The resulting habitat layer from the combined sources provided as an example above will generally represent the best available starting point for classifying pre-fire habitat for NSOs.

Consistent with habitat-based effects analyses for unsurveyed landscapes, where surveys of suitable habitat in the Action Area are not current, habitat is assumed to be occupied, including patches of suitable habitat that are of adequate size to provide for the life history functions of NSO, especially habitat polygons with physiographic features selected by spotted owls (northern aspects, lower slope position, proximity to water etc.). Conversely, small patches of apparently suitable habitat surrounded by non-habitat (brush fields, meadows, etc.) are not considered adequate for NSO occupancy, and therefore, are not considered to be occupied for this analysis.

**Fire Effects on NSO**

Research on all three spotted owl subspecies indicates variability and some level of uncertainty in the degree to which spotted owls use post-fire landscapes. Comprehensive analyses of the long-term effects of fire on NSO use and occupancy within a landscape, especially the small scale effects to pairs or individuals, are largely absent or inconclusive. This is due, in part, to the stochastic nature of wildfire and the difficulty of empirically testing hypotheses regarding pre- and post-fire responses of forests and organisms of interest including spotted owls. The studies that have been undertaken are constrained by small sample sizes and must often use comparative assumptions to look at post-fire habitat use. Few case studies have been able to compare pre- and post-fire habitat use and these studies are not directly comparable to each other. Large differences in landscapes and high degrees of variability exist between studies, and the spatial arrangement of suitable habitat, locations of activity centers, burn severities and scales, pre-fire forest management, post-fire forest management, and myriad other factors combine to reduce the certainty or applicability of site-specific results of observational studies to projects being proposed.

For the purposes of this analysis, we can rely on general patterns observed and reported in the literature as a basis for our assessment of the likely effects of fire and post-fire management activities, such as salvage, fuels reduction, or hazard tree mitigation on NSO given our understanding of their use of burned landscapes.

**Effects to Occupancy**

Due to the unpredictable nature of fire, research into the effects of wildfire on all three subspecies of spotted owls are often combined in order to achieve sufficient sample size and statistical power to detect differences between paired analyses (pre- and post-fire, unburned versus burned) (Bond et al. 2002, Lee et al. 2012). To increase statistical power the factors evaluated have also been lumped into increasingly broader categories (i.e. burned vs. unburned, occupied vs. unoccupied, logged vs. unlogged). While this may increase statistical power in data analysis, it severely limits the ability to evaluate project-level effects at fine scales. Responses such as shifts in home ranges or disproportional use of variably burned areas are difficult to detect, and the uncertainty is compounded by the wide array of core and home range quality
combined with post-fire treatments that may be applied. While Bond et al. (2002) and Lee et al. (2012) suggest similar occupancy, survival, and extinction rates between burned and unburned territories, or pre- and post-fire use of known territories, the detail of how and why spotted owls used the post-fire landscapes is not discernible from the data used. For instance, Lee et al. (2012) only required one nighttime observation one to three years post-fire within the general area of a Primary Activity Center (PAC) to classify an Activity Center as “occupied.” While this study suggests some site fidelity and habitat suitability one to three years post-fire, the methodology cannot determine if spotted owls shifted their use to unburned areas within the PAC, nor was it long enough in duration to determine if spotted owls would avoid burned areas in subsequent years. Important questions regarding persistence, reproductive success or fitness of spotted owls occupying burned habitats remain unanswered.

Research at more localized scales has had variable results that were again influenced by small sample sizes and a wide variety of forest management practices in pre- and post-fire landscapes (Bond et al. 2009, Clark 2007, Clark et al. 2011, Clark et al. 2013, Elliott 1985, Gaines et al. 1995, Jenness et al. 2004, King et al. 1998, Lee and Bond 2015a, Lee and Bond 2015b, Roberts et al. 2011). In southwest Oregon, lower occupancy and survival rates of NSO were found in burned areas compared to unburned, but the results were confounded by prior management and post-fire harvest (Clark 2007, Clark et al. 2011, Clark et al. 2013). Jenness et al. (2004) found decreased occupancy by Mexican spotted owls in burned areas compared to unburned areas; however, the authors considered the results statistically weak. Roberts et al. (2011) similarly found no significant difference in occupancy of California spotted owls between burned and unburned areas in Yosemite National Park; however, naïve models (models in which certain variables weren’t included) suggested slightly lower occupancy and density in burned areas. Additionally, while Roberts et al. (2011) presented that spotted owls may occupy areas that burned at generally low-to-moderate severity two to fourteen years prior, the study design did not allow them to determine whether any shifts in use occurred over time. The results produced by Roberts et al. (2011) were also confounded by low sample sizes and the inability to separate the effects of different fire types that influenced the fire size and intensity (prescribed fire, wilderness fire for resource benefit, and uncontrolled wildfire). Lee and Bond (2015a) found that the amount of high severity fire occurring in 121 hectare (300 acre) California spotted owl cores in the Sierra Nevada mountains did not affect short term occupancy (one year following fires).

Reproduction in the previous year appears to be correlated with current year’s occupancy and reproduction (Seamans and Gutierrez 2007, Lee and Bond 2015b). These same authors also suggested that the occupancy of California spotted owl in Southern California may be closely tied to the reproductive status of the given sites prior to the disturbance, but that in contrast to the Sierra study by Lee and Bond, spotted owl occupancy in a Southern California population was negatively correlated with fire and logging covariates.

In general, these studies in combination suggest a negative (and logical) influence of high severity wildfire on spotted owl occupancy and survival that may be further compounded by prior forest management or post-fire management activities (Clark et al. 2011, Clark et al. 2013, Jenness et al. 2004, Roberts et al. 2011).
Effects to pairs and individuals

Research that investigated the small scale effects to NSO pairs or individuals detected highly variable responses to fire-induced habitat changes with apparent habitat value declining with burn severity (Bond et al. 2009, Clark 2007, Clark et al. 2011, Clark et al. 2013, Gaines et al. 1995, King et al. 1998). Temporal aspects of several studies also influenced observations, and research that is conducted pre- and post-fire appears to more accurately describe the immediate effects of wildfire to individuals compared to research conducted post-fire only. Additionally, as the time since the wildfire increases and vegetation recovers, prey abundance likely increases (woodrats in particular), and thereby potentially influences observed habitat selection. Without a detailed assessment of the habitat conditions and resulting effects observed, however, comparisons between studies cannot be made. Thus, our assumptions about likely effects of fire and post-fire forest management on NSO are based on conditions and scenarios described in literature compared to the site-specific conditions for projects being evaluated.

Radio-telemetry based studies provide greater detail than occupancy-based studies when describing NSO use of burned landscapes and habitat selection. Based on a large number of observations radio-telemetry studies can accurately evaluate habitat types that individuals are selecting or avoiding and quantify the post-fire habitat use in core use areas and home ranges of NSOs. Occupancy-based studies essentially base their conclusions on whether a given area is occupied before and after the fire. These studies only require one observation to determine occupancy and therefore have limited ability to evaluate habitat selection or small scale movements. Our understanding of post-fire habitat selection is essential to our evaluation of proposed projects in burned areas and results from telemetry studies likely provide the strongest basis for predicting potential effects to NSO and NSO habitat.

Because the habitat conditions evaluated in the literature were highly variable, not adequately described, and not directly comparable to one another, these studies cannot be used to determine a single threshold value for determining post-fire occupancy. Therefore, the determination of occupancy by NSO in a post-fire landscape is based on professional judgment and the interpretation of the best available data, including pre- and post-fire habitat conditions, literature on spotted owl habitat use and occupancy following both fire and post-fire forest management practices, and other site-specific information. In addition to pre- and post-fire habitat conditions, abiotic factors such as distance to streams, slope position, elevation, and aspect also influence site selection (Forsman et al. 1984, Irwin et al. 2007, USDI 2009). Site fidelity, or continued use of an area over time, can influence NSO use of burned areas that were previously suitable (Bond et al. 2009, Clark 2007, Lee et al. 2012). Top-ranked models considered by Lee and Bond (2015b) suggested negative effects of fire on occupancy, with further reductions if compounded by salvage logging within core areas.

Several radio-telemetry studies detected a positive correlation between higher amounts of suitable habitat remaining post-fire and the probability of post-fire site occupancy by NSOs (Bond et al. 2009, Clark 2007, Gaines et al. 1995). Areas that were not suitable habitat pre-fire, such as brush fields or meadows, were not used to a greater extent post-fire and are not expected to contribute towards territory occupancy (Clark 2007). The amount and condition of nesting
and roosting habitat following fires is therefore the most powerful predictor of the probability of post-fire occupancy and potential reproduction.

**Nesting and Roosting**
Sites selected by NSOs for nesting and roosting generally experience either no fire or low- to moderate-severity fire (Bond et al. 2009, Clark 2007, Clark et al. 2011, Clark et al. 2013, King et al. 1998). Additionally, where vegetation was measured, sites selected consistently had high canopy closure (Bond et al. 2009). High-severity burns were generally not used by spotted owls for nesting or roosting (Bond et al. 2009, Clark 2007, Clark et al. 2011, Clark et al. 2013, King et al. 1998), presumably because the live canopy is essentially consumed in the fire. This would suggest that low- to moderate-severity fires that retain adequate canopy can function for nesting or roosting and thus allow the continued use of NSO activity centers, while territories that burned at high-severity no longer supported nesting NSOs. It is expected that within mixed severity burns, NSOs will select the best available post-fire suitable habitat and Activity Centers at these locations may persist into the future. The effects of wildfire on NSO Activity Center occupancy is categorized two ways, either as shifts or losses.

**Shifts**
Where activity centers were affected by fire (any range of severities), but sufficient suitable habitat remains in the home range and immediately adjacent area, site fidelity may cause NSOs to increase the size of their home ranges or shift locations to encompass the best available habitats rather than vacate the burned site (King et al. 1998, Clark 2007, Clark et al. 2011, 2013). Thus, a *shift* is defined as the condition where the area is presumably still functional and considered occupied, but the core use area may move to the best available habitat immediately adjacent to the prior activity center or to another location in suitable habitat within the immediate area, presumably within the pre-fire home range.

**Losses**
When high-severity fire affects a significant portion of the suitable habitat in the core and home range, available literature suggests that Activity Centers are no longer functional and the NSOs were either killed during the fire, move significantly, or perish soon after the fire (Clark 2007, Gaines et al. 1995, King et al. 1998). In some instances spotted owls were observed temporarily returning to these territories, though the territory no longer functioned to support spotted owl occupancy into the future (Clark 2007). Essentially, site fidelity was over ridden by the lack of suitable habitat remaining within the historic use area. Thus a *loss* is defined as the condition where the activity center is presumably no longer functional due to habitat alteration from high-severity fire, and there is insufficient habitat immediately nearby to allow the birds to shift. The activity center would be considered unoccupied for this analysis and may not be functional to support NSOs for several decades. It is important to recognize that post-fire management in burned but functional habitat may exacerbate the reduced habitat value following fire and result in losses where shifts might have otherwise occurred. Top-ranked models considered by Lee and Bond (2015b) suggested negative effects of fire on occupancy, with further reductions if compounded by salvage logging within core areas.
Post-Fire Habitat Use

Once a NSO Activity Center and territory is presumed to be occupied, we must predict how NSO use the post-fire landscape in order to determine the effects to NSOs from a proposed project. The use of burned landscapes by NSOs may depend both on severity and the distance from the activity center (Bond et al. 2009, Clark 2007, Clark et al. 2011, Clark et al. 2013). Because NSOs exhibit site fidelity and are central-place foragers, NSO may continue to use the post-fire landscapes depending on the remaining post-fire habitat conditions (suitable habitat) in the area (Clark 2007, Clark et al. 2011, Clark et al. 2013, Gaines et al. 1995, King et al. 1998). Site selection for nesting and roosting, described above, would therefore also influence the areas used for foraging. The reverse is also true, as nest site selection may be influenced by the proximity to sufficient foraging habitat.

Foraging

It is important to note that while high-severity burn areas do not meet standard definitions of foraging habitat, and are therefore characterized as non-habitat, spotted owl use of these burned areas is well documented (Bond et al 2002, Bond et al. 2009, Clark 2007, Clark et al. 2011, Clark et al. 2013, Eyes 2015, Gaines et al. 1995, Jenness et al. 2004, King et al. 1998, Lee et al. 2012, Roberts et al. 2011). Areas that were not suitable habitat pre-fire were not used to a greater extent post-fire, so this discussion focuses on areas that were suitable habitat before the fire but may not meet standard NSO foraging habitat definitions post-fire (Clark 2007).

Clark (2007) found that NSOs used the best available habitat, which largely consisted of areas of nesting/roosting or foraging habitats that were unburned or were burned at low-to-moderate-severity. He noted that NSOs occasionally traveled large distances to forage in unburned areas. While severely burned areas were used, observations indicated that NSOs selected the edges near less severely burned areas. Clark (2007) also described that within salvaged areas, 60 percent of locations were associated with ‘leave islands’, riparian reserves, and stands of thinned trees. However, he was unable to evaluate the difference in effect between high severity burn areas with or without subsequent salvage.

Utilizing Clark's data, Comfort (2014) found that spotted owls generally used habitat characterized by higher suitability, lower disturbance severity, lower amounts of hard edge and higher amounts of diffused edge, but these results varied by scale of measurement. Eyes (2015) described similar findings in a Yosemite National Park population where California spotted owls selected lower fire severities, edge sites, and habitats within their home ranges. Spotted owls avoided large, contiguous patches of high-severity disturbance, but the author also found that spotted owls can benefit from small patches of high severity fire that are surrounded by moderate to low-severity fire (Comfort 2014). Diffuse edges are likely to be good habitat for woodrats (Clark 2007), which are more likely to occur at high densities in early seral (brushy/sapling to pole-sized trees) and old-growth forests (Sakai and Noon 1993). Similarly, King et al. (1998) described observational studies where NSO use shifted away from burned areas, although only 20 percent of the locations were used for nighttime foraging. Four years post-fire, Bond et al. (2009) found that California spotted owls were foraging in all burn severities, with a stronger selection for the edges of high-severity burns, presumably taking advantage of an increase in prey (particularly woodrats) during a period of abundant regrowth of shrub and herbaceous
Based on the evidence that these studies provide, we make the following assumptions regarding spotted owl use of post-fire landscapes: 1) Spotted owls select for unburned or low-severity burned suitable habitat for nesting and roosting; and 2) As distance from cover increases, spotted owl foraging use declines such that limited use of the interior of high-severity burns is expected. The maximum distance from cover in which NSOs will forage remains unknown; however, spotted owls seem to select for the edges of high-severity burns rather than the interior; and 3) Spotted owls utilize fire created edges at different spatial scales (see Comfort 2014).

**Literature Cited**


Comfort, E.J. Comfort, E.J. 2014. Trade-offs between management for fire risk reduction and northern spotted owl habitat protection in the dry conifer forests of Southern Oregon. PhD. Dissertation; Oregon State University, Corvallis, OR.


Appendix C

STATUS OF THE SPECIES

1.0 STATUS OF THE NORTHERN SPOTTED OWL

1.1 Legal Status

The spotted owl was listed as threatened on June 26, 1990 due to widespread loss and adverse modification of suitable habitat across the owl’s entire range and the inadequacy of existing regulatory mechanisms to conserve the owl (USDI FWS 1990a, p. 26114). The northern spotted owl was originally listed with a recovery priority number of 3C, but that number was changed to 6C in 2004 during the 5-year review of the species (USDI FWS 2004, p. 55). Priority numbers are assigned on a scale of 1C (highest) to 18 (lowest). This number reflects a high degree of threat, a low potential for recovery, and the owl’s taxonomic status as a subspecies (USDI FWS 1983b, p. 51895). The “C” reflects conflict with development, construction, or other economic activity (USDI FWS 1983a, p. 43104). The most recent five year status review was completed on September 29, 2011, and did not propose changes to the listing status or introduce any new threats (USDI FWS 2011a). In 2012, the Service was petitioned to uplist the northern spotted owl from threatened to endangered status under the Endangered Species Act. In April 2015, the Service determined that petition presented substantial information indicating that the listing may be warranted due to a number of listing factors (80 FR pp.19259-19263).

1.2 Life History

1.2.1 Taxonomy

The northern spotted owl is one of three subspecies of spotted owls currently recognized by the American Ornithologists’ Union. The taxonomic separation of these three subspecies is supported by genetic (Barrowclough and Gutiérrez 1990, pp.741-742; Barrowclough et al. 1999, p. 928; Haig et al. 2004, p. 1354), morphological (Gutiérrez et al. 1995, p. 2), and biogeographic information (Barrowclough and Gutiérrez 1990, p.741-742). The distribution of the Mexican subspecies (S. o. lucida) is separate from those of the northern and California (S. o. occidentalis) subspecies (Gutiérrez et al. 1995, p.2). Recent studies analyzing mitochondrial DNA sequences (Haig et al. 2004, p. 1354; Chi et al. 2004, p. 3; Barrowclough et al. 2005, p. 1117) and microsatellites (Henke et al., unpublished data, p. 15) confirmed the validity of the current subspecies designations for northern and California spotted owls. The narrow hybrid zone between these two subspecies, which is located in the southern Cascades and northern Sierra Nevada, appears to be stable (Barrowclough et al. 2005, p. 1116).

Funk et al. (2008, pp. 1-11) tested the validity of the three current recognized subspecies of spotted owls and found them to be valid. During this genetics study, bi-directional hybridization and dispersal between northern spotted owls and California spotted owls centered in southern Oregon and northern California was discovered. In addition, a discovery of introgression of Mexican spotted owls into the northernmost parts of the northern spotted owl populations in Washington was made, indicating long-distance dispersal of Mexican spotted owls into the
northern spotted owl range (Funk et al. 2008, pp. 1-11). Some hybridization of northern spotted owls with barred owls has been recorded (Hamer et al. 1994, pp. 487-491; Dark et al. 1998, pp. 50-56; Kelly 2001, pp. 33, 38).

1.2.2 Physical Description

The northern spotted owl is a medium-sized owl and is the largest of the three subspecies of spotted owls (Gutiérrez et al. 1995, p. 2). It is approximately 46 to 48 centimeters (18 inches to 19 inches) long and the sexes are dimorphic, with males averaging about 13 percent smaller than females. The mean mass of 971 males taken during 1,108 captures was 580.4 grams (1.28 pounds) (out of a range 430.0 to 690.0 grams) (0.95 pound to 1.52 pounds), and the mean mass of 874 females taken during 1,016 captures was 664.5 grams (1.46 pounds) (out of a range 490.0 to 885.0 grams) (1.1 pounds to 1.95 pounds) (P. Loschl and E. Forsman, pers. comm. cited in USDI FWS 2011b, p. A-1). The northern spotted owl is dark brown with a barred tail and white spots on its head and breast, and it has dark brown eyes surrounded by prominent facial disks. Four age classes can be distinguished on the basis of plumage characteristics (Forsman 1981; Moen et al. 1991, p. 493). The northern spotted owl superficially resembles the barred owl, a species with which it occasionally hybridizes (Kelly and Forsman 2004, p. 807). Hybrids exhibit physical and vocal characteristics of both species (Hamer et al. 1994, p. 488).

1.2.3 Current and Historical Range

The current range of the spotted owl extends from southwest British Columbia through the Cascade Mountains, coastal ranges, and intervening forested lands in Washington, Oregon, and California, as far south as Marin County (USDI FWS 1990a, p. 26115). The range of the spotted owl is partitioned into 12 physiographic provinces (see Figure 1) based on recognized landscape subdivisions exhibiting different physical and environmental features (Thomas et al. 1993, USDI FWS 2011b, p. III-1). These provinces are distributed across the species’ range as follows:

- Four provinces in Washington: Eastern Washington Cascades, Olympic Peninsula, Western Washington Cascades, Western Washington Lowlands
- Five provinces in Oregon: Oregon Coast Range, Willamette Valley, Western Oregon Cascades, Eastern Oregon Cascades, Oregon Klamath
- Three provinces in California: California Coast, California Klamath, California Cascades

The spotted owl is extirpated or uncommon in certain areas such as southwestern Washington and British Columbia. Timber harvest activities have eliminated, reduced or fragmented spotted owl habitat sufficiently to decrease overall population densities across its range, particularly within the coastal provinces where habitat reduction has been concentrated (Thomas and Raphael 1993, USDI FWS 2011b, pp. B-1 to B-4).
<table>
<thead>
<tr>
<th>Demographic Study Area</th>
<th>Land Ownership</th>
<th># Owls Banded</th>
<th>Fecundity</th>
<th>Apparent Survival</th>
<th>$\lambda_{RUS}$</th>
<th>Population Trend Based on $\Delta\lambda$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Washington</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wenatchee (WEN)</td>
<td>Private</td>
<td>1,200</td>
<td>Stable</td>
<td>Declining</td>
<td>0.817</td>
<td>Declining</td>
</tr>
<tr>
<td>Rainer (RAI)</td>
<td>USFS</td>
<td>217</td>
<td>Stable</td>
<td>Declining</td>
<td>0.896</td>
<td>Declining</td>
</tr>
<tr>
<td>Olympic (OLY)</td>
<td>NPS &amp; USFS</td>
<td>985</td>
<td>Stable</td>
<td>Declining</td>
<td>0.956</td>
<td>Declining</td>
</tr>
<tr>
<td>Cle Elum (CLE)</td>
<td>USFS</td>
<td>724</td>
<td>Declining</td>
<td>Declining</td>
<td>0.938</td>
<td>Declining</td>
</tr>
<tr>
<td>Oregon</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oregon Coast Range (COA)</td>
<td>USFS &amp; BLM</td>
<td>1,025</td>
<td>Declining</td>
<td>Stable</td>
<td>0.868</td>
<td>Declining</td>
</tr>
<tr>
<td>Tyee (TYE)</td>
<td>BLM &amp; Private</td>
<td>1,032</td>
<td>Increasing</td>
<td>Stable</td>
<td>1.006</td>
<td>Stationary</td>
</tr>
<tr>
<td>South Oregon Cascades (CAS)</td>
<td>USFS &amp; BLM</td>
<td>881</td>
<td>Declining</td>
<td>Stable</td>
<td>0.974</td>
<td>Stationary</td>
</tr>
<tr>
<td>H.J. Andrews (HJA)</td>
<td>USFS</td>
<td>1,065</td>
<td>Stable</td>
<td>Stable</td>
<td>0.978</td>
<td>Declining</td>
</tr>
<tr>
<td>Klamath (KLA)</td>
<td>BLM &amp; Private</td>
<td>1,147</td>
<td>Stable</td>
<td>Stable</td>
<td>0.997</td>
<td>Stationary</td>
</tr>
<tr>
<td>Warm Springs (WSR)</td>
<td>Tribal</td>
<td>361</td>
<td>Stable</td>
<td>Stable</td>
<td>0.908</td>
<td>Declining</td>
</tr>
<tr>
<td>California</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Marin (MAR)</td>
<td>NPS</td>
<td>96</td>
<td>Stable</td>
<td>Stable</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Simpson (SIM)</td>
<td>Private</td>
<td>1,344</td>
<td>Declining</td>
<td>Stable</td>
<td>0.970</td>
<td>Declining</td>
</tr>
<tr>
<td>Hoopa (HUP)</td>
<td>Tribal</td>
<td>279</td>
<td>Increasing</td>
<td>Stable</td>
<td>0.980</td>
<td>Stationary</td>
</tr>
<tr>
<td>NW California (NWC)</td>
<td>USFS</td>
<td>1,026</td>
<td>Declining</td>
<td>Declining</td>
<td>0.985</td>
<td>Declining</td>
</tr>
</tbody>
</table>

1. Best model included age and even-odd year effects, but a competing model had a negative time effect on productivity.
2. Variable among years, but with a declining trend.
3. Decreasing in early years, increase in last 5 years, stable overall.
4. Gradual declines in fecundity and apparent survival, plus estimates of realized population change suggest a decline in last 8 years.

Figure 1. Physiographic provinces, northern spotted owl demographic study areas, and demographic trends (Anthony et al. 2006).
1.2.4 Behavior

Northern spotted owls are primarily nocturnal (Forsman et al. 1984, pp. 51-52) and spend virtually their entire lives beneath the forest canopy (Courtney et al. 2004, p. 2-5). They are adapted to maneuverability beneath the forest canopy rather than strong, sustained flight (Gutiérrez et al. 1995, p. 9). They forage between dusk and dawn and sleep during the day with peak activity occurring during the two hours after sunset and the two hours prior to sunrise (Gutiérrez et al. 1995, p. 5; Delaney et al. 1999, p. 44). They will sometimes take advantage of vulnerable prey near their roosts during the day (Layman 1991, pp. 138-140; Sovern et al. 1994, p. 202).

Northern spotted owls seek sheltered roosts to avoid inclement weather, summer heat, and predation (Forsman 1975, pp. 105-106; Barrows and Barrows 1978; Barrows 1981; Forsman et al. 1984, pp. 29-30). Northern spotted owls become stressed at temperatures above 28°C, but there is no evidence to indicate that they have been directly killed by temperature because of their ability to thermoregulate by seeking out shady roosts in the forest understory on hot days (Barrows and Barrows 1978; Forsman et al. 1984, pp. 29-30, 54; Weathers et al. 2001, pp. 678, 684). During warm weather, spotted owls seek roosts in shady recesses of understory trees and occasionally will even roost on the ground (Barrows and Barrows 1978, pp. 3, 7-8; Barrows 1981, pp. 302-306, 308; Forsman et al. 1984, pp. 29-30, 54; Gutiérrez et al. 1995, p. 7). Glenn et al. (2010, p. 2549) found that population growth was negatively associated with hot summer temperatures at their southernmost study area in the southern Oregon Cascades, indicating that warm temperatures may still have an effect on the species. Both adults and juveniles have been observed drinking water, primarily during the summer, which is thought to be associated with thermoregulation (Gutiérrez et al. 1995, p. 7).

Spotted owls are territorial; however, home ranges of adjacent pairs overlap (Forsman et al. 1984, p. 22; Solis and Gutiérrez 1990, p. 746) suggesting that the area defended is smaller than the area used for foraging. They will actively defend their nests and young from predators (Forsman 1975, p. 15; Gutiérrez et al. 1995, p. 11). Territorial defense is primarily effected by hooting, barking and whistle type calls. Some spotted owls are not territorial but either remain as residents within the territory of a pair or move among territories (Gutiérrez 1996, p. 4). These birds are referred to as “floaters.” Floaters have special significance in spotted owl populations because they may buffer the territorial population from decline (Franklin 1992, p. 822). Little is known about floaters other than that they exist and typically do not respond to calls as vigorously as territorial birds (Gutiérrez 1996, p. 4).

Spotted owls are monogamous and usually form long-term pair bonds. “Divorces” occur but are relatively uncommon. There are no known examples of polygyny in this owl, although associations of three or more birds have been reported (Gutiérrez et al. 1995, p. 10).  

1.2.5 Habitat Relationships
1.2.5.1 Home Range

Home-range sizes vary geographically, generally increasing from south to north, which is likely a response to differences in habitat quality (USDI FWS 1990a, p. 26117). Estimates of median size of their annual home range (the area traversed by an individual or pair during their normal
activities (Thomas and Raphael 1993, pp. IX-15) vary by province and range from 2,955 acres in the Oregon Cascades (Thomas et al. 1990, p. 194) to 14,211 acres on the Olympic Peninsula (USDI FWS 1994a, p. 3). Zabel et al. (1995, p. 436) showed that these provincial home ranges are larger where flying squirrels are the predominant prey and smaller where wood rats are the predominant prey. Home ranges of adjacent pairs overlap (Forsman et al. 1984, p. 22; Solis and Gutiérrez 1990, p. 746), suggesting that the defended area is smaller than the area used for foraging. Within the home range there is a smaller area of concentrated use during the breeding season (approximately 20 percent of the home range), often referred to as the core area (Bingham and Noon 1997, pp. 133-135). Spotted owl core areas vary in size geographically and provide habitat elements that are important for the reproductive efficacy of the territory, such as the nest tree, roost sites and foraging areas (Bingham and Noon 1997, p. 134). Spotted owls use smaller home ranges during the breeding season and often dramatically increase their home range size during fall and winter (Forsman et al. 1984, pp. 21-22; Sisco 1990, p. iii).

Although differences exist in natural stand characteristics that influence home range size, habitat loss and forest fragmentation effectively reduce habitat quality in the home range. A reduction in the amount of suitable habitat reduces spotted owl abundance and nesting success (Bart and Forsman 1992, pp. 98-99; Bart 1995, p. 944).

1.2.5.2 Habitat Use and Selection
Forsman et al. (1984, pp.15-16) reported that spotted owls have been observed in the following forest types: Douglas-fir (*Pseudotsuga menziesii*), western hemlock (*Tsuga heterophylla*), grand fir (*Abies grandis*), white fir (*Abies concolor*), ponderosa pine (*Pinus ponderosa*), Shasta red fir (*Abies magnifica shastensis*), mixed evergreen, mixed conifer hardwood (Klamath montane), and redwood (*Sequoia sempervirens*). The upper elevation limit at which spotted owls occur corresponds to the transition to subalpine forest, which is characterized by relatively simple structure and severe winter weather (Forsman 1975, p. 27; Forsman et al. 1984, pp. 15-16).

Spotted owls generally rely on older forested habitats because such forests contain the structures and characteristics required for nesting, roosting, and foraging. Features that support nesting and roosting typically include a moderate to high canopy closure (60 to 90 percent); a multi-layered, multi-species canopy with large overstory trees (with diameter at breast height [dbh] of greater than 30 inches); a high incidence of large trees with various deformities (large cavities, broken tops, mistletoe infections, and other evidence of decadence); large snags; large accumulations of fallen trees and other woody debris on the ground; and sufficient open space below the canopy for spotted owls to fly (Thomas et al. 1990, p. 19). Forested stands with high canopy closure also provide thermal cover (Weathers et al. 2001, p. 686) and protection from predators (Franklin et al. 2000, p. 578).

Spotted owls nest almost exclusively in trees. Like roosts, nest sites are found in forests having complex structure dominated by large diameter trees (Forsman et al. 1984, p. 30; Hershey et al. 1998, p. 1402). Even in forests that have been previously logged, spotted owls select forests having a structure (i.e., larger trees, greater canopy closure) different than forests generally

Roost sites selected by spotted owls have more complex vegetation structure than forests generally available to them (Barrows and Barrows 1978, p. 3; Forsman et al. 1984, pp. 29-30; Solis and Gutiérrez 1990, pp. 742-743). These habitats are usually multi-layered forests having high canopy closure and large diameter trees in the overstory.

Foraging habitat is the most variable of all habitats used by territorial spotted owls (Thomas et al. 1990; USDI FWS 2011b, p. G-2). Descriptions of foraging habitat have ranged from complex structure (Solis and Gutiérrez 1990, pp. 742-744) to forests with lower canopy closure and smaller trees than forests containing nests or roosts (Gutiérrez 1996, p. 5). Foraging habitat for northern spotted owls provides a food supply for survival and reproduction. Foraging activity is positively associated with tree height diversity (North et al. 1999, p. 524), canopy closure (Irwin et al. 2000, p. 180; Courtney et al. 2004, pp. 5-15), snag volume, density of snags greater than 20 in (50 cm) dbh (North et al. 1999, p. 524; Irwin et al. 2000, pp. 179-180; Courtney et al. 2004, pp. 5-15), density of trees greater than or equal to 31 in (80 cm) dbh (North et al. 1999, p. 524), volume of woody debris (Irwin et al. 2000, pp. 179-180), and young forests with some structural characteristics of old forests (Carey et al. 1992, pp. 245-247; Irwin et al. 2000, pp. 178-179). Northern spotted owls select old forests for foraging in greater proportion than their availability at the landscape scale (Carey et al. 1992, pp. 236-237; Carey and Peeler 1995, p. 235; Forsman et al. 2004, pp. 372-373), but will forage in younger stands with high prey densities and access to prey (Carey et al. 1992, p. 247; Rosenberg and Anthony 1992, p. 165; Thome et al. 1999, pp. 56-57).

Dispersal habitat is essential to maintaining stable populations by filling territorial vacancies when resident northern spotted owls die or leave their territories, and to providing adequate gene flow across the range of the species. Dispersal habitat, at a minimum, consists of stands with adequate tree size and canopy closure to provide protection from avian predators and at least minimal foraging opportunities (USDI FWS 2011b, p. G-1). Dispersal habitat may include younger and less diverse forest stands than foraging habitat, such as even-aged, pole-sized stands, but such stands should contain some roosting structures and foraging habitat to allow for temporary resting and feeding for dispersing juveniles (USDI FWS 2011b, p. G-1). Forsman et al. (2002, p. 22) found that spotted owls could disperse through highly fragmented forest landscapes. In a study of the natal dispersal of northern spotted owls, Sovern and others (2015, pp. 257-260) found the majority of roosts were in forested habitats with at least some large (>50 cm dbh) trees and they selected stands with high canopy cover (>70 percent) at the landscape scale. These authors suggested the concept of ‘dispersal’ habitat as a lower quality type of habitat may be inappropriate. The stand-level and landscape-level attributes of forests needed to facilitate successful dispersal have not been thoroughly evaluated (Buchanan 2004, p. 1341).

Spotted owls may be found in younger forest stands that have the structural characteristics of older forests or retained structural elements from the previous forest. In redwood forests and mixed conifer-hardwood forests along the coast of northwestern California, considerable numbers of spotted owls also occur in younger forest stands, particularly in areas where hardwoods provide a multi-layered structure at an early age (Thomas et al. 1990, p. 158; Diller
and Thome 1999, p. 275). In mixed conifer forests in the eastern Cascades in Washington, 27 percent of nest sites were in old-growth forests, 57 percent were in the understory reinitiation phase of stand development, and 17 percent were in the stem exclusion phase (Buchanan et al. 1995, p. 304). In the western Cascades of Oregon, 50 percent of spotted owl nests were in late-seral/old-growth stands (greater than 80 years old), and none were found in stands of less than 40 years old (Irwin et al. 2000, p. 41).

In the Western Washington Cascades, spotted owls roosted in mature forests dominated by trees greater than 50 centimeters (19.7 inches) dbh with greater than 60 percent canopy closure more often than expected for roosting during the non-breeding season. Spotted owls also used young forest (trees of 20 to 50 centimeters (7.9 inches to 19.7 inches) dbh with greater than 60 percent canopy closure) less often than expected based on this habitat’s availability (Herter et al. 2002, p. 437).

In the Coast Ranges, Western Oregon Cascades and the Olympic Peninsula, radio-marked spotted owls selected old-growth and mature forests for foraging and roosting and used young forests less than predicted based on availability (Forsman et al. 1984, pp. 24-25; Carey et al. 1990, pp. 14-15; Thomas et al. 1990; Forsman et al. 2005, pp. 372-373). Glenn et al. (2004, pp. 46-47) studied spotted owls in young forests in western Oregon and found little preference among age classes of young forest.

Habitat use is influenced by prey availability. Ward (1990, p. 62) found that spotted owls foraged in areas with lower variance in prey densities (that is, where the occurrence of prey was more predictable) within older forests and near ecotones of old forest and brush seral stages. Zabel et al. (1995, p. 436) showed that spotted owl home ranges are larger where flying squirrels (Glaucomys sabrinus) are the predominant prey and smaller where wood rats (Neotoma spp.) are the predominant prey.

Recent landscape-level analyses in portions of Oregon Coast and California Klamath provinces suggest that a mosaic of late-successional habitat interspersed with other seral conditions may benefit spotted owls more than large, homogeneous expanses of older forests (Zabel et al. 2003, p. 1038; Franklin et al. 2000, pp. 573-579; Meyer et al. 1998, p. 43). In Oregon Klamath and Western Oregon Cascade provinces, Dugger et al. (2005, p. 876) found that apparent survival and reproduction was positively associated with the proportion of older forest near the territory center (within 730 meters) (2,395 feet). Survival decreased dramatically when the amount of non-habitat (non-forest areas, sapling stands, etc.) exceeded approximately 50 percent of the home range (Dugger et al. 2005, pp. 873-874). The authors concluded that they found no support for either a positive or negative direct effect of intermediate-aged forest—that is, all forest stages between sapling and mature, with total canopy cover greater than 40 percent—on either the survival or reproduction of spotted owls. It is unknown how these results were affected by the low habitat fitness potential in their study area, which Dugger et al. (2005, p. 876) stated was generally much lower than those in Franklin et al. (2000) and Olson et al. (2004), and the low reproductive rate and survival in their study area, which they reported were generally lower than those studied by Anthony et al. (2006). Olson et al. (2004, pp. 1050-1051) found that reproductive rates fluctuated biennially and were positively related to the amount of edge between late-seral and mid-seral forests and other habitat classes in the central Oregon Coast
Range. Olson et al. (2004, pp. 1049-1050) concluded that their results indicate that while mid-seral and late-seral forests are important to spotted owls, a mixture of these forest types with younger forest and non-forest may be best for spotted owl survival and reproduction in their study area. In a large-scale demography modeling study, Forsman et al. (2011, pp. 1-2) found a positive correlation between the amount of suitable habitat and recruitment of young.

1.2.6 Reproductive Biology
The spotted owl is relatively long-lived, has a long reproductive life span, invests significantly in parental care, and exhibits high adult survivorship relative to other North American owls (Forsman et al. 1984; Gutiérrez et al. 1995, p. 5). Spotted owls are sexually mature at 1 year of age, but rarely breed until they are 2 to 5 years of age (Miller et al. 1985, p. 93; Franklin 1992, p. 821; Forsman et al. 2002, p. 17). Breeding females lay one to four eggs per clutch, with the average clutch size being two eggs; however, most spotted owl pairs do not nest every year, nor are nesting pairs successful every year (USDI FWS 1990b; Forsman et al. 1984, pp. 32-34; Anthony et al. 2006, p. 28), and renesting after a failed nesting attempt is rare (Gutiérrez 1996, p. 4). The small clutch size, temporal variability in nesting success, and delayed onset of breeding all contribute to the relatively low fecundity of this species (Gutiérrez 1996, p. 4).

Courtship behavior usually begins in February or March, and females typically lay eggs in late March or April. The timing of nesting and fledging varies with latitude and elevation (Forsman et al. 1984, p. 32). After they leave the nest in late May or June, juvenile spotted owls depend on their parents until they are able to fly and hunt on their own. Parental care continues after fledging into September (USDI FWS 1990a; Forsman et al. 1984, p. 38). During the first few weeks after the young leave the nest, the adults often roost with them during the day. By late summer, the adults are rarely found roosting with their young and usually only visit the juveniles to feed them at night (Forsman et al. 1984, p. 38). Telemetry and genetic studies indicate that close inbreeding between siblings or parents and their offspring is rare (Haig et al. 2001, p. 35; Forsman et al. 2002, p. 18). Hybridization of northern spotted owls with California spotted owls and barred owls has been confirmed through genetic research (Hamer et al. 1994, pp. 487-492; Gutiérrez et al. 1995, pp. 2-3; Dark et al. 1998, p. 52; Kelly 2001, pp. 33-35; Funk et al. 2008, pp. 161-171).

1.2.7 Dispersal Biology
Natal dispersal of spotted owls typically occurs in September and October with a few individuals dispersing in November and December (Miller et al. 1997; Forsman et al. 2002, p. 13). Natal dispersal occurs in stages, with juveniles settling in temporary home ranges between bouts of dispersal (Forsman et al. 2002, pp. 13-14; Miller et al. 1997, p. 143). The median natal dispersal distance is about 10 miles for males and 15.5 miles for females (Forsman et al. 2002, p. 16). Dispersing juvenile spotted owls experience high mortality rates, exceeding 70 percent in some studies (USDI FWS 1990a; Miller 1989, pp. 32-41). Known or suspected causes of mortality during dispersal include starvation, predation, and accidents (Miller 1989, pp. 41-44; USDI FWS 1990a; Forsman et al. 2002, pp. 18-19). Parasitic infection may contribute to these causes of mortality, but the relationship between parasite loads and survival is poorly understood (Hoberg et al. 1989, p. 247; Gutiérrez 1989, pp. 616-617; Forsman et al. 2002, pp. 18-19). Successful dispersal of juvenile spotted owls may depend on their ability to locate unoccupied suitable habitat in close proximity to other occupied sites (LaHaye et al. 2001, pp. 697-698).
There is little evidence that small openings in forest habitat influence the dispersal of spotted owls, but large, non-forested valleys such as the Willamette Valley apparently are barriers to both natal and breeding dispersal (Forsman et al. 2002, p. 22). The degree to which water bodies, such as the Columbia River and Puget Sound, function as barriers to dispersal is unclear, although radio telemetry data indicate that spotted owls move around large water bodies rather than cross them (Forsman et al. 2002, p. 22). Analysis of the genetic structure of spotted owl populations suggests that gene flow may have been adequate between the Olympic Mountains and the Washington Cascades, and between the Olympic Mountains and the Oregon Coast Range (Haig et al. 2001, p. 35).

Breeding dispersal occurs among a small proportion of adult spotted owls; these movements were more frequent among females and unmated individuals (Forsman et al. 2002, pp. 20-21). Breeding dispersal distances were shorter than natal dispersal distances and also are apparently random in direction (Forsman et al. 2002, pp. 21-22). In California spotted owls, a similar subspecies, the probability for dispersal was higher in younger owls, single owls, paired owls that lost mates, owls at low quality sites, and owls that failed to reproduce in the preceding year (Blakesley et al. 2006, p.77). Both males and females dispersed at near equal distances (Blakesley et al. 2006, p. 76). In 72 percent of observed cases of dispersal, dispersal resulted in increased habitat quality (Blakesley et al. 2006, p. 77).

Dispersal can also be described as having two phases: transience and colonization (Courtney et al 2004, p. 5-13). Fragmented forest landscapes are more likely to be used by owls in the transience phase as a means to move rapidly between denser forest areas (Courtney et al 2004, p. 5-13; USDI FWS 2012, p. 14086). Movements through mature and old growth forests occur during the colonization phase when birds are looking to become established in an area (Miller et al 1997, p. 144; Courtney et al 2004, p. 5-13). Transient dispersers use a wider variety of forest conditions for movements than colonizing dispersers, who require habitats resembling nesting/roosting/foraging habitats used by breeding birds (USDI FWS 2012, p. 14086). Dispersal success is likely highest in mature and old growth forest stands where there is more likely to be adequate cover and food supply (USDI FWS 2012, p. 14086).

1.2.8 Food Habits
Spotted owls are mostly nocturnal, although they also forage opportunistically during the day (Forsman et al. 1984, p. 51; 2004, pp. 222-223; Sovern et al. 1994, p. 202). The composition of the spotted owl’s diet varies geographically and by forest type. Generally, flying squirrels (*Glaucomys sabrinus*) are the most prominent prey for spotted owls in Douglas-fir and western hemlock (*Tsuga heterophylla*) forests (Forsman et al. 1984, pp. 40-41) in Washington and Oregon, while dusky-footed wood rats (*Neotoma fuscipes*) are a major part of the diet in the Oregon Klamath, and California Coastal provinces (Forsman et al. 1984, pp. 40-42; 2004, p. 218; Ward et al. 1998, p. 84; Hamer et al. 2001, p. 224). Depending on location, other important prey include deer mice (*Peromyscus maniculatus*), tree voles (*Arborimus longicaudus, A. pomo*), red-backed voles (*Clethrionomys* spp.), gophers (*Thomomys* spp.), snowshoe hare (*Lepus americanus*), bushy-tailed wood rats (*Neotoma cinerea*), birds, and insects, although these species comprise a small portion of the spotted owl diet (Forsman et al. 1984, pp. 40-43; 2004, p. 218; Ward et al. 1998; p. 84; Hamer et al. 2001, p.224).
Other prey species such as the red tree vole (*Arborimus longicaudus*), red-backed voles (*Clethrionomys gapperi*), mice, rabbits and hares, birds, and insects) may be seasonally or locally important (reviewed by Courtney et al. 2004, pp. 4-27). For example, Rosenberg et al. (2003, p. 1720) showed a strong correlation between annual reproductive success of spotted owls (number of young per territory) and abundance of deer mice (*Peromyscus maniculatus*) ($r^2 = 0.68$), despite the fact they only made up 1.6±0.5 percent of the biomass consumed. However, it is unclear if the causative factor behind this correlation was prey abundance or a synergistic response to weather (Rosenberg et al. 2003, p. 1723). Ward (1990, p. 55) also noted that mice were more abundant in areas selected for foraging by owls. Nonetheless, spotted owls deliver larger prey to the nest and eat smaller food items to reduce foraging energy costs; therefore, the importance of smaller prey items, like *Peromyscus*, in the spotted owl diet should not be underestimated (Forsman et al. 2001, p. 148; 2004, pp. 218-219). In the southern portion of their range, where woodrats are a major component of their diet, northern spotted owls are more likely to use a variety of stands, including younger stands, brushy openings in older stands, and edges between forest types in response to higher prey density in some of these areas (Forsman et al. 1984, pp. 24-29).

### 1.2.9 Population Dynamics

The spotted owl is relatively long-lived, has a long reproductive life span, invests significantly in parental care, and exhibits high adult survivorship relative to other North American owls (Forsman et al. 1984; Gutiérrez et al. 1995, p. 5). The spotted owl’s long reproductive life span allows for some eventual recruitment of offspring, even if recruitment does not occur each year (Franklin et al. 2000, p. 576).

In coniferous forests, mean fledgling production of the California spotted owl (*Strix occidentalis occidentalis*), a closely related subspecies, was higher when minimum spring temperatures were higher (North et al. 2000, p. 805), a relationship that may be a function of increased prey availability. Across their range, spotted owls have previously shown an unexplained pattern of alternating years of high and low reproduction, with highest reproduction occurring during even-numbered years (e.g., Franklin et al. 1999, p. 1). Annual variation in breeding may be related to weather (i.e., temperature and precipitation) (Wagner et al. 1996, p. 74; Zabel et al. 1996, p.81 In: Forsman et al. 1996) and fluctuation in prey abundance (Zabel et al. 1996, pp.437-438).

A variety of factors may influence spotted owl population levels. These factors may be density-dependent (e.g., habitat quality, habitat abundance) or density-independent (e.g., climate). Interactions may occur among factors. For example, as habitat quality decreases, density-independent factors may have more influence on survival and reproduction, which tends to increase variation in the rate of growth (Franklin et al. 2000, pp. 581-582). Specifically, weather could have increased negative effects on spotted owl fitness for those owls occurring in relatively lower quality habitat (Franklin et al. 2000, pp. 581-582). A consequence of this pattern is that at some point, lower habitat quality may cause the population to be unregulated (have negative growth) and decline to extinction (Franklin et al. 2000, p. 583). Recent findings suggest that competition with barred owls is an important stressor of spotted owl populations, but habitat availability and climatic patterns also appear to influence survival, occupancy, recruitment, and, to a lesser extent, fecundity (Dugger et al, 201, entire).
Olson et al. (2005, pp. 930-931) used open population modeling of site occupancy that incorporated imperfect and variable detectability of spotted owls and allowed modeling of temporal variation in site occupancy, extinction, and colonization probabilities (at the site scale). The authors found that visit detection probabilities average less than 0.70 and were highly variable among study years and among their three study areas in Oregon. Pair site occupancy probabilities declined greatly on one study area and slightly on the other two areas. However, for all owls, including singles and pairs, site occupancy was mostly stable through time. Barred owl presence had a negative effect on these parameters (see barred owl discussion in the New Threats section below). Recently the variable influences of different covariates for particular demographic parameters across study areas were noted by Dugger et al., 2015, entire. Authors noted that the control areas in Green Diamond Study Area (GDR-C), Washington Study Areas, and the Oregon Coast Study Area (COA) had the highest annual rates of population decline.

1.3 Threats

1.3.1 Reasons for Listing
The spotted owl was listed as threatened throughout its range “due to loss and adverse modification of suitable habitat as a result of timber harvesting and exacerbated by catastrophic events such as fire, volcanic eruption, and wind storms” (USDI FWS 1990a, p. 26114). More specifically, threats to the spotted owl included low populations, declining populations, limited habitat, declining habitat, inadequate distribution of habitat or populations, isolation of provinces, predation and competition, lack of coordinated conservation measures, and vulnerability to natural disturbance (USDI FWS 1992a, pp. 33-41). These threats were characterized for each province as severe, moderate, low, or unknown (USDI FWS 1992a, pp. 33-41). Declining habitat was recognized as a severe or moderate threat to the spotted owl throughout its range, isolation of populations was identified as a severe or moderate threat in 11 provinces, and a decline in population was a severe or moderate threat in 10 provinces. Together, these three factors represented the greatest concerns about range-wide conservation of the spotted owl. Limited habitat was considered a severe or moderate threat in nine provinces, and low populations were a severe or moderate concern in eight provinces, suggesting that these factors were also a concern throughout the majority of the spotted owl’s range. Vulnerability to natural disturbances was rated as low in five provinces.

The degree to which predation and competition might pose a threat to the spotted owl was unknown in more provinces than any of the other threats, indicating a need for additional information. Few empirical studies exist to confirm that habitat fragmentation contributes to increased levels of predation on spotted owls (Courtney et al. 2004, pp. 11-8 to 11-9). However, great horned owls (Bubo virginianus), an effective predator on spotted owls, are closely associated with fragmented forests, openings, and clearcuts (Johnson 1992, p. 84; Laidig and Dobkin 1995, p. 155). As mature forests are harvested, great horned owls may colonize fragmented forests, thereby increasing spotted owl vulnerability to predation.

1.3.2 New Threats
The Service conducted a 5-year review of the spotted owl in 1994 (USDI FWS 2004), for which the Service prepared a scientific evaluation of the status of the spotted owl (Courtney et al.
2004). An analysis was conducted assessing how the threats described in 1990 might have changed by 2004. Some of the key threats identified in 2004 are:

- “Although we are certain that current harvest effects are reduced, and that past harvest is also probably having a reduced effect now as compared to 1990, we are still unable to fully evaluate the current levels of threat posed by harvest because of the potential for lag effects...In their questionnaire responses...6 of 8 panel members identified past habitat loss due to timber harvest as a current threat, but only 4 viewed current harvest as a present threat” (Courtney and Gutiérrez 2004, pp.11-7).

- “Currently the primary source of habitat loss is catastrophic wildfire, although the total amount of habitat affected by wildfires has been small (a total of 2.3 percent of the range-wide habitat base over a 10-year period)” (Courtney and Gutiérrez 2004, pp.11-8).

- “Although the panel had strong differences of opinion on the conclusiveness of some of the evidence suggesting [barred owl] displacement of [spotted owls], and the mechanisms by which this might be occurring, there was no disagreement that [barred owls] represented an operational threat. In the questionnaire, all 8 panel members identified [barred owls] as a current threat, and also expressed concern about future trends in [barred owl] populations” (Courtney and Gutiérrez 2004, pp. 11-8).

Threats, as identified in the 2011 Revised Recovery Plan for the Northern Spotted Owl, continue to emphasize that habitat loss and barred owls are the main threats to northern spotted owl recovery (USDI FWS 2011b, Appendix B).

1.3.2.1 Barred Owls (*Strix varia*)
Barred owls currently appear to be the primary threat to northern spotted owls. With its range expansion to as far south as Marin County, California (Gutiérrez et al. 2004, pp. 7-12 to 7-13; Steger et al. 2006, p.226), the barred owl’s range now completely overlaps that of the northern spotted owl. Barred owls compete with spotted owls for prey (Hamer et al. 2001, p.226, Gutiérrez et al. 2007, p. 187; Livezey and Fleming 2007, p. 319,Weins et al., 2014, pp. 24 and 33) or habitat (Hamer et al. 1989, p.55; Dunbar et al. 1991, p. 467; Herter and Hicks 2000, p. 285; Pearson and Livezey 2003, p. 274). In addition, barred owls have been documented to physically attack spotted owls (Pearson and Livezey 2003, p. 274), and circumstantial evidence strongly indicated that a barred owl killed a spotted owl (Leskiw and Gutiérrez 1998, p. 226). And finally, the growing body of evidence that barred owls are causing significant negative demographic effects based on retrospective examination of long-term data collected on spotted owls (Kelly et al. 2003, p. 46; Pearson and Livezey 2003, p. 267; Olson et al. 2005, p. 921, Forsman et al., 2011, pp. 41-43, 69-70, Dugger et al., 2015, pp. 70-96).

Barred owls were initially thought to be more closely associated with early successional forests than spotted owls, based on studies conducted on the west slope of the Cascades in Washington (Hamer et al 1989, p. 34; Iverson 1993, p.39). However, recent studies conducted in the Pacific Northwest show that barred owls frequently use mature and old-growth forests (Pearson and Livezey 2003, p. 270; Gremel 2005, Schmidt 2006, p. 1; Singleton et al. 2010, pp. 290-292). In Western Oregon, Wiens and others (2011, p. 537) found the overall occupancy probability of
barred owls was high (.89) in an intensively managed forest landscape, representing an increase in barred owl occurrence in that region over the past 30 years (citing Taylor and Forsman 1976). In this Western Oregon study, barred owls were non-randomly distributed, with a highest proportion of public ownership containing a structurally diverse mixture of mature and old forests (p.537). In the fire prone forests of eastern Washington, a telemetry study conducted on barred owls showed that barred owl home ranges were located on lower slopes or valley bottoms, in closed canopy, mature, Douglas-fir forest, while spotted owl sites were located on mid-elevation areas with southern or western exposure, characterized by closed canopy, mature, ponderosa pine or Douglas-fir forest (Singleton et al. 2005, p. 1).

The two species of owls share similar habitats and are likely competing for food resources (Hamer et al. 2001, p. 226, Gutiérrez et al. 2007, p. 187; Livezey and Fleming 2007, p. 319, Weins et al., 2014, pp. 24 and 33). Hamer found a strong diet overlap (76 percent) between northern spotted and barred owl diets (pp. 221, 226). Barred owl diets are more diverse than northern spotted owl diets and include species associated with riparian and other moist habitats (e.g. fish, invertebrates, frogs, and crayfish), along with more terrestrial and diurnal species (Smith et al. 1983; Hamer et al. 2001; Gronau 2005, Weins et al., 2014, p. 24). Even though barred owls appear to be generalists, northern spotted owls may be affected by a sufficient reduction in the density of these prey when they co-exist in an area, leading to a depletion of prey to the extent that the northern spotted owl cannot find an adequate amount of food to sustain maintenance or reproduction (Gutiérrez et al. 2007, p. 187; Livezey and Fleming 2007, p. 319).

There is consensus in the literature on the negative influence barred owls are having on northern spotted owl detectability, site occupancy, reproduction, and survival. The occupancy of historical territories by spotted owls in Washington and Oregon was found to be significantly lower ($p < 0.001$) after barred owls were detected within 0.8 kilometer (0.5 miles) of the territory center but was “only marginally lower” ($p = 0.06$) if barred owls were located more than 0.8 kilometer (0.5 miles) from the spotted owl territory center (Kelly et al. 2003, p. 51). Pearson and Livezey (2003, p. 271) found that there were significantly more barred owl site-centers in unoccupied spotted owl circles than occupied spotted owl circles (centered on historical spotted owl site-centers) with radii of 0.8 kilometer (0.5 miles) ($p = 0.001$), 1.6 kilometer (1 mile) ($p = 0.049$), and 2.9 kilometer (1.8 miles) ($p = 0.005$) in Gifford Pinchot National Forest. In Olympic National Park, Gremel (2005, p. 11) found a significant decline ($p = 0.01$) in spotted owl pair occupancy at sites where barred owls had been detected, while pair occupancy remained stable at spotted owl sites without barred owls. Olson et al. (2005, p. 928) found that the annual probability that a spotted owl territory would be occupied by a pair of spotted owls after barred owls were detected at the site declined by 5 percent in the HJ Andrews study area, 12 percent in the Coast Range study area, and 15 percent in the Tyee study area. In contrast, Bailey et al. (2009, p. 2983), when using a two-species occupancy model, showed no evidence that barred owls excluded northern spotted owls from territories in Oregon. Preliminary results from a barred owl and northern spotted owl radio-telemetry study in Washington reported two northern spotted owls fleeing their territories and traveling six and 15 miles, believed to be as a result of frequent direct encounters with barred owls (Irwin et al. 2010, pp. 3-4). Both northern spotted owls were subsequently found dead (Irwin and Rock. 2010, p. 4). Yackulic and others (2014) modeled the occupancy dynamics of coexisting barred and spotted owls and found the competitive effects lead to a weaker relationship between habitat and northern spotted owl occupancy (Yackulic et al., 2014, pp. 271-273). Regarding territory occupancy dynamics, the most recent demographic meta-analysis found a consistent strong positive association between
the territory extinction rates of spotted owls and the presence of barred owls and in all 11 study areas. Occupancy rates declined as follows (Dugger et al., 2015, p. 74):

- Washington - 56–100 percent in 1995 to 11–26% in 2013;
- Oregon - 61–88% in 1995 to 28–48% in 2013;
- California - 75% to 38% in NWC and from 79% to 47% in HUP between 1995 and 2013;
- In the control areas in the GDR study area, occupancy rates declined from 92% in 1999 to 55% in 2013.

Olson et al. (2004, p. 1048) found that the presence of barred owls had a significant negative effect on the reproduction of spotted owls in the central Coast Range of Oregon (in the Roseburg study area). The conclusion that barred owls had no significant effect on the reproduction of spotted owls in one study (Iverson 2004, p. 89) was unfounded because of small sample sizes (Livezey 2005, p. 102). It is likely that all of the above analyses underestimated the effects of barred owls on the reproduction of spotted owls because spotted owls often cannot be relocated after they are displaced by barred owls (E. Forsman, pers. comm., cited in USDI FWS 2011b, p. B-11). Weins and others (2014, pp. 35-37) found barred owl demographic variables favoring barred owls. Survival and fecundity was higher in barred owls, with the barred owls producing on average 4.4 times the number of young. Dugger et al., 2015 found barred owls and habitat covariates explained little of the temporal variation in fecundity in most study areas and models suggested fecundity was partially influenced by additive effects of regional and annual time variation, the amount of suitable core area habitat, barred owl presence, and the amount of edge habitat. There is substantial annual variation in fecundity among study areas, with support for declining trends in eight areas (CLE, COA, HJA, TYE, KLA, NWC, HUP, and GDR; (Dugger et al., p.91).

Barred owls are also influencing the survival, extinction, and colonization of spotted owls. Anthony et al. (2006, p. 32) found significant evidence for negative effects of barred owls on apparent survival of spotted owls in two of 14 study areas (Olympic and Wenatchee). They attributed the equivocal results for most of their study areas to the coarse nature of their barred owl covariate. Dugger et al. (2011, pp. 2463-2467) confirmed the synergistic effects of barred owls and territory habitat characteristics on extinction and colonization rates of territories by northern spotted owls in Oregon. Some northern spotted owl pairs retained their territories and continued to survive and successfully reproduce during their study even when barred owls were present, but the effects of reduced old growth forest in the core habitat areas were compounded when barred owls were present - extinction rates of northern spotted owl territories nearly tripled when barred owls were detected. Yackulic and others documented similar findings; the effects of interspecific competition were likely to negatively affect spotted owls, both through its immediate effects on local extinction and by indirectly lowering colonization (Yackulic et al., 2014, pp. 271-273).

Most recently, the key vital rates barred owls are most influencing in spotted owl populations appear to be apparent survival and local extinction rates (Dugger et al., 2015, p. 93-98). Additionally, these authors found a positive association between barred owl removals and spotted owl vital rates. Regional climate cycles were found to be strongly associated with apparent survival across all study areas. These recent results suggested that apparent annual survival rates were declining in eight of eleven study areas, and that declines were most strongly
associated with increased detections of barred owls in seven areas. Because adult survival is a critical vital rate influencing the rate of population change in long-lived birds, the authors expressed concern that continued trends as found in this study could threaten the continued persistence of the subspecies.

Monitoring and management of northern spotted owls has become more complicated due to their possible reduced detectability when barred owls are present (Kelly et al. 2003, pp. 51-52; Courtney et al. 2004, p. 7-16; Olson et al. 2005, p. 929; Crozier et al. 2006, p.766-767). Olson et al. (2005, p. 924) found that the presence of barred owls had a significant negative effect on the detectability of spotted owls, and that the magnitude of this effect did not vary among years. In a study evaluating the response behavior and barred owl detection probabilities using spotted owl and barred owl (conspecific) calling, Wiens and others (2011) found that response behavior and detection probabilities of barred owls varied between the types of surveys. These authors found that per-visit barred owl detection probabilities were higher for conspecific surveys. On average, response rates of barred owls were 10 percent lower and single visit detection probabilities were 18 percent lower during surveys for spotted owls compared to conspecific surveys, suggesting that barred owl occurrence is likely higher than what generally was recognized by spotted owl monitoring programs (pp.535-536). Evidence that northern spotted owls were responding less frequently during surveys led the Service and its many research partners to include updates to the northern spotted owl survey protocol, which were based on the probability of detecting northern spotted owls when barred owls are present (USDI Fish and Wildlife Service, 2011).

Hybridization with barred owls may also negatively influence spotted owls, but the overall rangewide impact may not be significant. In an analysis of more than 9,000 banded spotted owls throughout their range, only 47 hybrids were detected (Kelly and Forsman 2004, p. 807). Consequently, hybridization with the barred owl is considered to be “an interesting biological phenomenon that is probably inconsequential, compared with the real threat—direct competition between the two species for food and space” (Kelly and Forsman 2004, p. 808).

Due to the evidence suggesting that barred owls are exacerbating the spotted owl population decline, the Service initiated an experimental barred owl removal study beginning in 2013. The goal of this experiment is to test the feasibility of barred owl removal to determine whether it improves conditions for spotted owls on a small scale. Barred owls will be removed on less than one twentieth of one percent of the range of the barred owl. If the experimental removal of barred owls results in improved spotted owl populations, wider scale treatments as part of a barred owl management strategy may be proposed (USDI 2015). In 2004 it was noted that there is no evidence that the increasing trend in barred owls has stabilized in any portion of the spotted owl’s range in the western United States, and “there are no grounds for optimistic views suggesting that barred owl impacts on northern spotted owls have been already fully realized” (Gutiérrez et al. 2004, pp. 7-38). This situation to date does not appear to have changed.

1.3.2.2 Wildfire
Fire is often considered a primary threat to spotted owls because of its potential to alter habitat rapidly (Bond et al. 2009, p. 1116) and is a major cause of habitat loss on Federal lands (Courtney et al. 2004, executive summary), particularly in the California Klamath Province
At the time of listing there was recognition that large-scale wildfire posed a threat to the spotted owl and its habitat (USDI FWS 1990a, p. 26183). Information since suggests fire may be more of a threat than previously thought. The most recent Northwest Forest Plan Habitat Monitoring Report indicates that range-wide, the nesting/roosting habitat lost from fire (505,800 acres) represents about 31 percent of the total habitat loss. The rate of habitat loss in the relatively dry East Cascades and Klamath provinces is proportionally higher, comprising about 68 percent of nesting/roosting habitats on federal and non-federal lands lost from fire (Table 7, Davis et al., 2015). This is particularly concerning as most of these acres are located in reserved lands (Table 5, Davis et al., 2015).

It may be possible to influence through forest management how fire prone forests will burn and the extent of the fire when it occurs. Forest fuels are currently being managed throughout the spotted owl’s range in an attempt to reduce the levels of fuels that have accumulated during nearly 100 years of effective fire suppression. However, our ability to protect spotted owl habitat and viable populations of spotted owls from large fires through risk-reduction endeavors is uncertain and debated in the literature (Courtney et al. 2004, pp. 12-11, Omi and Martenson 2002, pp. 19-27 Irwin et al., 2004, p. 21; Spies et al. 2006p. 359-361; Hanson et al., 2009, pp. 3-6; Spies et al., 2009, pp. 331-332; Ager et al., 2012, p.282; Odion et al 2014 pp. 10-12, Spies et al., 2012, pp. 10-12; Odion 2014, pp. 46-49)). The Northwest Forest Plan (NWFP) recognized wildfire as an inherent part of managing spotted owl habitat in certain portions of the range. The distribution and size of reserve blocks as part of the NWFP design and the critical habitat network may help mitigate the risks associated with large-scale fire (Lint 2005, p. 77). Fire is a disturbance factor spotted owls have evolved with; however, studies indicate that the effects of wildfire on spotted owls and their habitat are variable, depending on site-specific fire intensity, severity, size, and the availability and distribution of suitable habitat (See review of literature in Appendix B). Within the fire-adapted forests of the spotted owl’s range, spotted owls likely have adapted to withstand fires of variable sizes and severities, but these adaptations evolved under a different habitat baseline and different threats than those recognized currently. More research is needed to understand further the relationship between fire and spotted owl habitat use. Overall, we can conclude that fires are a change agent for northern spotted owl habitat, but there are still many unknowns regarding how much fire benefits or adversely affects northern spotted owl habitat (USDI FWS 2011b, p. III-31).

1.3.2.4 West Nile Virus

West Nile virus (WNV), caused by a virus in the family Flaviviridae, has killed millions of wild birds in North America since it arrived in 1999 (McLean et al. 2001; Caffrey 2003; Caffrey and Peterson 2003, pp. 7-8; Marra et al. 2004, p. 393). Mosquitoes are the primary carriers (vectors) of the virus that causes encephalitis in humans, horses, and birds. Mammalian prey may also play a role in spreading WNV among predators, like spotted owls. Owls and other predators of mice can contract the disease by eating infected prey (Garmendia et al. 2000, p. 3111; Komar et al. 2001). One captive spotted owl in Ontario, Canada, is known to have contracted WNV and died.

Health officials expect that WNV will eventually spread throughout the range of the spotted owl (Courtney et al. 2004; Blakesley et al. 2004, pp. 8-31), but it is unknown how WNV will ultimately affect spotted owl populations. Susceptibility to infection and the mortality rates of
infected individuals vary among bird species (Blakesley et al. 2004, pp. 8-33), but most owls appear to be quite susceptible. For example, breeding Eastern screech owls (Megascops asio) in Ohio experienced 100 percent mortality (T. Grubb pers. comm. in Blakesley et al. 2004, pp. 8-33). Barred owls, in contrast, showed lower susceptibility (B. Hunter pers. comm. in Blakesley et al. 2004, pp. 8-34). Some level of innate resistance may occur (Fitzgerald et al. 2003), which could explain observations in several species of markedly lower mortality in the second year of exposure to WNV (Caffrey and Peterson 2003). Wild birds also develop resistance to WNV through immune responses (Deubel et al. 2001). The effects of WNV on bird populations at a regional scale have not been large, even for susceptible species (Caffrey and Peterson 2003), perhaps due to the short-term and patchy distribution of mortality (K. McGowan, pers. comm., cited in Courtney et al. 2004) or annual changes in vector abundance and distribution.

Blakesley et al. (2004, pp. 8-35) offer competing propositions for the likely outcome of spotted owl populations being infected by WNV. One scenario is that spotted owls can tolerate severe, short-term population reductions due to WNV, because spotted owl populations are widely distributed and number in the several hundreds to thousands. An alternative scenario is that WNV will cause unsustainable mortality, due to the frequency and/or magnitude of infection, thereby resulting in long-term population declines and extirpation from parts of the spotted owl’s current range. Thus far, no mortality in wild, northern spotted owls has been recorded; however, WNV is a potential threat of uncertain magnitude and effect (Blakesley et al. 2004, pp. 8-34).

1.3.2.5 Sudden Oak Death
Sudden oak death was recently identified as a potential threat to the spotted owl (Courtney et al. 2004). This disease is caused by the fungus-like pathogen, Phytophthora ramorum that was recently introduced from Europe and is rapidly spreading. The disease is now known to extend over 650 km from south of Big Sur, California to Curry County, Oregon (Rizzo and Garbelotto 2003, p. 198), and has reached epidemic proportions in oak (Quercus spp.) and tanoak (Lithocarpus densiflorus) forests along approximately 300 kilometers of the central and northern California coast (Rizzo et al. 2002, p. 733). At the present time, sudden oak death is found in natural stands from Monterey to Humboldt Counties, California, and has reached epidemic proportions in oak (Quercus spp.) and tanoak (Lithocarpus densiflorus) forests along approximately 300 km of the central and northern California coast (Rizzo et al. 2002, p. 733). It has also been found near Brookings, Oregon, killing tanoak and causing dieback of closely associated wild rhododendron (Rhododendron spp.) and evergreen huckleberry (Vaccinium ovatum) (Goheen et al. 2002, p. 441). It has been found in several different forest types and at elevations from sea level to over 800 m. During a study completed between 2001 and 2003 in California, one-third to one-half of the hiker’s present in the study area carried infected soil on their shoes (Davidson et al. 2005, p. 587), creating the potential for rapid spread of the disease. Sudden oak death poses a threat of uncertain proportion because of its potential impact on forest dynamics and alteration of key prey and spotted owl habitat components (e.g., hardwood trees - canopy closure and nest tree mortality); especially in the southern portion of the spotted owl’s range (Courtney et al. 2004, pp. 11-8).

1.3.2.6 Inbreeding Depression, Genetic Isolation, and Reduced Genetic Diversity
Inbreeding and other genetic problems due to small population sizes were not considered an imminent threat to the spotted owl at the time of listing. Recent studies show no indication of
reduced genetic variation and past bottlenecks in Washington, Oregon, or California (Barrowclough et al. 1999, p. 922; Haig et al. 2004, p. 36). Canadian populations may be more adversely affected by issues related to small population size including inbreeding depression, genetic isolation, and reduced genetic diversity (Courtney et al. 2004, pp. 11-9). A 2004 study (Harestad et al. 2004, p. 13) indicates that the Canadian breeding population was estimated to be less than 33 pairs and annual population decline may be as high as 35 percent. In 2007, a recommendation was made by the Spotted Owl Population Enhancement Team to remove northern spotted owls from the wild in British Columbia (USDI FWS 2012, p. 14078). This recommendation resulted in the eventual capture of the remaining 16 wild northern spotted owls in British Columbia for a captive breeding program (USDI FWS 2012, p. 14078). Low and persistently declining populations throughout the northern portion of the species range (see “Population Trends” below) may be at increased risk of losing genetic diversity. Hybridization of northern spotted owls with California spotted owls, Mexican spotted owls, and barred owls has been confirmed through genetic research (Funk et al. 2008, p. 1; Hamer et al. 1994, p. 487; Gutiérrez et al. 1995, p. 3; Dark et al. 1998, p. 50; Kelly 2001, pp. 33-35).

1.3.2.7 Climate Change
Climate change, combined with effects from past management practices is influencing current forest ecosystem processes and dynamics by increasing the frequency and magnitude of wildfires, insect outbreaks, drought, and disease (USFWS 2011b, pp. III-5 - III-11). In the Pacific Northwest, mean annual temperatures rose 0.8° C (1.5° F) in the 20th century and are expected to continue to warm from 0.1° to 0.6° C (0.2° to 1° F) per decade (Mote and Salathe 2010, p. 29). Climate change models generally predict warmer, wetter winters and hotter, drier summers and increased frequency of extreme weather events in the Pacific Northwest (Salathe et al. 2010, pp. 72-73).

Predicted climate changes in the Pacific Northwest have implications for forest disturbances that affect the quality and distribution of spotted owl habitat. Both the frequency and intensity of wildfires and insect outbreaks are expected to increase over the next century in the Pacific Northwest (Littell et al. 2010, p. 130). One of the largest projected effects on Pacific Northwest forests is likely to come from an increase in fire frequency, duration, and severity. Westerling et al. (2006, pp. 940-941) analyzed wildfires and found that since the mid-1980s, wildfire frequency in western forests has nearly quadrupled compared to the average of the period from 1970-1986. The total area burned is more than 6.5 times the previous level and the average length of the fire season during 1987-2003 was 78 days longer compared to 1978-1986 (Westerling et al. 2006, p. 941). The area burned annually by wildfires in the Pacific Northwest is expected to double or triple by the 2080s (Littell et al. 2010, p. 140). Wildfires are now the primary cause of spotted owl habitat loss on Federal lands, with over 236,000 acres of habitat loss attributed to wildfires from 1994 to 2007 (Davis et al. 2011, p. 123).

Potential changes in temperature and precipitation have important implications for spotted owl reproduction and survival. Wet, cold weather during the winter or nesting season, particularly the early nesting season, has been shown to negatively affect spotted owl reproduction (Olson et al. 2004, p. 1039, Dugger et al. 2005, p. 863), survival (Franklin et al. 2000 pp. 576-577, Olson et al. 2004, p. 1039, Glenn et al. 2011, p. 1279), and recruitment (Glenn et al. 2010, pp.2446-2547). Cold, wet weather may reduce reproduction and/or survival during the breeding season.
due to declines or decreased activity in small mammal populations so that less food is available during reproduction when metabolic demands are high (Glenn et al. 2011, pp. 1288-1289). Cold, wet nesting seasons may increase the mortality of nestlings due to chilling and reduce the number of young fledged per pair per year (Franklin et al. 2000, p.557, Glenn et al. 2011, p. 1286). Most recently, the relationships between spotted owl populations and climate was complex and variable, but rangewide, Dugger and others (2015, page) suggested that survival of young spotted owls and their ability to become part of the breeding population increased when winters were drier. This may become a factor in population numbers in the future, given climate change predictions for the Pacific Northwest include warmer, wetter winters.

Drought or hot temperatures during the summer have also been linked to reduced spotted owl recruitment (Glenn et al. 2010, p. 2549). Drier, warmer summers and drought conditions during the growing season strongly influence primary production in forests, food availability, and the population sizes of small mammals that spotted owls prey upon (Glenn et al. 2010, p. 2549).

In summary, climate change is likely to exacerbate some existing threats to the spotted owl such as the projected potential for increased habitat loss from drought-related fire, tree mortality, insects and disease, as well as affecting reproduction and survival during years of extreme weather.

1.3.2.8 Disturbance
Northern spotted owls may also respond physiologically to a disturbance without exhibiting a significant behavioral response. In response to environmental stressors, vertebrates secrete stress hormones called corticosteroids (Campbell 1990, p. 925). Although these hormones are essential for survival, extended periods with elevated stress hormone levels may have negative effects on reproductive function, disease resistance, or physical condition (Carsia and Harvey 2000, pp. 517-518; Saplosky et al. 2000, p. 1). In avian species, the secretion of corticosterone is the primary non-specific stress response (Carsia and Harvey 2000, p. 517). The quantity of this hormone in feces can be used as a measure of physiological stress (Wasser et al. 1997, p. 1019). Recent studies of fecal corticosterone levels of northern spotted owls indicate that low intensity noise of short duration and minimal repetition does not elicit a physiological stress response (Tempel and Gutiérrez 2003, p. 698; Tempel and Gutiérrez 2004, p. 538). However, prolonged activities, such as those associated with timber harvest, may increase fecal corticosterone levels depending on their proximity to northern spotted owl core areas (Wasser et al. 1997, p.1021; Tempel and Gutiérrez 2004, p. 544).

The effects of noise on spotted owls are largely unknown, and whether noise is a concern has been a controversial issue. The effect of noise on birds is extremely difficult to determine due to the inability of most studies to quantify one or more of the following variables: 1) timing of the disturbance in relation to nesting chronology; 2) type, frequency, and proximity of human disturbance; 3) clutch size; 4) health of individual birds; 5) food supply; and 6) outcome of previous interactions between birds and humans (Knight and Skagan 1998, pp. 355-358). Additional factors that confound the issue of disturbance include the individual bird’s tolerance level, ambient sound levels, physical parameters of sound, and how it reacts with topographic characteristics and vegetation, and differences in how species perceive noise.
Information specific to behavioral responses of spotted owls to disturbance is limited, research indicates that recreational activity can cause Mexican spotted owls (*S. o. lucida*) to vacate otherwise suitable habitat (Swarthout and Steidl 2001, p. 314) and helicopter overflights can reduce prey delivery rates to nests (Delaney et al. 1999, p. 70). Additional effects from disturbance, including altered foraging behavior and decreases in nest attendance and reproductive success, have been reported for other raptors (White and Thurow 1985, p. 14; Andersen et al. 1989, p. 296; McGarigal et al. 1991, p. 5).

Although it has not been conclusively demonstrated, it is anticipated that nesting spotted owls may be disturbed by heat and smoke as a result of burning activities during the breeding season.

### 1.4 Conservation Needs of the Spotted Owl

Based on the above assessment of threats, the spotted owl has the following habitat-specific and habitat-independent conservation (i.e., survival and recovery) needs:

**1.4.1 Habitat-specific Needs**

1. Large blocks of habitat capable of supporting clusters or local population centers of spotted owls (e.g., 15 to 20 breeding pairs) throughout the owl’s range;

2. Suitable habitat conditions and spacing between local spotted owl populations throughout its range that facilitate survival and movement;

3. Suitable habitat distributed across a variety of ecological conditions within the northern spotted owl’s range to reduce risk of local or widespread extirpation;

4. A coordinated, adaptive management effort to reduce the loss of habitat due to catastrophic wildfire throughout the spotted owl’s range, and a monitoring program to clarify whether these risk reduction methods are effective and to determine how owls use habitat treated to reduce fuels; and

5. In areas of significant population decline, sustain the full range of survival and recovery options for this species in light of significant uncertainty.

**1.4.2 Habitat-independent Needs**

1. A coordinated research and adaptive management effort to better understand and manage competitive interactions between spotted and barred owls; and

2. Monitoring to understand better the risk that WNV and sudden oak death pose to spotted owls and, for WNV, research into methods that may reduce the likelihood or severity of outbreaks in spotted owl populations.

**1.4.3 Conservation Strategy**

Since 1990, various efforts have addressed the conservation needs of the northern spotted owl and attempted to formulate wide-ranging strategies based upon these needs. These efforts began with the ISC’s Conservation Strategy (Thomas et al. 1990); they continued with the designation
of critical habitat (USDI FWS 1992a), the Draft Recovery Plan (USDI FWS 1992b), and the Scientific Analysis Team report (Thomas et al. 1993), report of the Forest Ecosystem Management Assessment Team (Thomas and Raphael 1993); the NWFP (USDA FS and USDI BLM 1994a), and they culminated with the Revised Recovery Plan (USDI FWS 2011) and the revised final critical habitat designation (USDI FWS 2011). Each of these strategies was based upon the reserve design principles first articulated in the ISC’s report, which are summarized as follows:

- Species that are well distributed across their range are less prone to extinction than species confined to small portions of their range.

- Large blocks of habitat, containing multiple pairs of the species, are superior to small blocks of habitat with only one to a few pairs.

- Blocks of habitat that are close together are better than blocks far apart.

- High quality habitat that occurs in contiguous blocks is better than habitat that is more fragmented.

- Habitat between blocks is more effective as dispersal habitat if it resembles suitable habitat.

1.4.4 Federal Contribution to Recovery

Since it was signed on April 13, 1994, the NWFP has guided the management of Federal forest lands within the range of the spotted owl (USDA FS and USDI BLM 1994a, 1994b). The NWFP was designed to protect large blocks of old growth forest and provide habitat for species that depend on those forests including the spotted owl. Land management under the NWFP was expected to provide for the long term conservation of the spotted owl by including land use allocations which would sustain population clusters of northern spotted owls (i.e., demographic support) and maintain connectivity between populations. Certain land use allocations in the plan contribute to supporting population clusters: LSRs, Managed Late-successional Areas, and Congressionally Reserved areas. Riparian Reserves, Adaptive Management Areas, and Administratively Withdrawn areas can provide both demographic support and connectivity/dispersal between the larger blocks, but were not necessarily designed for that purpose. To ensure a predictable and sustainable level of timber sales, “matrix” areas were designated to support timber production while also retaining some connectivity and biological legacy components important to old-growth obligate species (in 100-acre owl cores, 15 percent late-successional provision, etc. (USDA FS and USDI BLM 1994a, USDA FWS 1994b) which would persist into future managed timber stands.

One of the overall goals of the NWFP was to protect and enhance habitat for the NSO on federal lands. The NWFP predicted that over time, the rate of habitat losses would be reduced and the spotted owl population would decline in the Matrix land use allocation, while the population would stabilize and eventually increase within LSRs as habitat conditions improved over the next 50 to 100 years (Thomas and Raphael 1993, p. II-31; USDA FS and USDI BLM 1994a, 1994b, p.3&4-229).
Periodic assessments monitoring changes in NSO habitat on federal and non-federal lands within its geographic range in the United States have been published every five years since 2005 (Lint 2005, Davis et al., 2011; Forsman et al., 2011, Davis et al., 2015). These assessments evaluate assumptions made during development of the NWFP; including the assumption that habitat would not decline faster than five percent per decade. Key points of the 2015 NWFP Monitoring Report (Davis et al., 2015, pp. 20, 36-39):

- Reductions in habitat rangewide have not exceeded expectations. During its first two decades, rangewide losses of nesting/roosting habitat on federal lands were estimated at total rangewide loss of 7.2 percent (5.2 percent (474,300 ac) from wildfire, 1.3 percent (116,100 ac) from timber harvesting, and 0.7 percent (59,800 ac) from insects, disease, or other natural disturbances)
- Rangewide there has been a gross loss of about 650,200 ac of nesting/roosting habitat on federal lands or about 7.2 percent of what was present right before the NWFP was established.
- Most of the losses (73 percent) occurred within the federally reserved land use allocations, or a loss of about 7.5 percent of the habitat reserved by the NWFP.
- Non-reserved federal land use allocations experienced a 6.4 percent rangewide loss of habitat that existed in 1993.
- Wildfires were the primary cause of habitat loss since 1993, accounting for about 82 percent of the loss in reserved allocations and about half of the loss in non-reserved allocations.
- Some areas are affected by nesting/roosting habitat loss disproportionally particularly within the Oregon and California Klamath provinces - 56 percent of the rangewide habitat loss on federal lands occurred in these two provinces.
- Oregon and California Klamath physiographic provinces experienced the largest amounts (132,000 to 199,800 ac respectively) and double digit percentage losses (13.2 and 10.7 percent respectively) since the plan was implemented.
- Some habitat growth/recruitment is occurring in portions of the range and appears to have begun to help offset losses.
- These authors project that if localized habitat losses continue at the current rates within some provinces in the reserved land allocations, the effectiveness of the Plan to maintain the distributed and connected NSO populations across the range is in question (Davis et al., 2011, p. 54).

Similar to the periodic assessments monitoring changes in NSO habitat on federal and non-federal lands, population trends are also monitored on eleven study sites in Washington, Oregon, and California. The most recent meta-analysis has determined a mean annual decline of 3.8 percent decline rangewide (Dugger et al., 2015), an increase from the 2.8 percent decline reported in 2011. Refer to Population Dynamics and Barred Owl sections above for more information pertaining to recent findings.

On June 28, 2011 the Service published the Revised Recovery Plan for the Northern Spotted Owl (USDI FWS 2011b). The recovery plan identifies threats from competition with barred owls, ongoing loss of northern spotted owl habitat as a result of timber harvest, loss or modification of northern spotted owl habitat from uncharacteristic wildfire, and loss of amount and distribution of northern spotted owl habitat as a result of past activities and disturbances (USDI FWS 2011b,
To address these threats, the current recovery strategy identifies five main steps: 1) development of a range-wide habitat modeling framework; 2) barred owl management; 3) monitoring and research; 4) adaptive management; and 5) habitat conservation and active forest restoration (USDI FWS 2011b, p. II-2). The recovery plan lists recovery actions that address each of these items, some of which were retained from the 2008 recovery plan. The Managed Owl Conservation Areas and Conservation Support Areas recommended in the 2008 recovery plan are not a part of the recovery strategy outlined in the revised recovery plan. The Service completed a range-wide, multi-step habitat modeling process to help evaluate and inform management decisions and critical habitat development (USDI FWS 2011b, Appendix C).

The revised recovery plan (USDI FWS 2011b) recommended implementing a robust monitoring and research program for the spotted owl. The recovery plan encourages these efforts by laying out the following primary elements to evaluate progress toward meeting recovery criteria: monitoring spotted owl population trends, comprehensive barred owl research and monitoring, continued habitat monitoring; inventory of spotted owl distribution, and; explicit consideration for climate change mitigation goals consistent with recovery actions (USDI FWS 2011b, p. II-5). The revised recovery plan also strongly encourages land managers to be aggressive in the implementation of recovery actions. In other words, land managers should not be so conservative that, to avoid risk, they forego actions that are necessary to conserve the forest ecosystems that are necessary to the long-term conservation of the spotted owl. But they should also not be so aggressive that they subject spotted owls and their habitat to treatments where the long-term benefits do not clearly outweigh the short-term risks. Finding the appropriate balance to this dichotomy will remain an ongoing challenge for all who are engaged in spotted owl conservation (USDI FWS 2011b, p. II-12). The revised recovery plan estimates that recovery of the spotted owl could be achieved in approximately 30 years (USDI FWS 2011b, p. II-3).

1.4.5 Conservation Efforts on Non-Federal Lands
In the report from the Interagency Scientific Committee (Thomas et al. 1990, p. 3, p. 272), the draft recovery plan (USDI FWS 1992b), and the report from the Forest Ecosystem Management Assessment Team (Thomas and Raphael 1993, p. IV-189), it was noted that limited Federal ownership in some areas constrained the ability to form a network of old-forest reserves to meet the conservation needs of the spotted owl. In these areas in particular, non-Federal lands would be important to the range-wide goal of achieving conservation and recovery of the spotted owl. The U.S. Fish and Wildlife Service’s primary expectations for private lands are for their contributions to demographic support (pair or cluster protection) to Federal lands, or their connectivity with Federal lands. In addition, timber harvest within each state is governed by rules that provide protection of spotted owls or their habitat to varying degrees.

There are 17 current and ongoing conservation plans (CPs) including Habitat Conservation Plans (HCPs) and Safe Harbor Agreements (SHAs) that have incidental take permits issued for northern spotted owls. Eight of these are located in Washington, three in Oregon, and six in California (USDI FWS 2011b, p. A-15). The CPs range in size from 76 acres to more than 1.8 million acres, although not all acres are included in the mitigation for northern spotted owls. In total, the CPs cover approximately 3 million acres (9.4 percent) of the 32 million acres of non-Federal forest lands in the range of the northern spotted owl. The period of time that the HCPs
will be in place ranges from 20 to 100 years. While each CP is unique, there are several general approaches to mitigation of incidental take:

- Reserves of various sizes, some associated with adjacent Federal reserves
- Forest harvest that maintains or develops nesting habitat
- Forest harvest that maintains or develops foraging habitat
- Forest management that maintains or develops dispersal habitat
- Deferral of harvest near specific sites

**Washington.** In 1996, the State Forest Practices Board adopted rules (Washington Forest Practices Board 1996) that would contribute to conserving the spotted owl and its habitat on non-Federal lands. Adoption of the rules was based in part on recommendations from a Science Advisory Group that identified important non-Federal lands and recommended roles for those lands in spotted owl conservation (Hanson et al. 1993, pp. 11-15; Buchanan et al. 1994, p. ii). The 1996 rule package was developed by a stakeholder policy group and then reviewed and approved by the Forest Practices Board (Buchanan and Swedeen 2005, p. 9). Spotted owl-related HCPs in Washington generally were intended to provide demographic or connectivity support (USDI FWS 1992b, p. 272). There are over 2.1 million acres of land in six HCPs and two SHAs (USDI FWS 2011b, p. A-15). Some of these CPs focus on providing nesting/roosting habitat throughout the area or in strategic locations; while others focus on providing connectivity through foraging habitat and/or dispersal habitat. In addition, there is a long term habitat management agreement covering 13,000 acres in which authorization of take was provided through an incidental take statement (section 7) associated with a Federal land exchange (USDI FWS 2011b, p. A-15).

**Oregon.** The Oregon Forest Practices Act provides for protection of 70-acre core areas around sites occupied by an adult pair of spotted owls capable of breeding (as determined by recent protocol surveys), but it does not provide for protection of spotted owl habitat beyond these areas (Oregon Department of Forestry 2007, p. 64). In general, no large-scale spotted owl habitat protection strategy or mechanism currently exists for non-Federal lands in Oregon. The three spotted owl-related HCPs currently in effect cover more than 300,000 acres of non-Federal lands. These HCPs are intended to provide some nesting habitat and connectivity over the next few decades (USDI FWS 2011b, p. A-16). On July 27, 2010, the Service completed a programmatic SHA with the Oregon Department of Forestry that will enroll up to 50,000 acres of non-federal lands within the State over 50 years. The primary intent of this programmatic SHA is to increase time between harvests and to lightly to moderately thin younger forest stands that are currently not habitat to increase tree diameter and stand diversity (USDI FWS 2011b, p. A-16).

**California.** The California State Forest Practice Rules, which govern timber harvest on private lands, require surveys for spotted owls in suitable habitat and to provide protection around activity centers (California Department of Forestry and Fire Protection 2007, pp. 85-87). Under the Forest Practice Rules, no timber harvest plan can be approved if it is likely to result in
incidental take of federally listed species, unless the take is authorized by a Federal incidental take permit (California Department of Forestry and Fire Protection [CALFIRE] 2007, pp. 85-87). Currently CALFIRE reviews all timber harvest plans to ensure that take was is not likely to occur. Two industrial timberland owners operate under spotted owl management plans that have been reviewed by the U.S. Fish and Wildlife Service and that specify basic measures for spotted owl protection. Four HCPs and two SHAs authorizing take of spotted owls have been approved; these HCPs cover more than 622,000 acres of non-Federal lands. Implementation of these plans is intended to provide for spotted owl demographic and connectivity support to NWFP lands (USDI FWS 2011b, p. A-16).

1.5 Current Condition of the Spotted Owl

The current condition of the species incorporates the effects of all past human activities and natural events that led to the present-day status of the species and its habitat (USDI FWS and USDC NMFS 1998, pp. 4-19).

1.5.1 Range-wide Habitat and Population Trends

1.5.1.1 Range-wide Habitat Baseline

The Service has used information provided by the USFS, BLM, and National Park Service to update the habitat baseline conditions by tracking relative habitat changes over time on Federal lands for northern spotted owls on several occasions, since the northern spotted owl was listed in 1990 (USDA and USDI 1994b, USDI 2001, Lint 2005, Davis et al. 2011). The estimate of 7.4 million acres used for the NWFP in 1994 (USDA and USDI 1994b) was believed to be representative of the general amount of northern spotted owl habitat on NWFP lands at that time. Periodic range-wide evaluations of habitat, as compared to the Final Supplemental Environmental Impact Statement (FSEIS; USDA and USDI 1994b), are necessary to determine if the rate of potential change to northern spotted owl habitat is consistent with the change anticipated in the NWFP: a reduction in suitable habitat of approximately 2.5 percent per decade (USDA and USDI 1994a, p. 46). The most recent mapping effort estimates a range-wide gross loss of about 650,200 ac of nesting/roosting habitat on federal lands, amounting to about 7.2 percent of what was present in 1993. Most of the losses (73 percent) occurred within the federally reserved land use allocations, or a loss of about 7.5 percent of the habitat reserved by the NWFP. The primary cause of habitat loss since 1993 was wildfires, accounting for about 82 percent of the rangewide loss in reserved allocations (388,500 acres) and about half of the loss in non-reserved allocations (85,900 ac) (Davis et al. 2015, p. 17).

Although the spatial resolution of this new habitat map currently makes it unsuitable for tracking habitat effects at the scale of individual projects, it is informative for tracking provincial and range-wide habitat trends and now considers these data as the best available information on the distribution and abundance of extant spotted owl habitat within its range as of 2006 for Oregon and Washington, and 2007 for California (when the base imagery was collected).

April 13, 2004, marked the start of the second decade of the NWFP. Decade-specific baselines and summaries of effects by State, physiographic province and land use function from proposed management activities and natural events are not provided here, but are consistent with expected
habitat changes under the NWFP. In February 2013, the Service adopted the 2006/2007 satellite imagery data on spotted owl habitat as the range-wide habitat baseline for Federal lands which effectively resets the timeframe for establishing changes in the distribution and abundance of spotted owl habitat. On that basis, the assessment of local, provincial and range-wide spotted owl habitat status in this and future Opinions as well as Biological Assessments will rely on these 2006/07 habitat data to characterize changes in the status of spotted owl habitat. Note that tables in this database have not yet been updated to reflect the adjusted values estimated by Davis and others (2015).

1.5.1.2 Service’s Consultation Database
In general, the analytical framework of these section 7 consultations focuses on the reserve and connectivity goals established by the NWFP land-use allocations (USDA FS and USDI BLM 1994a), with effects expressed in terms of changes in suitable northern spotted owl habitat within those land-use allocations. To update information considered in 2001 (USDI 2001), the Service designed the Consultation Effects Tracking System database in 2002, which recorded impacts to northern spotted owls and their habitat at different spatial and temporal scales. In 2011, the Service replaced the Consultation Effects Tracking System with the Consulted on Effects Database located in the Service’s Environmental Conservation Online System (ECOS). The ECOS Database corrected technical issues with the Consultation Effects Tracking System. Data are currently entered into the ECOS Database under various categories including; land management agency, land-use allocation, physiographic province, and type of habitat affected.

1.5.1.3 Range-wide Consultation Effects: 1994 to December 7, 2015
The Service updated the ECOS Database to reflect the 2006/2007 habitat baseline developed for the NWFP 15-year monitoring report (Davis et al. 2011, Appendix D, Table D) but at the time of this writing, this had not been updated to reflect the data within the 2015 NWFP 20-year report. On NWFP lands between 1994 and December 22, 2015, the Service has consulted on the proposed removal/downgrade of approximately 207,070 acres (Table A) or 2.3 percent of the 8.854 million acres of northern spotted owl nesting/roosting habitat estimated by Davis et al. (2011) to have occurred on Federal lands (Table A). These changes in suitable northern spotted owl habitat are consistent with the expectations for implementation of the NWFP, which anticipated a rate of habitat harvested at 2.5 percent per decade (USDA FS and USDI BLM 1994a).

The Service tracks habitat changes on non-NWFP lands through consultations for long-term Habitat Conservation Plans, Safe Harbor Agreements, or Tribal Forest Management Plans. Service consultations conducted since 1992 have documented the eventual loss of over 522,431 acres (about 6 percent) habitat on non-NWFP lands. Most of these losses have yet to be realized because they are part of large-scale, long-term Habitat Conservation Plans.
Table A: Range-wide Aggregate of Changes to NRF\(^1\) Habitat Acres From Activities Subject to Section 7 Consultations and Other Causes

NWFP Timeframe (Decade):

<table>
<thead>
<tr>
<th>Land Ownership</th>
<th>Consulted On Habitat Changes(^2)</th>
<th>Other Habitat Changes(^3)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Removed/Downgraded</td>
<td>Maintained/Improved</td>
</tr>
<tr>
<td>NWFP (FS,BLM,NPS)</td>
<td>207,070</td>
<td>549,778</td>
</tr>
<tr>
<td>Bureau of Indian Affairs / Tribes</td>
<td>113,926</td>
<td>28,372</td>
</tr>
<tr>
<td>Habitat Conservation Plans/Safe Harbor Agreements</td>
<td>339,692</td>
<td>14,539</td>
</tr>
<tr>
<td>Other Federal, State, County, Private Lands</td>
<td>68,813</td>
<td>28,447</td>
</tr>
<tr>
<td>Total Changes</td>
<td>729,501</td>
<td>621,136</td>
</tr>
</tbody>
</table>

Notes:

1. Nesting, roosting, foraging (NRF) habitat. In California, suitable habitat is divided into two components; nesting - roosting (NR) habitat, and foraging (F) habitat. The NR component most closely resembles NRF habitat in Oregon and Washington. Due to differences in reporting methods, effects to suitable habitat compiled in this, and all subsequent tables include effects for nesting, roosting, and foraging (NRF) for 1994-6/26/2001. After 6/26/2001 suitable habitat includes NRF for Washington and Oregon but only nesting and roosting (NR) for California.

2. Includes both effects reported in USFWS 2001 and subsequent effects reported in the Northern Spotted Owl Consultation Effects Tracking System (web application and database.)

3. Includes effects to suitable NRF habitat (as generally documented through technical assistance, etc.) resulting from wildfires (not from suppression efforts), insect and disease outbreaks, and other natural causes, private timber harvest, and land exchanges not associated with consultation.

1.5.1.4 Range-wide Consultation Effects: 2006/2007 to December 22, 2015
Because the data developed for the NWFP monitoring program is only current through 2006/2007, the Service continues to rely on information compiled in the spotted owl consultation database to summarize effects to current owl habitat at provincial and range-wide scales.
Table B: Summary of northern spotted owl suitable habitat (NRF)\textsuperscript{1} acres removed or downgraded on Federal lands within the Northwest Forest Plan area through timber harvest, natural disturbance, or other management actions as documented through section 7 consultation and technical assistance. Range-wide changes by land-use function from 2006 to present.

<table>
<thead>
<tr>
<th>Suitable Habitat (NRF) Effects</th>
<th>Reserves (LSR, MLSA, CRA)\textsuperscript{3}</th>
<th>Non-reserves (AWA, AMA, Matrix)\textsuperscript{3}</th>
<th>Totals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Evaluation Baseline (2006/2007)\textsuperscript{2}</td>
<td>5,961,000</td>
<td>2,594,200</td>
<td>8,555,200</td>
</tr>
<tr>
<td>Removed/Downgraded (timber harvest only)\textsuperscript{4}</td>
<td>8,514</td>
<td>40,763</td>
<td>49,277</td>
</tr>
<tr>
<td>Removed/Downgraded (other management activities)\textsuperscript{5}</td>
<td>3,660</td>
<td>2,575</td>
<td>6,235</td>
</tr>
<tr>
<td>Subtotal</td>
<td>12,174</td>
<td>43,338</td>
<td>55,512</td>
</tr>
<tr>
<td>Removed/Downgraded (natural disturbance)\textsuperscript{6}</td>
<td>38,015</td>
<td>29,789</td>
<td>67,804</td>
</tr>
<tr>
<td>Total Net Change</td>
<td>50,189</td>
<td>73,127</td>
<td>123,316</td>
</tr>
<tr>
<td>Baseline Balance</td>
<td>5,910,811</td>
<td>2,521,073</td>
<td>8,431,884</td>
</tr>
<tr>
<td>Habitat Maintained\textsuperscript{7}</td>
<td>53,338</td>
<td>64,390</td>
<td>117,728</td>
</tr>
</tbody>
</table>

Notes:

1. Nesting, roosting, foraging (NRF) habitat. In California, suitable habitat is divided into two components; nesting - roosting (NR) habitat, and foraging (F) habitat. The NR component most closely resembles NRF habitat in Oregon and Washington. Due to differences in reporting methods, effects to suitable habitat compiled in this, and all subsequent tables include effects for nesting, roosting, and foraging (NRF) for 1994-6/26/2001. After 6/26/2001 suitable habitat includes NRF for Washington and Oregon but only nesting and roosting (NR) for California.

2. Includes both effects reported in USFWS 2001 and subsequent effects reported in the Northern Spotted Owl Consultation Effects Tracking System (web application and database.). Note consulted on effects to NSO habitat (NR and F) for Fruit Growers’ HCP is included in these totals, but has not yet been entered into the web application database.

3. Includes effects to suitable NRF habitat (as generally documented through technical assistance, etc.) resulting from wildfires (not from suppression efforts), insect and disease outbreaks, and other natural causes, private timber harvest, and land exchanges not associated with consultation.

Table B summarizes the habitat impacts on Federal lands that have occurred since 2006/2007 through December 22, 2015. Note these data reflect data provided through the section 7 consultation efforts and may not reflect the same data displayed in Davis et al., 2015. The rangewide effects from 2014 or 2015 fires were not available for the preparation of this biological opinion. This database reports an estimated 123,320 acres of nesting, roosting, and foraging habitat has been lost from Federal lands since 2006/2007 due to land management activities and natural events. When overall habitat loss is evaluated as a proportion of provincial baselines (Table C), the Oregon Cascades and the California Klamath provinces have proportional losses greater than the loss of habitat across all provinces (about 51 percent of rangewide loss). While variable among the individual provinces, most of the impacts are due to
management-related actions and are concentrated within the ‘Non-Reserves’ land-use allocations (about 73,000 acres in non-reserve land allocations and about 50,000 acres reported). When habitat loss is evaluated as a proportion of the affected acres range-wide from management activities, Oregon reports the highest proportion, with almost 48,000 acres removed (about 87 of rangewide loss from management activities). Washington reports about 6,500 acres (12 percent) and California about 1,010 acres removed (about two percent). Wildland fires have resulted in considerable loss of NRF habitat within the California Klamath Province (about 40 percent of total lost habitat range-wide).
Table C. Summary of northern spotted owl suitable habitat (NRF\(^3\)) acres removed or downgraded as documented through Section 7 consultations on all Federal Lands within the Northwest Forest Plan area. Environmental baseline and summary of effects by State, Physiographic Province, and Land Use Function from 2006 to present.

Tue Dec 22 17:56:43 MST 2015

<table>
<thead>
<tr>
<th>State</th>
<th>Physiographic Province (^2)</th>
<th>Evaluation Baseline (2006/2007) (^3)</th>
<th>Habitat Removed/Downgraded (^4)</th>
<th>Land Management Effects</th>
<th>Habitat Loss from Natural Events</th>
<th>Total NRF removed/downgraded</th>
<th>% Provincial Baseline Affected</th>
<th>% Range-wide Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@</td>
<td>@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@</td>
<td>@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@ @@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@</td>
<td>@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@</td>
<td>@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@</td>
<td>@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@</td>
<td>@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@</td>
<td>@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@</td>
</tr>
</tbody>
</table>
| WA        | Eastern Cascades               | 462,400/181,100/643,500/2,700/2,238 | 4,938/1,559/132/1,691/6,629 | 1.03/5.38 | WA/CA: 5.46/16.68
|           | Olympic Peninsula              | 729,000/33,400/672,400/6/0/0 | 7,639/2,434/107/20,566/5.46 | 1.31/23.44
|           | Western Cascades               | 1,031,600/246,600/1,278,200/779/834 | 1,613/0/3/1,616/0.13 | 1.31/12.74
|           | Western Lowlands               | 24,300/0/24,300/0/0 | 0/0/0/0 | 0/0
| OR        | Eastern Cascades               | 248,500/128,400/376,900/2,994/7,499 | 10,49/7,639/2434/10,07/20,566 | 5.46/16.68
|           | Cascade West                  | 1,275,200/939,600/2,214,800/1,587/25,029 | 26,61/761/1,531/2,292/28,908 | 1.31/23.44
|           | Coast Range                   | 494,400/113,400/607,800/750/1,623 | 2,373/0/0/2,373/0.39 | 1.92/12.74
|           | Klamath Mountains             | 549,400/334,900/884,300/2,999/5,464 | 8,463/3,427/3,816/7,243/15,706 | 1.78/12.74
|           | Willamette Valley             | 700/2,600/3,300/0/0 | 0/0/0/0 | 0/0
| CA        | Cascades                      | 101,700/102,900/204,600/10/1 | 11/325/0/325/336 | 0.16/0.27
|           | Coast                         | 132,900/10,100/143,000/274/1 | 275/0/175/175/450 | 0.31/0.36
|           | Klamath                       | 910,900/501,200/1,412,100/75/649 | 724/24,301/21,700/46,001/46,725 | 3.31/37.89
| Total     |                              | 5,961,00/0/0/2,594,20/0/0/8,555,20/0/12,174/43,338 | 55,51/2/38,015/29,789/67,804 | 123,316/1.44/100 |

Notes:

1. Nesting, roosting, foraging (NRF\(^3\)) habitat. In WA/OR, the values for Nesting/Roosting habitat generally represent the distribution of suitable owl habitat, including foraging habitat. In CA, foraging habitat occurs in a much broader range of forest types than what is represented by nesting/roosting habitat. Baseline information for foraging habitat as a separate category in CA is currently not available at a provincial scale.


3. Spotted owl nesting and roosting habitat on all Federal lands (includes USFS, BLM, NPS, DoD, USFWS, etc.) as reported by Davis et al. 2011 for the the Northwest Forest Plan 15-Year Monitoring Report (PNW-GTR-80, Appendix D). NR habitat acres are approximate values based on 2006 (OR/WA) and 2007 (CA) satellite imagery (Not updated for 20-Year Monitoring Report).

4. Estimated NRF habitat removed or downgraded from land management (timber sales) or natural events (wildfires) as documented through section 7 consultation or technical assistance. Effects reported here include all acres removed or downgraded from 2006 to present. Effects in California reported here only include effects
to Nesting/Roosting habitat. Foraging habitat removed or downgraded in California is not summarized in this table.

5. Reserve land use allocations under the NWFP intended to provide demographic support for spotted owls include LSR, MLSA, and CRA. Non-reserve allocations under the NWFP intended to provide dispersal connectivity between reserves include AWA, AMA, and MX.

1.5.1.5

**Spotted Owl Population Trends and Distribution**

There are no estimates of the historical population size and distribution of spotted owls, although they are believed to have inhabited most old-growth forests throughout the Pacific Northwest prior to modern settlement (mid-1800s), including northwestern California (USDI FWS 1989, pp. 2-17).

The current range of the spotted owl extends from southwest British Columbia through the Cascade Mountains, coastal ranges, and intervening forested lands in Washington, Oregon, and California, as far south as Marin County (USDI FWS 1990a, p. 26114). The range of the spotted owl is partitioned into 12 physiographic provinces (Figure 1) based on recognized landscape subdivisions exhibiting different physical and environmental features (USFWS 1992a, p. 31). The spotted owl has become rare in certain areas, such as British Columbia, southwestern Washington, and the northern coastal ranges of Oregon.

Population estimates are difficult to achieve on wide-ranging species such as the Northern spotted owl. As of July 1, 1994, there were about 5,430 known site-centers of spotted owl pairs or resident singles: about 85 sites (16 percent) in Washington, 2,890 sites (53 percent) in Oregon, and 1,685 sites (31 percent) in California (USDI FWS 1995, p. 9495). The totals above represent the cumulative number of locations recorded in the three states, not population estimates. Estimated populations were modeled during the 2012 critical habitat designation which projected a steady-state range-wide population size of roughly 3,400 female NSOs. Population sizes varied regionally from low in the north, especially the northwest (e.g., about 100 in the North Coast Olympics and West Cascades North modeling regions), to high in parts of southern Oregon and northern California (e.g. about 750 each in the Inner California Coast, Klamath East, Klamath West, Redwood Coast, and West Cascades South modeling regions) (Dunk et al., 2012, p. 64). These estimates likely over represent the numbers of females as this modeling effort was based on 2008 NSO data and does not reflect subsequent declines over the last seven years. Additionally, the actual number of currently occupied spotted owl locations across the range is unknown because many areas remain un-surveyed (USFWS 2011b, p. A-2) and many historical sites are no longer occupied because spotted owls have been displaced by barred owls, timber harvest, or severe fires. Additionally, it is possible that some new sites have been established due to reduced timber harvest on Federal lands since 1994.

Because the existing survey coverage and effort are insufficient to produce reliable range-wide estimates of population size, demographic data are used to evaluate trends in spotted owl populations. Analysis of demographic data can provide an estimate of the finite rate of population change (\( \lambda \)), which provides information on the direction and magnitude of population change. A \( \lambda \) of 1.0 indicates a stationary population, meaning the population is neither increasing nor decreasing. A \( \lambda \) of less than 1.0 indicates a decreasing population, and a \( \lambda \) of
greater than 1.0 indicates a growing population. Demographic data are analyzed periodically to estimate trends in the populations of the spotted owl.

As described above, after the implementation of the NWFP, populations were expected to decline in the short term, and then stabilize or increase after 50–100 years (Thomas et al. 1990, Lint et al. 1999). Previous demographic analyses suggested that populations confirmed this projection, but the rates of decline began to taper through 2009 (Dugger et al., 2015, Table 26, p.97); however, these rates have varied among study areas (Franklin et al. 1999, Anthony et al. 2006, Forsman et al. 2011).

The most recent meta-analysis results suggest that the rates of decline have now increased range-wide, as summarized below (Dugger et al., 2015, entire). Estimated declines in annual rates of population change and occupancy rates were found to continue from past reports in all parts of their range (Table D). That rate of decline was increasing in many areas, including southern Oregon and northern California (Dugger et al., 2015, p. 91).

**Table D. Summary of spotted owl population trends from in demographic study areas (Dugger et al., 2015, Table 25, p.97).**

<table>
<thead>
<tr>
<th>Study Area</th>
<th>Fecundity</th>
<th>Apparent Survival¹</th>
<th>Occupancy Rates</th>
<th>Mean Population change / population change</th>
<th>% Population Change¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cle Elum</td>
<td>Declining</td>
<td>Declining</td>
<td>Declining</td>
<td>.916/No trend</td>
<td>-77%</td>
</tr>
<tr>
<td>Rainier</td>
<td>No trend</td>
<td>Declining</td>
<td>Declining</td>
<td>.953/No trend</td>
<td>-61%</td>
</tr>
<tr>
<td>Olympic</td>
<td>No trend</td>
<td>No trend</td>
<td>Declining</td>
<td>.961/No trend</td>
<td>-59%</td>
</tr>
<tr>
<td>Coast Ranges</td>
<td>Declining</td>
<td>No trend</td>
<td>Declining</td>
<td>.949/Declining</td>
<td>-64%</td>
</tr>
<tr>
<td>HJ Andrews</td>
<td>Declining</td>
<td>Declining</td>
<td>Declining</td>
<td>.965/Declining</td>
<td>-47%</td>
</tr>
<tr>
<td>Tyee</td>
<td>Declining</td>
<td>Declining</td>
<td>Declining</td>
<td>.976/Declining</td>
<td>-31%</td>
</tr>
<tr>
<td>Klamath</td>
<td>Declining</td>
<td>No trend</td>
<td>Declining</td>
<td>.972/Declining</td>
<td>-34%</td>
</tr>
<tr>
<td>Southern Cascades</td>
<td>No trend</td>
<td>Declining</td>
<td>Declining</td>
<td>.963/No trend</td>
<td>-44%</td>
</tr>
<tr>
<td>NW California</td>
<td>Declining</td>
<td>Declining</td>
<td>Declining</td>
<td>.970/Declining</td>
<td>-55%</td>
</tr>
<tr>
<td>Hoopa</td>
<td>Declining</td>
<td>Declining</td>
<td>Declining</td>
<td>.977/Declining</td>
<td>-32%</td>
</tr>
<tr>
<td>Green Diam. - CB</td>
<td>Declining</td>
<td>Declining</td>
<td>Declining</td>
<td>.988/Declining</td>
<td>-31%</td>
</tr>
<tr>
<td>Green Diam. - TB</td>
<td>Declining</td>
<td>Declining</td>
<td>Declining</td>
<td>.961/Declining</td>
<td>-26%</td>
</tr>
<tr>
<td>Green Diam. - CA</td>
<td>**</td>
<td>**</td>
<td>Declining</td>
<td>.878/**</td>
<td>-41%</td>
</tr>
<tr>
<td>Green Diam. - TA</td>
<td>**</td>
<td>**</td>
<td>N/A²</td>
<td>1.030/**</td>
<td>-9%</td>
</tr>
</tbody>
</table>

¹ With the exception of the Green Diamond study area, percent population change was based on estimates of *realized population change* in 2011, the last year for which an estimate of population change could be generated.

² Data used for occupancy modeling in the GDR study area excluded treatment areas after Barred Owl removals began in 2009.

** Too few years since Barred Owl removal to evaluate a trend.

CB = control before barred owl removal; TB=treatment before removal; CA=control after removal; TA= treatment after removal
Individual study area annual rates of population change ($\lambda$) were based on capture histories for 5,992 territorial owls from all age classes. Almost all study areas showed declining population trends, with strong evidence of declines in all of Washington study areas, the coastal and HJ Andrews study areas in Oregon and three California study areas. Less of a decline was found Tyee, Klamath, and Cascades study areas of Oregon. The only study area with an increasing population was observed in Green Diamond treatment areas after barred owl removals began in 2009 (GDR-TA). The rates of decline were variable across the range; the highest were in Green Diamond control areas (GDR-CA) after 2009 (12.0% annual decline), and the Washington CleElum study area (8.4 percent), and the lowest was in the Green Diamond before barred owl removals began in treatment areas in 2009 (1.2 percent annual decline). The weighted mean population change for all study areas (excluding GDR-TB) was an estimated decline of 3.8 percent per year from 1985-2013 (Dugger et al., 2015, p.70-71). This is an increase from 2.8 percent reported by Forsman et al., 2011).

Recent estimates of realized population change (change in populations since studies were initiated) showed sharper declines in the northern portion of the range. Populations in Washington declined by 55–77 percent; sites in Oregon ranged from 31 percent in TYE to 68 percent in COA, with two cases more uncertain (KLA and TYE). The 95% confidence intervals in these sites widely overlapped 1.0 for most or all of the last several years. Declines in California, ranged from 32 – 55 percent, with exceptions in HUP and treatment areas of GDR T where confidence limits overlapped 1.0 in many years, indicating uncertainty about annual rates of population change in these areas.

Decreases in adult apparent survival rates were an important factor contributing to decreasing population trends. Dugger et al., 2015 (p.58) found strong evidence that barred owls negatively affected spotted owl populations, largely from increasing local territory extinction rates and decreasing apparent survival. The amount of suitable habitat, local weather, and regional climatic patterns also were related to survival, occupancy (via colonization rate), and recruitment. Associated effects to fecundity were weaker. Five of the 11 study areas included either a negative linear or log-linear time trend on survival.

There are few spotted owls remaining in British Columbia. Chutter et al. (2004, p. v) suggested immediate action was required to improve the likelihood of recovering the spotted owl population in British Columbia. In 2007, personnel in British Columbia captured and brought into captivity the remaining 16 known wild spotted owls (USFWS 2011b, p. A-6). Prior to initiating the captive-breeding program, the population of spotted owls in Canada was declining by as much as 10.4 percent per year (Chutter et al. 2004, p. v). The amount of previous interaction between spotted owls in Canada and the United States is unknown.

1.5.3 Spotted Owl Recovery Units
The 2011 Final Revised Recovery Plan for the Northern Spotted Owl determined that the 12 existing physiographic provinces meet the criteria for use as recovery units (USDI FWS 2011b, p. III 1-2). The proposed project is within the California Klamath Physiographic Province (Ibid, p. A-2). Recovery criteria, as described in the 2011 Final Revised Recovery Plan (p. 11-3), are measurable and achievable goals that are believed to be achievable through implementation of the recovery actions described in the recovery plan. Achievement of the recovery criteria will
take time and is intended to be measured over the life of the plan, not on a short-term basis. The
criteria are the same for all 12 identified recovery units. The four recovery criteria are: 1) stable
population trend, 2) adequate population distribution, 3) continued maintenance and recruitment
of northern spotted owl habitat, and 4) post-delisting monitoring (USDI FWS 2011b, p III-3).

As discussed above, demographic data are used to evaluate trends in northern spotted owl
populations. In the recent meta-analysis, California overall shows similar overall trends as other
study areas throughout the range. One Demographic Study Area most resembling the Westside
action area occurs within the California Klamath Province (Northwest California study area in
Willow Creek (NWC)). The Hoopa Study Area also occurs in the Klamath Province and is
composed of mixed-conifer vegetation types, but with a much more significant tanoak
component than found in NWC or the Westside action area. NSOs in the NWC study area were
found to have declining trends in fecundity, apparent survival, and population trends. In
particular, strong evidence for declines was found in all areas in California. These findings are
similar to other study areas across the range, where the overall results suggest that the influences
of barred owls could be the primary cause of NSO rangewide population declines. Where barred
owls were present, there were corresponding declines in apparent survival and increased local
extinction rates of NSO, and a positive association between barred owl removals and NSO
demographic performance. Overall, across the range (California included), apparent survival and
local extinction rates appeared to be the key vital rates through which barred owls influenced
NSO populations. Also, the associations of habitat and demographic rates of NSOs were similar
to findings of previous studies which supported recommendations to preserve as much high-
quality habitat in late-successional forests as possible across the range of the subspecies (see
Dugger et al., p. 98).
LITERATURE CITED


Gutiérrez, R. J., M. Cody, S. Courtney, and A. Franklin. 2007. The Invasion of Barred Owls


Kelly, E.G. and E.D. Forsman. 2004. Recent records of hybridization between barred owls (Strix varia) and northern spotted owls (S. occidentalis caurina). Auk 121:806-810.


Sisco, C.L. 1990. Seasonal home range and habitat ecology of spotted owls in northwestern California. M.S. Thesis. Humboldt State University, Arcata, California.


USDA Forest Service, and USDI Bureau of Land Management. 1994a. Record of decision for amendments to Forest Service and Bureau of Land Management planning documents within the range of the northern spotted owl; standards and guidelines for management of habitat for late-successional and old-growth forest related species within the range of the northern spotted owl. Portland, Oregon.
USDA Forest Service and USDI Bureau of Land Management. 1994b. Final supplemental environmental impact statement on management of habitat for late-successional and old-growth forest related species within the range of the northern spotted owl. Portland, Oregon. Two vols. and appendices.


USDI Fish and Wildlife Service. 1994a. Letter from D.C. Frederick (USFWS) to J. Belcher (Washington Department of Natural Resources) dated February 1, 1994, regarding correction to spotted owl home-range data for the Olympic Peninsula. USFWS, Olympia, Washington.


Appendix D

NORTHERN SPOTTED OWL CRITICAL HABITAT

Conservation Role of Critical Habitat

Critical habitat contains those areas that are essential to the conservation of the species. The expectation of critical habitat is to ameliorate habitat-based threats. The recovery of the northern spotted owl requires habitat conservation in concert with the implementation of recovery actions that address other, non-habitat-based threats to the species, including the barred owl (USFWS 2012, p. 71879). The conservation role of northern spotted owl critical habitat is to “adequately support the life-history needs of the species to the extent that well-distributed and inter-connected northern spotted owl nesting populations are likely to persist within properly functioning ecosystems at the critical habitat unit and range-wide scales” (USDI FWS 2012, p. 71938). The specific conservation role of the subunits included in the action area is described in the Environmental Baseline in the document.

Physical or Biological Features and Primary Constituent Elements

When designating critical habitat, the Service considers “the physical or biological features [PBFs] essential to the conservation of the species and which may require special management considerations or protection” (50 CFR §424.12; USDI FWS 2012, p. 71897). “These include, but are not limited to: (1) space for individual and population growth and for normal behavior; (2) food, water, air, light, minerals, or other nutritional or physiological requirements; (3) cover or shelter; (4) sites for breeding, reproduction, or rearing (or development) of offspring; and (5) habitats that are protected from disturbance or are representative of the historical, geographical, and ecological distributions of a species” (USDI FWS 2012, p. 71897). The final critical habitat rule states that “for the northern spotted owl, the physical or biological features essential to the conservation of the species are forested areas that are used or likely to be used for nesting, roosting, foraging, or dispersing” (USDI FWS 2012, p. 71897). The final critical habitat rule for the northern spotted owl provides an in-depth discussion of the PBFs, which may be referenced for further detail (USDI FWS 2012, pp. 71897-71906).

The primary constituent elements (PCEs) are the specific elements of the PBFs that are considered essential to the conservation of the northern spotted owl and are those elements that make areas suitable as nesting, roosting, foraging, and dispersal habitat (USDI FWS 2012, p. 71904). The PCEs should be arranged spatially such that it is favorable to the persistence of populations, survival, and reproductive success of resident pairs, and survival of dispersing individuals until they are able to recruit into a breeding population (USDI FWS 2012, p. 71904). Within areas essential for the conservation and recovery of the northern spotted owl, the Service has determined that the PCEs are:

1) Forest types that may be in early-, mid-, or late-seral stages and that support the northern spotted owl across its geographic range;
2) Habitat that provides for nesting and roosting;
3) Habitat that provides for foraging;
4) Habitat to support the transience and colonization phases of dispersal, which in all cases would optimally be composed of nesting, roosting, or foraging habitat (PCEs 2 or 3), but which may also be composed of other forest types that occur between larger blocks of nesting, roosting, or foraging habitat (USDI FWS 2012, pp. 72051-72052).

Some critical habitat subunits may contain all of the above PCEs and support multiple life history requirements of the northern spotted owl, while some subunits may contain only those PCEs necessary to support the species particular use of that habitat. All of the areas designated as critical habitat, however, do contain PCE 1, forest type. Therefore, PCE 1 always occurs in concert with at least one other PCE (PCE 2, 3, or 4; USDI FWS 2012, p. 72051). Northern spotted owl critical habitat does not include meadows, grasslands, oak woodlands, aspen woodlands, or manmade structures and the land upon which they are located (USDI FWS 2012, p. 71918).

**PCE 1: Forest Types**

The primary forest types that support the northern spotted owl are: Sitka spruce, western hemlock, mixed conifer, mixed evergreen, grand fir, Pacific silver fir, Douglas-fir, white fir, Shasta red fir, redwood/Douglas-fir, and moister ponderosa pine (USDI FWS 2012, p. 72051). Specific to the California Klamath Province, the western portions of this zone support a diverse mix of mesic forest communities interspersed with drier forest types. Forests of mixed conifers and evergreen hardwoods are typical of the zone. Eastern portions of this zone have a Mediterranean climate with increased occurrence of ponderosa pine.

**PCE 2: Nesting and Roosting Habitat**

Nesting and roosting habitat for northern spotted owl provides structural features for nesting, protection from adverse weather conditions, and cover to reduce predation risk for adults and young. In many cases, the same habitat may also provide for foraging. Nesting and roosting habitats must provide: sufficient habitat for foraging by territorial pairs, moderate to high canopy closure (60 to over 80 percent), multilayered and multispecies canopies with large overstory trees (20 to 30 inches dbh), basal area greater than 240 square feet per acre, high diversity of tree diameters, high incidence of large live trees with various deformities (e.g., large cavities, broken tops, mistletoe infections, and other evidence of decadence), large snags and large accumulations of woody debris on the ground, and sufficient open space beneath the canopy for flight (USDI FWS 2012, p. 72051).

**PCE 3: Foraging Habitat (California Klamath Emphasis)**

Across the range of the northern spotted owl, nesting and roosting habitats also provide foraging opportunities; however, northern spotted owls may use other habitat types for foraging as well. The components of PCE 3 for northern spotted owl foraging habitat in the Klamath and Northern California Interior Coast Ranges are: stands of nesting and roosting habitat and other forest types with mature and old-forest characteristics, presence of conifer species (such as incense-cedar, sugar pine, and Douglas fir) and hardwood species (such as bigleaf maple, black oak, live oaks, and madrone) as well as shrubs, forest patches within riparian zones of low-order streams and
edges between conifer and hardwood forest stands, brushy openings and dense young stands or low-density forest patches within a mosaic of mature and older forest habitat, high canopy cover (87 percent at frequently used sites), multiple canopy layers, mean stand diameter greater than 21 inches, increasing mean stand diameter and densities of trees greater than 26 inches which increase foraging habitat quality, large accumulations of fallen trees and other woody debris on the ground, and sufficient open space below the canopy for northern spotted owls to fly (USDI FWS 2012, p. 72051-72052).

PCE 4: Dispersal habitat

Northern spotted owl dispersal habitat is habitat that supports the transience and colonization phases of owl dispersal, and in all cases would optimally be composed of nesting, roosting, or foraging habitat (PCE 2 or 3), but which may also be composed of other forest types that occur between larger blocks of northern spotted owl nesting, roosting, or foraging habitat. In cases where nesting, roosting, or foraging habitats are insufficient to provide for dispersing or nonbreeding owls, the specific dispersal PCEs are: habitat supporting the transience phase of dispersal (protection from avian predators, minimal foraging opportunities, younger and less diverse forests that provide some roosting structures and foraging opportunities) and habitat supporting the colonization phase of dispersal (nesting, roosting, and foraging habitat but in smaller amounts than needed to support a nesting pair) (USDI FWS 2012, p. 72052).

Current Condition of Northern Spotted Owl Critical Habitat

The current condition of critical habitat incorporates the effects of all past human activities and natural events that led to the present-day status of the habitat (USDI and USDC 1998, pg. 4-19). With the revision of spotted owl critical habitat, the range-wide condition has been “reset” as of December 4, 2012.

Range-Wide Critical Habitat Baseline

A number of data sources can be used to evaluate critical habitat baseline. The Service updated the ECOS Database to reflect the 2006/2007 habitat baseline developed for the NWFP 15-year monitoring report (Davis et al. 2011, Appendix D, Table D). At the time of this writing, these data have not been updated within the ECOS database to reflect baseline data reported in the NWFP 20-year monitoring report (Davis et al., 2015). The database indicates that approximately 9.577 million acres of spotted owl critical habitat existed in 2006/2007 (Table 1). The tracking database quantifies effects to critical habitat by physiographic provinces rather than designated units and subunits, which makes it problematic to compare incremental changes in specific areas of interest such as subunits. As of December 22, 2015, the database reports consulted on actions that have removed or downgraded about 9,845 acres from 2012 critical habitat range-wide.

To supplement the ECOS database, information obtained for this analysis describes effects to areas in affected critical habitat units from 1993-2012 in addition to changes from fire since 2012 (Davis 2015 pers. comm). Between 1993 and 2012, about 72,700 acres have been lost from human-caused or natural events in areas that are within the current boundaries of critical habitat units 9 and 10. Between 2012 and 2015, approximately 15,540 acres within Unit 9 burned at
high/moderate severity fire, and about 16,200 acres within Unit 10 burned at high/moderate severity (Table 2). Effects specific to PCEs are not known, but these broad-scale impacts in a relatively short time period are representative of current threats to NSO habitats described in Davis et al. 2015.
Table 1: Summary of Northern Spotted Owl Critical Habitat NRF\textsuperscript{1} Acres Removed or Downgraded as documented through Section 7 Consultations on Northwest Forest Plan (NWFP) Lands; Environmental Baseline and Summary of Effects By State, Physiographic Province and Land Use Function.  Tue Dec 22 17:59:14 MST 2015

<table>
<thead>
<tr>
<th>Physiographic Province\textsuperscript{2}</th>
<th>Evaluation Baseline</th>
<th>Habitat Removed/Downgraded</th>
<th>% Provincial Baseline Affected</th>
<th>% Range-wide Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total Designated Critical Habitat Acres\textsuperscript{3}</td>
<td>Nesting/Roosting Acres\textsuperscript{4}</td>
<td>Land Use Allocations\textsuperscript{5}</td>
<td>Habitat Loss to Natural Events</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Reserves</td>
<td>Non-Reserves</td>
</tr>
<tr>
<td>WA</td>
<td>Eastern Cascades</td>
<td>1,022,960</td>
<td>416,069</td>
<td>265</td>
</tr>
<tr>
<td></td>
<td>Olympic Peninsula</td>
<td>507,165</td>
<td>238,390</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Western Cascades</td>
<td>1,387,567</td>
<td>667,173</td>
<td>268</td>
</tr>
<tr>
<td>OR</td>
<td>Cascades East</td>
<td>529,652</td>
<td>181,065</td>
<td>887</td>
</tr>
<tr>
<td></td>
<td>Cascades West</td>
<td>1,965,407</td>
<td>1,161,780</td>
<td>648</td>
</tr>
<tr>
<td></td>
<td>Coast Range</td>
<td>1,151,874</td>
<td>535,602</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Klamath Mountains</td>
<td>911,681</td>
<td>481,577</td>
<td>1,306</td>
</tr>
<tr>
<td>CA</td>
<td>Cascades</td>
<td>243,205</td>
<td>98,243</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Coast</td>
<td>149,044</td>
<td>58,278</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Klamath</td>
<td>1,708,787</td>
<td>752,131</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>9,577,342</td>
<td>4,590,308</td>
<td>3,381</td>
</tr>
</tbody>
</table>

Notes:
1. Nesting, roosting, foraging (NRF) habitat. In California, suitable habitat is divided into two components; nesting - roosting (NR) habitat, and foraging (F) habitat. The NR component in CA most closely resembles NRF habitat in Oregon and Washington.


3. Northern spotted owl critical habitat as designated December 4, 2012 (77 FR 71876). Total designated critical habitat acres listed here (9,577,342 acres) are derived from GIS data, and vary slightly from the total acres (9,577,969 acres) listed in the Federal Register (-627 acres).


5. Reserve land use allocations under the NWFP intended to provide demographic support for spotted owls include LSR, MLSA, and CRA. Non-reserve allocations under the NWFP intended to provide dispersal connectivity between reserves include AWA, AMA, and MX.

Table 2. NSO nesting/roosting habitat lost within boundaries of 2012 critical habitat from 1993-2012 (acres) (Davis, pers.comm).

<table>
<thead>
<tr>
<th>SUBUNIT</th>
<th>Harvest</th>
<th>Wildfire</th>
<th>Insects</th>
<th>Other</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>KLW 7</td>
<td>598</td>
<td>18,542</td>
<td>83</td>
<td>19</td>
<td>19,243</td>
</tr>
<tr>
<td>KLW 3</td>
<td>568</td>
<td>2,593</td>
<td>38</td>
<td>9</td>
<td>3,208</td>
</tr>
<tr>
<td>KLW 4</td>
<td>1,177</td>
<td>5</td>
<td>91</td>
<td>2</td>
<td>1,274</td>
</tr>
<tr>
<td>KLW 1</td>
<td>1,572</td>
<td>154</td>
<td>85</td>
<td>4</td>
<td>1,815</td>
</tr>
<tr>
<td>KLE 6</td>
<td>1,151</td>
<td>408</td>
<td>95</td>
<td>9</td>
<td>1,662</td>
</tr>
<tr>
<td>KLE 3</td>
<td>849</td>
<td>1,917</td>
<td>71</td>
<td>0</td>
<td>2,836</td>
</tr>
<tr>
<td>KLE 5</td>
<td>1,249</td>
<td>693</td>
<td>157</td>
<td>1</td>
<td>2,099</td>
</tr>
<tr>
<td>KLE 2</td>
<td>1,301</td>
<td>0</td>
<td>41</td>
<td>0</td>
<td>1,342</td>
</tr>
<tr>
<td>KLW 2</td>
<td>1,032</td>
<td>2,363</td>
<td>88</td>
<td>4</td>
<td>3,488</td>
</tr>
<tr>
<td>KLE 4</td>
<td>2,084</td>
<td>1,812</td>
<td>144</td>
<td>10</td>
<td>4,051</td>
</tr>
<tr>
<td>KLE 7</td>
<td>561</td>
<td>0</td>
<td>70</td>
<td>1</td>
<td>632</td>
</tr>
<tr>
<td>KLW 8</td>
<td>444</td>
<td>1,841</td>
<td>97</td>
<td>0</td>
<td>2,383</td>
</tr>
<tr>
<td>KLE 1</td>
<td>1,015</td>
<td>14,142</td>
<td>62</td>
<td>3</td>
<td>15,221</td>
</tr>
<tr>
<td>KLW 5</td>
<td>50</td>
<td>1</td>
<td>4</td>
<td>12</td>
<td>66</td>
</tr>
<tr>
<td>KLW 9</td>
<td>206</td>
<td>10,307</td>
<td>99</td>
<td>0</td>
<td>10,612</td>
</tr>
<tr>
<td>KLW 6</td>
<td>124</td>
<td>2,613</td>
<td>19</td>
<td>4</td>
<td>2,759</td>
</tr>
<tr>
<td>Totals</td>
<td>13,981</td>
<td>57,391</td>
<td>1,243</td>
<td>78</td>
<td>72,692</td>
</tr>
</tbody>
</table>
Zones of Habitat Associations used by Northern Spotted Owls

Differences in patterns of habitat associations used by the northern spotted owl across its range suggest four different broad zones of habitat use, which we characterize as the (1) West Cascades/Coast Ranges of Oregon and Washington, (2) East Cascades, (3) Klamath and Northern California Interior Coast Ranges, and (4) Redwood Coast (Figure 3.1). We configured these zones based on a qualitative assessment of similarity among ecological conditions and habitat associations within the 11 different regions analyzed during the critical habitat designation process (see USDI FWS 2012). These four zones capture the range in variation of some of the PBFs essential to the conservation of the northern spotted owl. Summarized below are the PBFs for each of these four zones, emphasizing zone-specific features that are distinctive within the context of general patterns that apply across the entire range of the northern spotted owl.

![Figure 1. Eleven regions and four zones of habitat associations used by northern spotted owls in Washington, Oregon, and California.](image)

West Cascade/Coast Ranges of Oregon and Washington

This zone includes five regions west of the Cascade crest in Washington and Oregon (Western Cascades North, Central and South; North Coast Ranges and Olympic Peninsula; and Oregon Coast Ranges; USDI FWS 2011, p. C–13). Climate in this zone is characterized by high rainfall and cool to moderate temperatures. Variation in elevation between valley bottoms and ridges is relatively low in the Coast Ranges, creating conditions favorable for development of contiguous forests. In contrast, the Olympic and Cascade ranges have greater topographic variation with many high-elevation areas supporting permanent snowfields and glaciers. Douglas-fir and western hemlock dominate forests used by northern spotted owls in this zone. Root diseases and wind-throw are important natural disturbance mechanisms that form gaps in forested areas.
Flying squirrels (*Glaucomys sabrinus*) are the dominant prey, with voles and mice also representing important items in the northern spotted owl’s diet.

Our habitat modeling indicates that vegetation structure has a dominant influence on owl population performance, with habitat pattern and topography also contributing. High canopy cover, high density of large trees, high numbers of sub-canopy vegetation layers, and low to moderate slope positions are all important features.

Nesting habitat in this zone is mostly limited to areas with large trees with defects such as mistletoe brooms, cavities, or broken tops. The subset of foraging habitat that is not nesting/roosting habitat generally had slightly lower values than nesting habitat for canopy cover, tree size and density, and canopy layering. Prey species (primarily the northern flying squirrel) in this zone are associated with mature to late-successional forests, resulting in small differences between nesting, roosting, and foraging habitats.

**East Cascades**

This zone includes the Eastern Cascades North and Eastern Cascades South regions (USDI FWS 2011, p. C–13). This zone is characterized by a continental climate (cold, snowy winters and dry summers) and a high frequency of natural disturbance due to fires and outbreaks of forest insects and pathogens. Flying squirrels are the dominant prey species, but the diet of northern spotted owls in this zone also includes relatively large proportions of bushy-tailed woodrats (*Neotoma cinerea*), snowshoe hare (*Lepus americanus*), pika (*Ochotona princeps*), and mice (*Microtus spp.* (Forsman et al. 2001, pp. 144–145).

Our modeling indicates that habitat associations in this zone do not show a pattern of dominant influence by one or a few variables (USDI FWS 2011, Appendix C). Instead, habitat association models for this zone included a large number of variables, each making a relatively modest contribution (20 percent or less) to the predictive ability of the model. The features that were most useful in predicting northern spotted owl habitat quality were vegetation structure and composition, and topography, especially slope position in the north. Other efforts to model habitat associations in this zone have yielded similar results (e.g., Gaines et al. 2010, pp. 2048–2050; Loehle et al. 2011, pp. 25–28).

Relative to other portions of the northern spotted owls’ range, nesting and roosting habitat in this zone includes relatively younger and smaller trees, likely reflecting the common usage of dwarf mistletoe (*Arceuthobium douglasii*) brooms (dense growths) as nesting platforms (especially in the north). Forest composition that includes high proportions of Douglas-fir is also associated with this nesting structure. Additional foraging habitat in this zone generally resembles nesting and roosting habitat, with reduced canopy cover and tree size, and reduced canopy layering. High prey diversity suggests relatively diverse foraging habitats are used. Topographic position was an important variable, particularly in the north, possibly reflecting competition from barred owls (Singleton et al. 2010, pp. 289, 292). Barred owls, which have been present for over 30 years in the northern portions of this zone, preferentially occupy valley-bottom habitats, possibly compelling northern spotted owls to establish territories on less productive, mid-slope locations (Singleton et al. 2010, pp. 289, 292).
Klamath and Northern California Interior Coast Ranges

This zone includes the Klamath West, Klamath East, and Interior California Coast regions (USFWS 2011, p. C–13). The action area occurs within the California Klamath physiographic province, but the affected critical habitat subunits, as defined in the critical habitat rule, overlap into the western edge of the Southern Cascades. These areas in northern California and southwestern Oregon are characterized by very high climatic and vegetative diversity resulting from steep gradients of elevation, dissected topography, and large differences in moisture from west to east. The western portions of this zone support a diverse mix of mesic forest communities interspersed with drier forest types that increase to the east into the Cascades. Forests of mixed conifers and evergreen hardwoods are typical of the zone. The mixed-conifer/evergreen hardwood forest types typical of the Klamath region extend into the southern Cascades in the vicinity of Roseburg and the North Umpqua River, where they grade into the western hemlock forest typical of the Cascades. Douglas-fir/dwarf mistletoe is less commonly used for nesting platforms in the western part of the northern spotted owl’s range, but is commonly used in the east.

The prey base for northern spotted owls in this zone is correspondingly diverse, but dominated by dusky-footed woodrats, bushy-tailed woodrats, and flying squirrels. Northern spotted owls have been well studied in the western Klamath portion of this zone (Forsman et al. 2004, p. 217), but relatively little is known about northern spotted owl habitat use in the eastern portion of this zone.

Our habitat association models for this zone suggest that vegetation structure and topographic features are nearly equally important in influencing owl population performance, particularly in the Klamath. High canopy cover, high levels of canopy layering, and the presence of very large dominant trees were all important features of nesting and roosting habitat. Compared to other zones, additional foraging habitat for this zone showed greater divergence from nesting habitat, with much lower canopy cover and tree size. Low to intermediate slope positions were strongly favored. In the eastern Klamath, the presence of Douglas-fir was an important compositional variable in our habitat model (USDI FWS 2011, Appendix C).

Redwood Coast

This zone is confined to the northern California coast, and is represented by the Redwood Coast region (USFWS 2011, p. C–13). It is characterized by a maritime climate with moderate temperatures and generally mesic conditions. Near the coast, frequent fog delivers consistent moisture during the summer. Terrain is typically low-lying (0 to 3,000 feet). Forest communities are dominated by redwood, Douglas-fir–tanoak (*Lithocarpus densiflorus*) forest, coast live oak (*Quercus agrifolia*), and tanoak series.

Dusky footed woodrats are the dominant prey items for northern spotted owls in this zone.
Habitat association models for this zone diverged strongly from models for other zones. Topographic variables (slope position and curvature) had a dominant influence with vegetation structure having a secondary role. Low position on slopes was strongly favored, along with concave landforms. Several studies of northern spotted owl habitat relationships suggest that stump-sprouting and rapid growth of redwood trees, combined with high availability of woodrats in patchy, intensively managed forests, enables northern spotted owls to occupy a wide range of vegetation conditions within the redwood zone. Rapid growth rates enable young stands to develop structural characteristics typical of older stands in other regions. Thus, relatively small patches of large remnant trees can also provide nesting habitat structure in this zone.

Climate Change and Range-wide Spotted Owl Critical Habitat

There is growing evidence that recent climate change has impacted a wide range of ecological systems (Stenseth et al. 2002, entire; Walther et al. 2002, entire; Ådahl et al. 2006, entire; Karl et al. 2009, entire; Moritz et al. 2012, entire; Westerling et al. 2011, p. S459; Marlon et al. 2012, p. E541). Climate change, combined with effects from past management practices, is exacerbating changes in forest ecosystem processes and dynamics to a greater degree than originally anticipated under the NWFP. Environmental variation affects all wildlife populations; however, climate change presents new challenges as systems may change beyond historical ranges of variability. In some areas, changes in weather and climate may result in major shifts in vegetation communities that can persist in particular regions.

Climate change will present unique challenges to the future of northern spotted owl populations and their habitats. Northern spotted owl distributions (Carroll 2010, entire) and population dynamics (Franklin et al. 2000, entire; Glenn et al. 2010, entire; Glenn et al. 2011a, entire; Glenn et al. 2011b, entire) may be directly influenced by changes in temperature and precipitation. In addition, changes in forest composition and structure as well as prey species distributions and abundance resulting from climate change may impact availability of habitat across the historical range of the subspecies. The 2011 Northern Spotted Owl Revised Recovery Plan provides a detailed discussion of the possible environmental impacts to the habitat of the northern spotted owl from the projected effects of climate change (USDI FWS 2011, pp. III-5 to III-11).

Because both northern spotted owl population dynamics and forest conditions are likely to be influenced by large-scale changes in climate in the future, we have attempted to account for these influences in our designation of critical habitat by recognizing that forest composition may change beyond the range of historical variation, and that climate changes may have unpredictable consequences for both Pacific Northwest forests and northern spotted owls. Our critical habitat designation also recognizes that forest management practices that promote ecosystem health under changing climate conditions will be important for northern spotted owl conservation.
LITERATURE CITED


Appendix E

Methods to Assess Baseline for Affected NSO Critical Habitat Based on Review of Recent Wildfires

Section I: Process to review baseline habitat / current condition of Critical Habitat units 9 and 10. FWS determined no update was needed at this time.

FWS developed a habitat baseline for each Critical Habitat unit by using the habitat layer associated with the Northwest Forest Plan (NWFP) 20 year monitoring report (Davis et al. 2015 and R. Davis pers. comm. December 4, 2015). In order to better understand current conditions in Critical Habitat units 9 and 10 (hereafter CHU), which overlap the Westside Recovery Project, fire severity data was gathered on fires occurring across the two CHUs from 2012 to 2015. The year 2012 was selected as a cutoff year because the habitat layer associated with the NWFP 20 year monitoring report was based on 2012 remotely sensed vegetation data (Lemma working group, 2014). CHU 9 occurs primarily within the Klamath west (KLW) modeling region and CHU 10 occurs primarily within the Klamath East (KLE) modeling region (USDI FWS 2012). CHU 9 is about 1.2 million acres in size and is entirely federal land with the exception of about 10,000 acres of state lands. CHU 10 is about one million acres and is entirely federal land with the exception of about 3,000 acres of state lands.

The following process was used to calculate the total acres of nesting, roosting, and foraging habitat (NRF) within the boundary of the two CHUs and the total acres within wildfire perimeters 2012 to 2015 that had burn severity classified through the Rapid Assessment of Vegetation after Wildfire (RAVG). On December 2, all available final RAVG data from 2012-2015 within CHUs 9 and 10 was obtained from the Forest Service’s Remote Sensing Applications Center (RSAC) via an email request (USFS 2015). FWS obtained draft 2015 RAVG products for 2015 fire complexes from the Shasta Trinity National Forest on November 3, 2015 via email as a result of an ongoing collaborative planning process. These 2015 STNF fires, which occurred only in Unit 9, were not yet available through RSAC and were important to consider as they were largest fires within the California Klamath Province in recent years. Additional 2015 RAVG data may be available within the CHUs, but was either not available through RSAC at this time, or was otherwise unknown to the YFWO, at the time of this analysis. In some cases, no data was available for a portion of fire perimeters because classification was not possible with available Landsat TM imagery (these are RAVG grid code 9).

RAVG is classified with a detection process using two Landsat Thematic Mapper (Landsat TM) images or other multi-spectral imagery captured before and after a wildfire. The RAVG process is used for all fires where more than 1000 acres of the wildfire occur on forested National Forest (USFS) lands. Fires which do not meet the RAVG criteria could not be included in this analysis (e.g. those with less than 1,000 acres on USFS lands). The algorithm uses TM images and the Relative Differenced Normalized Burn Ratio (RdNBR) (USFS 2015b, Miller and Thode 2007, Miller et. al 2009) to create 30 meter x 30 meter pixel outputs of expected basal area loss.
For this analysis, we used the nine grid code and seven classes of basal area loss RAVG: 0 percent - unburned, 0-10 percent and 10-25 percent – very low severity, 25-50 percent – low severity, 50-75 – moderate severity, 75-90 percent and greater than 90 percent basal area loss – high severity or stand-replacing fire, since that was the format provided from Shasta Trinity National Forest (STNF) for their 2015 fire complexes. The GIS analysis for Unit 9 would have been more difficult if the majority of fires’ RAVG data was in four basal area class (5 grid code RAVG used in Section II below) while the complexes from STNF were in the seven classes of basal area loss format, because the RAVG grid codes would not be directly comparable.

Methods

Using ArcGIS the RAVG data was converted from raster file format to polygon format using the raster to polygon tool. Within the raster to polygon tool, the “simplify polygon” option was deselected to retain full fidelity to the original raster data file. After conversion, the “intersect” tool within ArcGIS was used to compute the geometric intersection of the CHUs and RAVG layers. Using this method, only those features in the area common to both layers (CHU 9 or CHU 10 and RAVG indicating moderate severity burn or higher) were preserved in the final output layer. The estimates for CHU 9 and CHU 10 burned at different severities was then exported to database format for summary based on the aforementioned ArcGIS methods (see table 8.6A and 8.6B below).

Results

Our goal was to capture a rough estimate of the total acreage burned at moderate to high severity where NRF habitat quality may have been reduced to post-fire foraging (PFF) or dispersal (D) habitat or that may now be unsuitable for use by NSO. These potential changes in habitat from fire serve to inform the current condition and integrity of NRF habitat across the two CHUs. In the California Province and Oregon Klamath Provinces, which largely overlap CHU 9 and CHU 10, habitat loss to fire on federal lands, and particularly within Critical Habitat, has far exceeded habitat loss due to harvest (Davis et al. 2015). However, in the Oregon Klamath Province more of that habitat loss occurred prior to 2008 while in the California Klamath Province more habitat loss occurred 2008 to present (Davis et al. 2011 and Davis et al. 2015). CHU 10 also encompasses a small piece of the Oregon South Cascades Province where harvest rates have been higher, but as a whole across the two CHUs the vast majority of habitat loss appears to have been the result of wildfires.

From 2012 to 2015, 15,400 and 16,200 acres burned moderate to high severity respectively in unit 9 and unit 10. These acreages include the areas burned in 2014 on the KNF which are the subject of this biological opinion and the areas burned in 2015 on the STNF. Collectively these two fire years include the largest acreage burned since 2008.

In contrast to what is described in the subunit habitat baseline update below (Section II), we did not do further GIS analysis to account for the proportion moderate to high severity only within NRF habitat because it appeared that the subsequent adjustment would be inconsequential to the analysis. The basis for not adjusting the habitat baseline is that moderate to high severity fire (basal area loss greater than 50 percent) has affected less than 20,000 acres in each CHU since
2012. Each CHU is over one million acres in size with the majority comprised of NRF based on the habitat layer associated with the NWFP 20 year monitoring report (pers. comm. Davis 2015). Potential habitat loss to wildfires in recent years was not subtracted from the NRF baseline for the analysis in Section 8 of this BO: Effects to Critical Habitat.

Our estimate of the NRF habitat baseline based on the habitat layer for the 20 year NWFP monitoring report (Davis et al. 2015 and R. Davis pers. comm. December 4, 2015) is that CHU 9 contains about 792,000 acres of NSO NRF habitat and CHU 10 contains about 567,000 acres of NRF habitat. These estimates are based on the total within both the ‘highly suitable’ and ‘suitable’ categories in the habitat layer which correlate with NRF rangewide. There may be a portion of foraging habitat in the Klamath provinces that is not included within these two categories as NSO in the drier portions of the range occasionally use more brushy or open stands or forage along edge ecotones (USDI FWS 2012), but this layer serves as a reasonable approximation of NRF.

The table below, and on the following page, summarize the end results of the GIS analysis described above. All fires are lumped together by basal area classes. As mentioned above, basal area loss over 50 percent is generally considered moderate burn severity and basal area loss over 75 percent is generally considered high severity or stand replacing.

Each CHU is made up of multiple subunits. All subunits (CHU 9 is made up of KLW1 to KLW9 and CHU 10 is made up of KLE1 to KLE7) that had areas burned moderate to high severity based on data from RSAC were included in this assessment, not just the four impacted by the proposed action since the goal was to assess fire impacts to the entire CHU. However, some appeared to have no wildfires during the specified time interval and are not displayed in the tables below and on the following page.

Table 8.6A. Estimates of total acres burned moderate to high severity in CHU 9 from 2012 to 2015.

Note: The portion of CHU 9 within subunits KLW1, KLW3, KLW4, and KLW5 is not displayed because there were no large fires for which RAVG was available.

<table>
<thead>
<tr>
<th>Unit/Subunit</th>
<th>Acres</th>
</tr>
</thead>
<tbody>
<tr>
<td>KLW2</td>
<td></td>
</tr>
<tr>
<td>Moderate burn severity</td>
<td>191</td>
</tr>
<tr>
<td>High burn severity</td>
<td>1,272</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>1,463</td>
</tr>
<tr>
<td>KLW4</td>
<td></td>
</tr>
<tr>
<td>Moderate burn severity</td>
<td>4</td>
</tr>
<tr>
<td>High burn severity</td>
<td>3</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>7</td>
</tr>
<tr>
<td>KLW7</td>
<td></td>
</tr>
<tr>
<td>Moderate burn severity</td>
<td>1,437</td>
</tr>
<tr>
<td>High burn severity</td>
<td>2,683</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>4,120</td>
</tr>
<tr>
<td>Unit/Subunit</td>
<td>Acres</td>
</tr>
<tr>
<td>--------------</td>
<td>--------</td>
</tr>
<tr>
<td>KLE1</td>
<td></td>
</tr>
<tr>
<td>Moderate Burn Severity</td>
<td></td>
</tr>
<tr>
<td>High Burn Severity</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>1,081</td>
</tr>
<tr>
<td>KLE4</td>
<td></td>
</tr>
<tr>
<td>Moderate Burn Severity</td>
<td></td>
</tr>
<tr>
<td>High Burn Severity</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>954</td>
</tr>
<tr>
<td>KLE7</td>
<td></td>
</tr>
<tr>
<td>Moderate Burn Severity</td>
<td></td>
</tr>
<tr>
<td>High Burn Severity</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>14,141</td>
</tr>
<tr>
<td>CHU 10 Grand Total</td>
<td>16,176</td>
</tr>
</tbody>
</table>

Table 8.6B. Estimates of total acres burned moderate to high severity in CHU 10 from 2012 to 2015.

Note: The portion of CHU 10 within subunits KLE2, KLE3, KLE5, and KLE6 is not displayed because there were no large fires for which RAVG was available.
Section II: Additional analysis to update current condition of baseline habitat for the four critical habitat subunits for which the proposed action modifies NSO habitat (degrades, downgrades, or removes).

Background

This is a large project and it follows fires that affected an even larger area. The proposed action includes an action area over 277,000 acres in size and affects four Critical Habitat subunits (KLE6, KLE7, KLW7, and KLW8), which cover portions of two units (CHU 9 and CHU 10). In order to get a comprehensive look at the baseline condition of Critical Habitat both in the action area and across the affected subunits, FWS worked with several models produced as a part of the Critical Habitat rule (USDI FWS 2012). Our goal was to understand how the baseline of the subunits may have changed and if there were associated impacts to the conservation purposes for which it was designated (e.g. demographic support or connectivity) due to recent fires. As stated above in Section I, the majority of NSO NRF habitat loss on federal lands over the past two decades has been due to wildfires (Davis et al. 2011 and Davis et al. 2015).

The models used in the 2012 designation of NSO critical habitat were originally created using Gradient Nearest Neighbor (GNN) vegetation data (Ohmann and Gregory 2002) from 1994-2007 (2007 GNN) (Dunk 2012). A new GNN data set became available recently that is updated with remotely sensed vegetation data current to the year 2012 (2012 GNN). This gave FWS the opportunity to examine changes in average relative habitat suitability (RHS), as well as PCE2 (nesting and roosting habitat or NR for the remainder of this document) and PCE 3 (foraging habitat or F for remainder of this document) that occurred in each subunit following fires that occurred 2008 to 2012. We then use the observed patterns of change in model outputs due to fires 2008 to 2012 to predict changes that are likely to occur or may have already occurred due to fires occurring in 2012-2014.

Methods

Data sets used in this analysis:

- Klamath West (KLW) and Klamath East (KLE) modeling regions’ NR model and F only models:

The process used to create the models associated with Critical Habitat is described in detail in the modeling supplement (Dunk et al. 2012) and Appendix C of the Recovery Plan (USDI FWS 2011). The Critical Habitat rule speaks to why modeling regions have different geographic distributions than Recovery Units (analogous to physiographic provinces) (USDI FWS 2012). Specifically KLW was split apart from KLE due to the presence of tanoak and differences in tree species and nesting substrates. For our analysis, we used the “expert models” that were developed specifically for the KLE and KLW modeling regions. These models were run once using 2007 GNN and a second time using 2012 GNN by Dave LaPlante (a contractor for the Yreka Fish and Wildlife Office (YFWO) who also worked on the original modeling to support the Critical Habitat rule). We will refer to the resulting model outputs respectively as ‘2007 habitat’ and ‘2012 habitat’. Because some changes were
made to the GNN algorithms between the release of 2007 GNN and 2012 GNN, not all changes are necessarily due to fire or other disturbance events.

It is important to note subunits KLE7, K LW7, and K LW8 span portions of both KLE and K LW modeling regions, while KLE 6 is entirely within KLE modeling region. These modeling regions cover portions of three physiographic provinces: California Klamath Province, Oregon Klamath Mountains, and Oregon South Cascades Provinces.

- RAVG Fire severity data:

We used fire severity data from the RAVG program (Miller and Thode 2007, Miller et. al 2009, and USDA FS 2015. For this analysis, we used the version that shows loss of basal area classified into four categories. For some of the 2014 fires we relied on RAVG based on imagery 30-45 days post-fire; for all other fires we have RAVG based on imagery one year post-fire. Measures of basal area loss in RAVG may be underestimates of the eventual long-term effects of the 2014 fire. However, this additional basal area loss after the creation of RAVG is accounted for in this analysis because we are examining data derived from the 2012 GNN vegetation layer to see effects of fires that occurred in 2008-2010.

Measures of change between 2007 habitat and 2012 habitat:

We initially calculated 2007 habitat and 2012 habitat separately for each individual fire, grouped by fire year, and all fires looked at collectively. There was no meaningful difference in the three calculations so the results we report in the results section below are with all fires looked at collectively, because it was the simplest of the three calculation methods.

We primarily examined changes in model outputs in two ways. Within KLE and KLW modeling regions, for each fire severity class, we calculated the average change in RHS values for each pixel, as well as the proportion of pixels that crossed the threshold of the RHS value 35 (in both directions).

For calculation 2, we chose the value 35 because this value was used as a threshold for inclusion in a modeled NSO territory for the population model used in the designation of critical habitat; this threshold was in turn based on analysis of actual, known NSO territories. Modeled NSO territories were made up of three 200 acre hexagons each of which must have an RHS value over 35 (USFWS 2012, p. C-62). Pixels crossed these thresholds in both directions indicating both gains and loss in habitat depending on fire severity. Increases in NSO habitat post-fire may seem counterintuitive, but this occurs because of increases in quadratic mean diameter (QMD) or diversity of tree size classes due to lower severity fire removing the suppressed, small trees.

Projecting change to critical habitat subunits from fires between 2012 and 2014:

We projected the effects to the average RHS values within each fire perimeter using the adjustments calculated for each modeling region and fire severity class. An area-weighted average of these values, along with the unchanged values from unburned areas, gave a projected
post-fire average RHS value for each fire and for each critical habitat subunit. These projections result in estimates of acres, but cannot be mapped spatially.

For each fire, we projected the changes to the amount of habitat with RHS values greater than 35 by applying the previously-calculated transition probabilities appropriate to the modeling region (KLE or KLW), fire-severity class (very low, low, moderate, or high), and pre-fire RHS value. The application of the transition probabilities gave estimates of total acres with RHS value greater than 35 in 2007, 2012, and currently. We used the results of the calculations described above to predict the proportion and acres of 2012 habitat burned 2012 to 2014 that likely maintained existing NSO habitat function. The baseline of NR habitat (PCE 2) and foraging habitat (PCE 3) were then adjusted based on the predicted changes from recent fires for the four affected subunits (KLE6, KLE7, KLW7, and KLW8).

Results

Changes between 2007 and 2012:

At the pixel scale, there was generally a large amount of change in NRF habitat both inside and outside of burned areas. These changes took the form of habitat improvement (e.g., change from other which is dispersal or unsuitable to F) as well as habitat downgrade or loss (e.g., change from NR to F habitat). Even in “unburned” areas outside of major fire perimeters (which may actually have experienced fires that were not included in the RAVG dataset), the 2012 NR and F expert models show net decreases in NR habitat (14 percent decrease for KLE and 5 percent decrease for KLW), as well as net increase of 2 percent F habitat in KLE, and negligible increase in F habitat in KLW (less than 1 percent). In general, in burned areas, as fire severity increased, there was a trend for changes to be dominated by NRF habitat loss.

Changes between 2012 and 2014:

When the transition probabilities between habitat types observed in fires between 2008 and 2010 were applied to fires occurring between 2012 and 2014, all four subunits were projected to experience a net loss of NRF habitat due to the fires. However, the extent of the loss varied greatly by subunit, see below and summaries in tables 8.16 to 8.19:

- In KLE6, a small increase in the amount of NR habitat is projected due to ingrowth from foraging following lower-severity (<50 percent basal area lost) fire. This gain was offset by a slightly larger, though still relatively small, projected decrease in the quantity of F habitat.
- KLW7 was projected to lose three percent of NR and five percent of F habitat.
- KLE7 showed the greatest losses, with six percent of NR habitat and 37 percent loss of F habitat due to fires, primarily the 2014 fires on KNF.
- KLW8 was projected to lose the largest amount (acreage as well as proportion) of NR habitat (11 percent loss), as well as nine percent of F habitat.

When the changes in average RHS between 2007 and 2012 (Table 8.7A shows KLE modeling region and Table 8.7B shows KLW modeling region) were applied to areas burned between 2012
and 2014, all fire areas were projected to experience an overall decrease in RHS ranging from seven to 12 points in RHS (table 8.7A and table 8.7B summarize by modeling region and tables 8.8 to 8.11 summarize by subunit). These changes also resulted in decreases of the RHS averaged over the entire subunit ranging from one RHS point (from 47 to 46) in KLE6 to five points (from 43 to 38) in KLE7 (Table 8.17 and Table 8.18).

In conclusion, net losses of areas with RHS > 35 were projected for all four subunits (figure 3, figure 4, and tables 8.8 to 8.11) and NRF habitat loss was 1, 6, 14, and 31 percent for subunits KLE6, KLE7, KLW8, and KLE7 respectively (figure 1 and 2 below). Again we chose the value 35 because this value was used as a threshold for a 200 acre hexagon to be included in a modeled NSO territory (HexSim software) (see page 6 above for further explanation of modeling to support Critical Habitat designation).

Discussion

Limitations of this analysis:

This analysis is subject to a number of limitations, which should be acknowledged and kept in mind for the most useful interpretation of the results. These caveats are related to the underlying data, to the analysis itself, and perhaps most importantly to the state of our knowledge about how NSOs use post-fire landscapes.

There are many uncertainties regarding NSO use of post-fire landscapes. Both the RAVG data and the GNN data, on which the NR and F habitat expert models are based, are remotely sensed data. In general, these data sets should not be regarded as being highly accurate at the 30 x 30 meter pixel scale, but may increase in accuracy over larger scales.

It is important to note that not all differences between the 2007 and 2012 GNN are necessarily due to fire. These changes may be due to improvements in the GNN algorithm, differences in the quality of the satellite imagery for a given location, other disturbance events (e.g. insects or disease), post-fire salvage logging, or other factors that altered vegetation substantially. The vast majority of fires in CHU 9 and CHU 10 burned on land owned by USFS, and although some salvage operations were planned, very few were actually carried out (USFS 2014). Therefore, we expect that these other effects (not related to wildfire) represent only a very small proportion of acres with differences in RHS or expert models of NR habitat and F habitat. FWS assumed the vast majority of changes in RHS or NRF habitat would be based on fire severity based on data presented in the 15 and 20 year NWFP monitoring reports (Davis et al. 2011 and Davis et al. 2015).

It is not clear the analysis we performed is the most accurate and detailed approach possible; however, given the limitations on time inherent in the planning process for a fire salvage project, we chose to use this analysis rather than attempt any more complex spatial approach and it does provide us with an understanding of the current and near future condition of the affected subunits. Additionally this analysis is straightforward and relatively easy to perform and understand. Thus, it is easily repeatable.
Effects of fire on NR or F habitat by subunit and fire severity:

In areas burned across the four subunits, there was a dichotomy between very low severity fire (grid code 1 – less than 25 percent basal area loss) and low to high severity fire (grid codes 2-4), although effects were particularly noticeable above moderate severity fire (grid codes 3-4 - basal area loss greater than 50 percent). Areas burned at very low to low severity were more likely to remain NR habitat or to change from F habitat to NR habitat than areas outside of fire perimeters. In contrast, other burned areas were more likely to move from NR or F habitat into the other category (dispersal and unsuitable).

The consequence of this apparent effect is noticeable in our projections for effects to NR habitat from fires in 2012-2014 in subunit KLE6. This subunit showed a projected increase in NR habitat as a consequence of the 2012 Fort Goff and 2014 Beaver fires.

Effects of fire on 2012 RHS layer:

Higher fire severity is associated with larger decreases in RHS by all of the measures we examined. However, in some instances even low-severity fire was associated with decreases in RHS value. This apparent disconnect is due to one of the limitations of our analysis of the effects. The RHS value of a given pixel is based not only on the vegetation characteristics present at that 30 x 30 area, but also by the RHS value of surrounding pixels. If a pixel burned at very low severity has nearby pixels burned at higher severity its value will likely be reduced in the 2012 RHS layer. The spatial effects described above may affect the accuracy of our projections for the effects of the 2012-2014 fires on RHS associated measures.

It is also noteworthy that the pre-fire RHS of pixels that burned at high severity was lower than the pre-fire RHS of pixels that burned at low severity. This is likely due in part to the prevalence of high-severity fire along ridgelines, which have lower average RHS values to begin with due to slope position. Slope position was a highly influential variable in the RHS models for both modeling regions. Higher severity fires in brush fields and plantations may also contribute to this pattern.

Conclusion

Although we note the key limitations of datasets and assumptions used, this analysis used the best available science and data available to assess how previous fires have been associated with projected changes in RHS and NRF habitat within the four subunits. The projected changes are assumed to have already occurred or to occur in the near future, once all of the subsequent mortality and basal area loss associated with 2012 to 2014 fires is complete.

We projected that KLE7 has already or will experience a substantial decrease in the quantity of NRF habitat. We projected that K LW7 and K LW8 will have more moderate decreases in NRF habitat. Although the amounts of NRF habitat lost are comparable, K LW7 has relatively more NRF habitat available to cushion the loss. Finally, in subunit KLE6, very little change is
projected (slight increase due to F transitioning to NR). Results of this analysis and other portions of analysis described above are displayed in tables and figures on the following pages. For all Tables and Figures shown below:

RAVG Grid code 1 = less than 25 percent basal area loss = ‘very low severity’
RAVG Grid code 2 = 25 to 50 percent basal area loss = ‘low severity’
RAVG Grid code 3 = 50 to 75 percent basal areas loss = ‘moderate severity’
RAVG Grid code 4 = greater than 75 percent basal area loss = high severity

Table 8.7A Changes between 2007 RHS and 2012 RHS layer by fire severity class in the portions of the four subunits that occur within KLE modeling region.

<table>
<thead>
<tr>
<th>Fire Severity</th>
<th>2007 RHS</th>
<th>2012 RHS</th>
<th>change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very low</td>
<td>29</td>
<td>22</td>
<td>-7</td>
</tr>
<tr>
<td>Low</td>
<td>28</td>
<td>19</td>
<td>-9</td>
</tr>
<tr>
<td>Moderate</td>
<td>25</td>
<td>15</td>
<td>-10</td>
</tr>
<tr>
<td>High</td>
<td>24</td>
<td>12</td>
<td>-12</td>
</tr>
</tbody>
</table>

Table 8.7B Changes between 2007 RHS and 2012 RHS layer by fire severity class in the portions of the four subunits that occur within KLW modeling region.

<table>
<thead>
<tr>
<th>Fire Severity</th>
<th>2007 RHS</th>
<th>2012 RHS</th>
<th>change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very low</td>
<td>39</td>
<td>29</td>
<td>-10</td>
</tr>
<tr>
<td>Low</td>
<td>37</td>
<td>24</td>
<td>-13</td>
</tr>
<tr>
<td>Moderate</td>
<td>32</td>
<td>18</td>
<td>-14</td>
</tr>
<tr>
<td>High</td>
<td>26</td>
<td>11</td>
<td>-15</td>
</tr>
</tbody>
</table>
Figure 1. The images convey changes in RHS value and corresponding NSO habitat type by each RAVG fire severity between 2007 and 2012 RHS layers for the portions of the four subunits in KLE modeling region.

Note: Habitat types for 2012 are depicted as: dark green = NR habitat, orange = F habitat, and light gray = other.
Figure 2. The images convey changes in RHS value by each RAVG fire severity between 2007 and 2012 RHS layers for the portions of the four subunits in KLW modeling region.

Note: Habitat types are depicted in the same symbology as Figure 1 on the previous page. Dark green = NR, Orange = F, Gray = other.
Figure 3. Portions of the four subunits in KLE modeling region that transitioned across the threshold of RHS value 35.

Note: This generally indicates they either became ‘selected for’ or ‘strongly selected for’ by nesting NSO, or were lost from these categories due to wildfires between the 2007 and 2012. Thresholds of RHS 32 and 56, rather than RHS 35, is used for the delineation of the strength of selection categories and 35 was the threshold of average RHS for a 200 acre hexagon to be included in a NSO territory (USDI FWS 2012 and Dunk et al. 2012).
Figure 4. Portions of the four subunits in the KLW modeling region that transitioned across the threshold of RHS value 35 between the 2007 and 2012 RHS layer. See note above for figure 3.
For tables 8.8, 8.9, 8.10, and 8.11 below, KLE or KLW following the name of a fire, denotes the portion of the fire in the Eastern Klamath or Western Klamath modeling region, respectively.

Table 8.8. Subunit KLE6 predicted changes in acres of NRF or F habitat to other habitat types due to fires that occurred during 2012-2014 fire seasons.

<table>
<thead>
<tr>
<th></th>
<th>Nesting and roosting (ac)</th>
<th>Foraging (ac)</th>
<th>Dispersal and Unsuitable (ac)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012 baseline</td>
<td>34,535</td>
<td>51,364</td>
<td>81,973</td>
</tr>
<tr>
<td>2012 Fort Goff Complex (KLE)</td>
<td>26</td>
<td>-93</td>
<td>67</td>
</tr>
<tr>
<td>2014 Beaver Fire (KLE)</td>
<td>-7</td>
<td>-21</td>
<td>28</td>
</tr>
<tr>
<td><strong>Total projected change</strong></td>
<td><strong>19</strong></td>
<td><strong>-114</strong></td>
<td><strong>95</strong></td>
</tr>
<tr>
<td><strong>Fire-adjusted baseline</strong></td>
<td><strong>34,554</strong></td>
<td><strong>51,250</strong></td>
<td><strong>82,068</strong></td>
</tr>
<tr>
<td><strong>Projected percent change</strong></td>
<td><strong>0%</strong></td>
<td><strong>0%</strong></td>
<td><strong>0%</strong></td>
</tr>
</tbody>
</table>

Table 8.9. Subunit KLE7 predicted changes in acres of NRF or F habitat to other habitat types due to fires that occurred during 2012-2014 fire seasons.

<table>
<thead>
<tr>
<th></th>
<th>Nesting and roosting (ac)</th>
<th>Foraging (ac)</th>
<th>Dispersal and Unsuitable (ac)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012 baseline</td>
<td>9,680</td>
<td>21,476</td>
<td>35,320</td>
</tr>
<tr>
<td>2014 Happy Camp Complex (KLE)</td>
<td>-421</td>
<td>-7,359</td>
<td>7,780</td>
</tr>
<tr>
<td>2014 Happy Camp Complex (KLW)</td>
<td>-158</td>
<td>-691</td>
<td>849</td>
</tr>
<tr>
<td><strong>Total projected change</strong></td>
<td><strong>-579</strong></td>
<td><strong>-8,050</strong></td>
<td><strong>8,629</strong></td>
</tr>
<tr>
<td><strong>Fire-adjusted baseline</strong></td>
<td><strong>9,101</strong></td>
<td><strong>13,426</strong></td>
<td><strong>43,949</strong></td>
</tr>
<tr>
<td><strong>Projected percent change</strong></td>
<td><strong>-6%</strong></td>
<td><strong>-37%</strong></td>
<td><strong>24%</strong></td>
</tr>
</tbody>
</table>
Table 8.10. Subunit KLW7 predicted changes in acres of NRF or F habitat to other habitat types due to fires that occurred during 2012-2014 fire seasons.

<table>
<thead>
<tr>
<th></th>
<th>Nesting and roosting (ac)</th>
<th>Foraging (ac)</th>
<th>Dispersal and Unsuitable (ac)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013 Forks Fire (KLW)</td>
<td>-413</td>
<td>-1,307</td>
<td>1,720</td>
</tr>
<tr>
<td>2014 Happy Camp Complex (KLE)</td>
<td>42</td>
<td>-107</td>
<td>65</td>
</tr>
<tr>
<td>2014 Happy Camp Complex (KLW)</td>
<td>-835</td>
<td>-2,434</td>
<td>3,268</td>
</tr>
<tr>
<td>Total projected change</td>
<td>-1,205</td>
<td>-3,847</td>
<td>5,053</td>
</tr>
<tr>
<td>Fire-adjusted baseline</td>
<td>37,172</td>
<td>70,133</td>
<td>147,150</td>
</tr>
<tr>
<td>Projected percent change</td>
<td>-3%</td>
<td>-5%</td>
<td>4%</td>
</tr>
</tbody>
</table>

Table 8.11. Subunit KLW8 predicted changes in acres of NRF or F habitat to other habitat types due to fires that occurred during 2012-2014 fire seasons.

<table>
<thead>
<tr>
<th>Habitat type row 1 / subunit in column 1</th>
<th>Nesting and roosting (ac)</th>
<th>Foraging (ac)</th>
<th>Dispersal and unsuitable (ac)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013 Forks Fire (KLW)</td>
<td>-2</td>
<td>-4</td>
<td>6</td>
</tr>
<tr>
<td>2013 Salmon Fire (KLE)</td>
<td>-5</td>
<td>-148</td>
<td>153</td>
</tr>
<tr>
<td>2013 Salmon Fire (KLW)</td>
<td>-119</td>
<td>-978</td>
<td>1,098</td>
</tr>
<tr>
<td>2014 Log Fire (KLW)</td>
<td>-22</td>
<td>-75</td>
<td>97</td>
</tr>
<tr>
<td>2014 Whites Fire (KLE)</td>
<td>-1,048</td>
<td>-1,063</td>
<td>2,110</td>
</tr>
<tr>
<td>2014 Whites Fire (KLW)</td>
<td>-996</td>
<td>-604</td>
<td>1,600</td>
</tr>
<tr>
<td>Total projected change</td>
<td>-2,192</td>
<td>-2,872</td>
<td>5,064</td>
</tr>
<tr>
<td>Fire-adjusted baseline</td>
<td>17,449</td>
<td>29,322</td>
<td>67,928</td>
</tr>
<tr>
<td>Projected percent change</td>
<td>-11%</td>
<td>-9%</td>
<td>8%</td>
</tr>
</tbody>
</table>
For tables 8.12, 8.13, 8.14, and 8.15 below, expected average RHS post-fire totals are weighted averages of projected post-fire values from each fire area with the 2012 RHS value from the un-burned area.

**Table 8.12. Projected changes in average RHS values across fire areas in KLE6.**

Note: Relative to the project’s action area this subunit is within Beaver fire portion.

<table>
<thead>
<tr>
<th></th>
<th>Average 2012 RHS Value</th>
<th>Expected Average RHS Value after 2008-2014 fires</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average across subunit (167,000 acres (ac))</td>
<td>47</td>
<td>46</td>
</tr>
<tr>
<td>2012 Fort Goff complex (KLE) (600 ac)</td>
<td>38</td>
<td>30</td>
</tr>
<tr>
<td>2014 Beaver Fire (KLE) (2,900 ac)</td>
<td>34</td>
<td>25</td>
</tr>
</tbody>
</table>

**Table 8.13. Projected changes in average RHS values across fire areas in KLE7. Relative to the project’s action area this subunit is within the Happy Camp complex portion.**

Note: About 53 percent of the subunit overlapped wildfires from 2008 to 2014.

<table>
<thead>
<tr>
<th></th>
<th>Average 2012 RHS Value</th>
<th>Expected Average RHS Value after 2008-2014 fires</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average across subunit (66,100 acres (ac))</td>
<td>43</td>
<td>38</td>
</tr>
<tr>
<td>2014 Happy Camp complex (KLE) (30,900 ac)</td>
<td>43</td>
<td>34</td>
</tr>
<tr>
<td>2014 Happy Camp complex (KLW) (4,100 ac)</td>
<td>43</td>
<td>31</td>
</tr>
</tbody>
</table>

**Table 8.14. Projected changes in average RHS values across fire areas in KLW7. Relative to the project’s action area this subunit is within the Happy Camp complex portion.**

Note: About 12 percent of the subunit overlapped wildfires from 2008 to 2014.

<table>
<thead>
<tr>
<th></th>
<th>Average value in RHS 2012</th>
<th>Expected Average RHS Value after 2008-2014 fires</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average across subunit (252,000 acres (ac))</td>
<td>42</td>
<td>40</td>
</tr>
<tr>
<td>2013 Forks Fire (KLW) (11,000 ac)</td>
<td>44</td>
<td>33</td>
</tr>
<tr>
<td>2014 Happy Camp complex (KLE) (400 ac)</td>
<td>47</td>
<td>40</td>
</tr>
<tr>
<td>2014 Happy Camp complex (KLW) (19,100 ac)</td>
<td>42</td>
<td>31</td>
</tr>
</tbody>
</table>
Table 8.15. Projected changes in average RHS values across fire areas in KLW8. Relative to the project’s action area this subunit is within the Whites fire portion.

Note: About seven percent of the subunit was within wildfire perimeters from 2008 to 2014.

<table>
<thead>
<tr>
<th>Area Description</th>
<th>Average RHS Value in 2012</th>
<th>Expected Average RHS Value after 2008-2014 fires</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average across subunit (114,000 acres (ac))</td>
<td>44</td>
<td>41</td>
</tr>
<tr>
<td>2013 Forks Fire (KLW) (400 ac)</td>
<td>42</td>
<td>30</td>
</tr>
<tr>
<td>2013 Salmon Fire (KLE) (400 ac)</td>
<td>42</td>
<td>32</td>
</tr>
<tr>
<td>2013 Salmon Fire (KLW) (6,700 ac)</td>
<td>55</td>
<td>43</td>
</tr>
<tr>
<td>2014 Log Fire (KLW) (500 ac)</td>
<td>48</td>
<td>40</td>
</tr>
<tr>
<td>2014 Whites Fire (KLE) (9,700 ac)</td>
<td>43</td>
<td>35</td>
</tr>
<tr>
<td>2014 Whites Fire (KLW) (11,300 ac)</td>
<td>47</td>
<td>36</td>
</tr>
</tbody>
</table>
**Literature cited**


Davis, R.J. 2015. Email correspondence with C. Anderson of FWS (excel spreadsheet with NRF habitat estimates for critical habitat units based on habitat layer associated with the 20 year monitoring report), 4 December.


17, 2015 or via email request dated Nov. 28, 2015 from USDA Forest Service Remote Sensing Applications Center (RSAC) at http://www.fs.fed.us/eng/rsac/contactus/index.html