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July 29, 2016

Memorandum

To: District Manager, Medford District
Bureau of Land Management
Medford, Oregon

From: Field Supervisor, Roseburg Fish and Wildlife Office
Roseburg, Oregon

Subject: Formal Consultation on the Medford District of the Bureau of Land Management's Nedsbar Forest Management Project (Reference Number 01EOFW00-2016-F-0283).

This document transmits the Fish and Wildlife Service's (Service) Biological Opinion (Opinion) addressing the Nedsbar Forest Management Project as proposed by the Medford District (District) of the Bureau of Land Management (BLM). At issue are the effects of the proposed action (or Project) on the threatened northern spotted owl (*Strix occidentalis caurina*) (spotted owl) and spotted owl critical habitat. The enclosed Opinion was prepared in accordance with the requirements of section 7 of the Endangered Species Act (ESA) of 1973, as amended (16U.S.C. 1531 et seq.).

This Opinion is based on information provided in the District's Biological Assessment (USDI BLM 2016a; Assessment) dated April 21, 2016 and received in our office on April 25, 2016, as well as subsequent amendments to the Assessment and other supporting information cited herein. The Opinion incorporates memos and reports by the District to the Service addressing previous harvest-implementation errors in the action area. As detailed in these memos and reports, as well as in the Environmental Baseline section of this Opinion, the habitat baseline for the action area has been updated and reflects best available information, upon which this consultation is based. A complete decision record for this consultation is on file at the Service's Roseburg Field Office.

In the Assessment, the District also requested consultation on the Jack-Ash Trail construction project. Consultation on the Jack-Ash Trail project has already been provided by the Service to the District in a separate document.

The Nedsbar Project is located on adaptive management and matrix lands (USDA FS/USDI BLM 1994) and has multiple objectives: commercial timber sales for economic return, improving forest health by increasing landscape resiliency to environmental disturbances and accelerating development of forest-structural complexity (USDI BLM 2016a). Overall, up to 2,599 acres are proposed for treatment, including the removal/downgrade of 394 acres of spotted owl roosting/foraging habitat. The Project was planned within a District priorized-integrated-watershed based system for restoration and timber harvest activities. At the larger regional scale, the Project is in an area recognized in the best available information as needing active management in support of reducing the risk of large-scale wildfire in dry-forest systems.

This Opinion includes a finding by the Service that while the Nedsbar Project is anticipated to have adverse effects (but no take of resident spotted owls), it is not likely to jeopardize the spotted owl. Additionally, the Project incorporates Recovery Action recommendations 10 and 32 of the Revised Recovery Plan for the Northern Spotted Owl (USDI FWS 2011), which provides further conservation of spotted owls through conservation of older, structurally more complex forests, increased demographic support and amerilorating barred owl effects.

The Nedsbar proposed action will have adverse affects to spotted owl critical habitat due to the downgrade of 241 acres of spotted owl roosting/foraging habitat. The Service finds however, that the proposed action is not likely to adversely modify spotted owl critical habitat because the proposed action is not anticipated to diminish the intended connectivity or demographic support conservation functions of critical habitat subunit KLE 6.

The Assessment includes a finding that it may take several years to fully complete the activities included in the proposed action. On that basis, this consultation is valid for the term of the proposed action as discussed and analyzed herein. In accordance with the implementing regulations for section 7 at 50 CFR 402.16, re-initiation of consultation on the proposed action is required where discretionary Federal agency involvement or control over the actions has been maintained (or is authorized by law) and if: (1) the amount or extent of exempted incidental take is exceeded; (2) new information reveals effects of the agencies' action that may affect listed species or critical habitat in a manner or to an extent not considered in the consultation; (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 the consultation; or (4) a new species is listed or critical habitat designated that may be affected by one or both of these actions. When consultation is reinitiated, the provisions of section 7 (d) of the ESA apply.

If you have any questions regarding the enclosed Opinion, please contact Cindy Donegan of the Service's Roseburg Field Office at 541-618-2374.

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Biological Opinion
Nedsbar Forest Management Project
Proposed by
Medford District of the Bureau of Land Management
(FWS Reference Number 01EOFW00-2015-F-0283)

U.S. Department of the Interior
U.S. Fish and Wildlife Service
Roseburg Field Office
July 29, 2016

Signature: Jim Thrailkill
Jim Thrailkill
Field Supervisor

Date Signed: 7/29/2016

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INTRODUCTION

This document transmits the Fish and Wildlife Service's (Service) Biological Opinion (Opinion) addressing the Nedsbar Project as proposed by the Medford District (District) of the Bureau of Land Management (BLM). At issue are the effects of the proposed action (or Project) on the threatened northern spotted owl (*Strix occidentalis caurina*) (spotted owl) and spotted owl critical habitat (USDI FWS 2012a). We prepared this response in accordance with the requirements of section 7 of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531 et seq.).

The District has determined the proposed action would have No Effect on the endangered gray wolf (*Canis lupus*); therefore, the Opinion will not include further analysis for that species.

This Opinion is based on information provided in the District's Biological Assessment (USDI BLM 2016a; Assessment) dated April 21, 2016 and received in our office on April 25, 2016, as well as other supporting information cited herein. A complete decision record for this consultation is on file at the Service's Roseburg Field Office.

This Opinion applies the new regulatory definition of "destruction or adverse modification" of critical habitat at 50 CFR 402.02 (81 FR 7214, published February 11, 2016).

The analysis and findings presented in this Opinion do not rely on the Spotted Owl Estimation Methodology (OEM) (USDI/USDA 2008). The analysis and findings presented herein regarding the effects of the Project on the spotted owl rely on the best available science as discussed in the *Spotted Owl Resource Use* section as provided below, the accompanying Appendices, along with the Service's professional judgment on the Project's potential effects to spotted owls, which includes site specific circumstances.

CONSULTATION HISTORY

The Nedsbar Project includes new units proposed for harvest (herein) along with some units that were originally included in the Bald Lick, Bobar and Wagner Anderson timber sales which were analyzed in three previous Biological Assessments (FY 04-08 Programmatic, FY 06-08 Programmatic and 2008 DA BA FH Programmatic). Project units being carried forward from the previous Assessments for these three timber sales were not implemented under those previous timber sale contracts. The District is requesting new consultation for all units in the Nedsbar Project.

The Rogue Basin Level 1 Team (Team), as established by USDI BLM et al. (1999), was briefed on the Nedsbar Project during its development. The Team includes the Rogue River-Siskiyou National Forest Biologist, the Medford BLM District Biologist, and the Roseburg Fish and Wildlife Office Biologist.

The Team was initially briefed by the District on the Nedsbar proposed action on October 14, 2014. Subsequently, the Team attended an interdisciplinary meeting on December 16, 2014. Team field trips to the Nedsbar project occurred on October 14 and December 5, 2014. The District's Nedsbar core team met with the Level 1 Team on February 25, 2015, to review the final proposal. However, the District did not submit the Nedsbar Project for another review until March 23, 2016. Recommendations from the Level 1 Team were incorporated into design of the proposal submitted for consultation, which the District brought forward in a final Assessment on

April 25, 2016. The Service provided a draft of the Opinion to the Level 1 Team on June 2, 2016. This final Opinion incorporates comments, as appropriate, provided during that review.

As discussed in the Environmental Baseline section of the Opinion, the Nedsbar action area baseline has been updated to reflect best available information. The updated information is reflected in the record and consultation history.

DESCRIPTION OF THE ACTION AREA

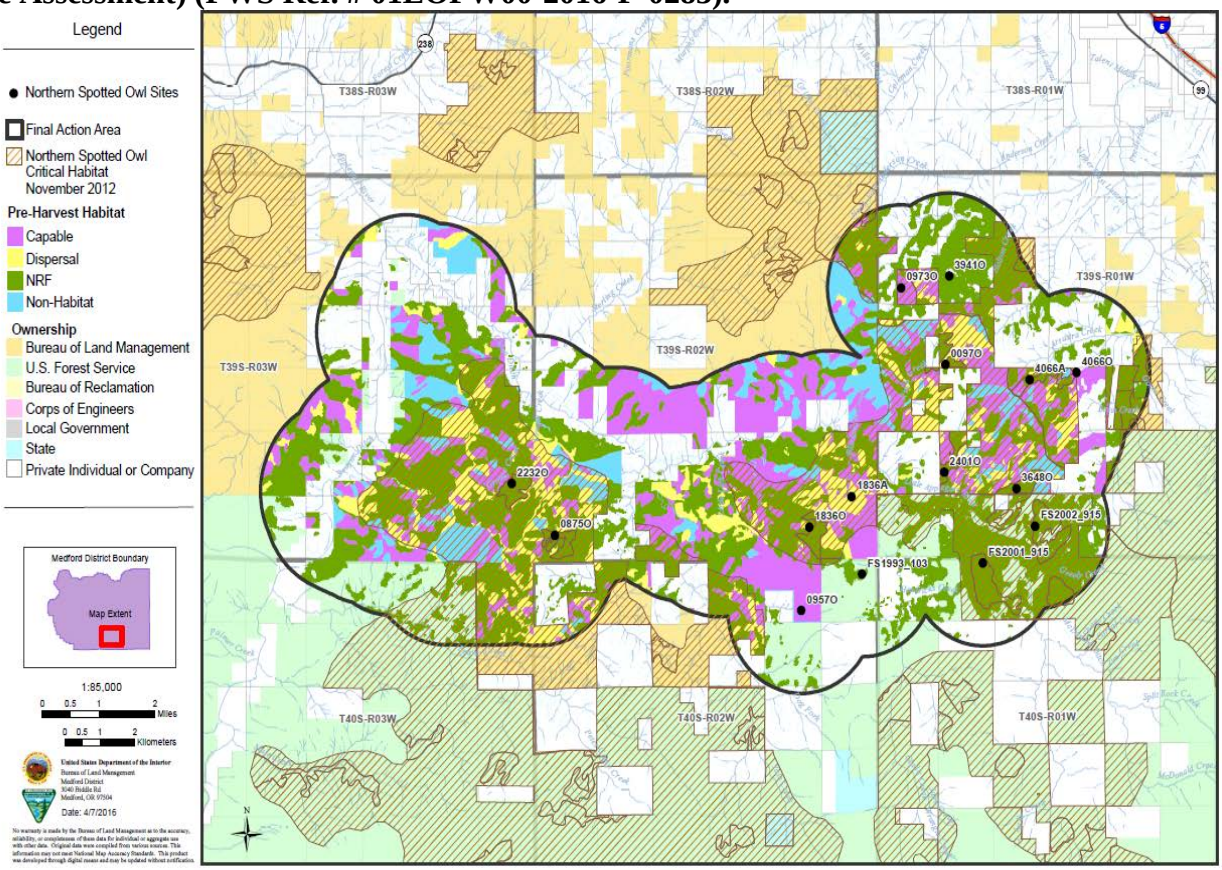
The term "action area" is defined in the implementing regulations for section 7 at 50 CFR 402.02 as "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action."

Because the Nedsbar Project is located within the Oregon Klamath Mountains Physiographic Province (Province), we used spotted owl habitat composition and known spotted owl site distribution (and associated 1.3 mile radius home ranges) to characterize conditions in the action area (Figure 1) (see *Spotted Owl Resource Use and Selection* below). This configuration represents an appropriate scale at which to assess potential effects of habitat modifying actions to known spotted owl activity centers. The delineation includes all lands within 1.3 miles of proposed treatment units and all lands within any overlapped associated provincial home ranges of known spotted sites that could be directly, indirectly or cumulatively impacted by the proposed action. Please note that while the action area as defined as above includes a distance specific perimeter, it should be noted that there are variations in topography, vegetation and weather conditions that could introduce slight variations to this description. The District utilized multiple information sources and habitat data to inform and characterize spotted owl habitat in the action area (Assessment, p. 18).

The Nedsbar Project is located within the Little Applegate River, Upper Applegate River and Bear Creek fifth-field watersheds, near the City of Jacksonville, in southwest Oregon. It occurs within the Mixed-Conifer Zone as described by Franklin and Dyrness (1973) and where the vegetation native to the watershed is the result of time, the unique geology of the area, slope aspect, and anthropogenic influences. Over the course of thousands of years, native inhabitants regularly used fire on the landscape for a wide variety of purposes (USDI BLM 1998). Natural disturbances such as lightning fires, windstorms, and drought contributed to the variation in current vegetation. The lower elevation areas were historically dominated by grassland, oak savanna, and open oak/pine woodland. In the higher elevation areas, prime black oak woodland likely existed. Douglas-fir stands were comparatively open, with a higher proportion of mature ponderosa and sugar pine than at present (USDI BLM 1998). Infrequent, stand-replacing natural fires likely played a dominant role in shaping existing vegetation conditions. As a consequence of these factors, the variations and scales of landscape components are innumerable (USDI BLM 1998).

More recent vegetation disturbance mechanisms (abiotic and biotic) that influence the watershed's forest stand structure include logging, fire and fire suppression, bark beetles, pathogens, and dwarf mistletoe species associated with Douglas-fir and true fir species (USDI BLM 1998). The 2001 Quartz fire was the most recent fire that impacted the project area and at least two known owl sites (0957O and FS1993). Additionally, forest stands in the project area contain noticeable Douglas-fir mortality occurring in pockets and along ridge tops. This mortality is caused by high competition for resources (because of high density levels and limited resources) which results in stands having a higher vulnerability to insects/diseases.

Figure 1. Vicinity Map of the Nedsbar Action Area, Medford District BLM (copied from the Assessment) (FWS Ref. # 01EOFW00-2016-F-0283).



DESCRIPTION OF THE PROPOSED ACTION

The Nedsbar Project is planned consistent with the Medford District Resource Management Plan (USDI BLM 1995) and the Northwest Forest Plan (NWFP) (USDA FS/USDI BLM 1994) (USDI BLM Medford District 2016a, Assessment, p. 1). The District's Assessment is herein incorporated by reference. The Project is within the Applegate Adaptive Management Area (AMA) and Matrix Land Use Allocations (LUA) of the NWFP. Some thinning within Riparian Reserves to enhance the development of vertical structure and heterogeneity in otherwise homogeneous stands with smaller diameter trees is also included in the proposed timber harvest.

The District ranked fifth-field watersheds as part of their 2012 Integrated Vegetation Management (IVM) (USDI BLM 2012) analysis of current conditions of these watersheds (Assessment, p. 7). The overall goal of the IVM process was to integrate project planning across the District. A product of the IVM process was prioritized watersheds based on restoration, fuels reduction and timber harvest opportunities. The IVM Environmental Assessment's (USDI BLM 2012) goal is restoration and resilient landscapes through harvest actions that provide forest products.

The majority of the Nedsbar units occur within two fifth-field watersheds (Little Applegate and Upper Applegate), each ranked as medium in the IVM process. The District has already implemented projects in the only high ranking fifth-field watershed (Middle Applegate River) in

the Ashland Resource Area (where the proposed action is located), which covers the southwestern portion of the District. As a result of the District previously completing this high priority work, it is now allocating resources to watersheds next in the IVM prioritization process in this portion of the District.

The District proposes to implement up to 2,599 acres of projects in forest-habitat. Of these acres, 1,847 (671 acres of roosting/foraging habitat and 1,176 acres of dispersal-only habitat) are characterized as spotted owl habitat (Table 1).

Table 1. Summary of the Nedsbar proposed action within northern spotted owl habitat and non-habitat (see definitions below) (FWS Ref. # 01EOFW00-2016-F-0283).

Nesting, Roosting and Foraging (NRF) Habitat		Dispersal-only Habitat	Capable Habitat	Non-Habitat	Total
	Roosting/Foraging (McKelvey 2)				
	671	1,176	247	505	2,599

Capable and non-habitat do not have current forest structure supporting spotted owls. "Capable habitat is forestland that is currently not habitat but can become NRF or dispersal habitat in the future, as trees mature and the canopy closes" (Assessment, p. 5). Proposed activities in capable habitat include "Small Diameter Thin Stewardship" and "Understory Reduction" treatments (Assessment, p. 11). These treatments are intended to increase tree growth rates and promote horizontal and vertical structural heterogeneity in stands (Assessment, p. 11). Growth of spotted owl habitat is not anticipated to be delayed with these treatments in these type of stands. However, structural growth on up to 25 acres of capable habitat will be delayed due to road/landing construction. These small amount of acres are likely immaterial to the overall quality and distribution of habitat across the action area, including critical habitat, because of the units small size and broad distribution (e.g., not precluding blocks of habitat development). As a result, no further analysis of capable habitat will be provided in this consultation.

Non-habitat does not provide spotted owl habitat and will not develop into NRF or dispersal habitat in the future (Assessment, p. 5). As a result, no further analyses of this habitat will be provided in this consultation.

Up to 671 acres of the Nedbar proposed action is in Roosting/Foraging (R/F) habitat. This R/F habitat is a subset of spotted owl nesting, roosting, foraging habitat (NRF) (see Assessment, p. 4 for NRF definition) but is different in that even though the stands might have large trees and high canopy, they are often single story, lack decadent features, and usually have at least 150ft^2/acre basal area (Assessment, p. 4). In the District's habitat categorization, R/F habitat is also known as McKelvey 2 habitat (Assessment, p.4), which is based on field observations and a mapped product the District uses in project planning and consultation. For consultation purposes, effects to R/F habitat is tracked as NRF habitat.

Up to 1,1762 acres of the proposed action is within dispersal-only habitat. This habitat at a minimum consists of stands with adequate tree size and canopy cover to provide protection from avian predators and at least minimal foraging opportunities. 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 1992 a and b). Dispersal habitat is generally forest stands with canopy cover of 40 percent or greater and an average

diameter at breast height (dbh) of 11 inches or greater. It provides temporary shelter for owls moving through an area between NRF habitats and some opportunities for owls to find prey; but does not provide all of the requirement to support a spotted owl throughout its life. NRF habitat can also function as dispersal habitat. However, dispersal, i.e., dispersal-only, will be used throughout this document to refer to habitat that does not meet the criteria to be NRF habitat, but has adequate cover to facilitate movement between blocks of habitat (Assessment, p. 5)

Project Description

Overstocked forest stands or those impacted by disease, drought, or insects were selected for treatment (Assessment, p. 8). As trees compete for limited water, nutrients, and growing space they become stressed and more susceptible to mortality from insects, forest pathogens, and drought. Forest thinning is needed to maintain vigorously growing forest stands, which are more fire resilient and resistant to insect and disease attacks, in accord with sustained yield forestry and to capture tree mortality (USDI BLM 1995, p. 186).

The Nedsbar Project has multiple objectives; including: implementing commercial timber sales for economic return, improving forest health by increasing landscape resiliency to environmental disturbances and accelerating the development of structural complexity and spatial heterogeneity (Assessment, pp. 8-15). To accomlish these objectives, the District will use a variety of treatments, including selective thinning, group selection, density management, structural retention, riparian thinning, small diameter thinning (stewardship), understory reduction and hazardous fuels reduction (including activity fuels treatments and maintenance treatments) (Assessment, pp. 8-14 and Assessment Appendix B pp. 61-66).

A variety of manual and mechanical methods will be used to harvest the units and include ground-based, skyline-cable and helicopter log extraction. This analysis includes (accounts for) likely landing locations and construction impacts anticipated due to the removal of up to nine acres of spotted owl roosting/foraging habitat and five acres of dispersal-only habitat (Assessment, Table 10, pp. 32-33 and Assessment Appendix C, Table C-1). Similarly, openings created from yarding corridors were assessed and added to the potential treatment effects. If the District anticipates that the actual effects from the utilization of these methods could exceed the anticipated effects, re-initiation of consultation with the Service will occur (Assessment, p. 14).

Project Development Strategies, Project Design Criteria and Conservation Measures

In developing the Nedsbar Project, the District utilized the following ***Strategies*** to meet both the Project's objectives (see above) and reduce adverse effects to spotted owls and their critical habitat (Assessment, pp. 15-16), which is part of the ESA section 7 process.

- The Districts's known/historic spotted owl site locations and results from recent spotted owl surveys were used to inform treatment options and unit placement.
- The Relative Habitat Suitability model (USDI FWS 2011, Appendix C and described in the Effects section) informed placement for less impactful treatment options.
- Spotted owl sites were prioritized (high or low priority) for conservation and restoration opportunities (USDA FS and USDI BLM 2013) (USDI FWS 2011,

Recovery Action 10) and adverse effects from proposed vegetation treatments were avoided to the extent practicable (Assessment, Table 15).

- Proposed treatments at lower priority sites may have adverse effects, but are designed to improve habitat in the long-term.
- Proposed treatments in 418 acres of NRF habitat were dropped by the District.
- The Final Critical Habitat Rule (USDI FWS 2012a) and principles in the 2011 Recovery Plan were used to inform specific prescriptions when treatment units were located within Critical Habitat. For example:

  a) Adverse effects were avoided to the extent practicable within the home ranges and outside of core-use areas of occupied sites to minimize impacts to the demographic support role of the critical habitat sub-unit.

  b) Treatments proposed in young stands, such as capable and dispersal-only stands, are intended to accelerate the development of late-successional forest conditions. In roosting/foraging stands, treatments may result in short-term habitat downgrade but are intended to increase stand resiliency for long-term stand benefits (see examples per Assessment, Table 13).

  c) NRF and R/F habitat is not proposed for removal through vegetation treatments. Though a small amount (up to 9 acres) of these acres may be removed due to road and landing construction (Assessment Table 10 and Appendix C Table C-2).

  d) More intense prescriptions that have adverse impacts to spotted owl habitat were primarily planned in areas outside of critical habitat and outside of home ranges of high priority owl sites. For example, out of the 110 R/F acres proposed for removal, 94 acres are outside of critical habitat, 100 acres outside of spotted owl home ranges (R. Snider pers. comm. 7-1-16).

  e) Portions of the proposed action were designed to meet dry forest restoration restoration principles of the Recovery Plan.

The District used the following ***Project Design Criteria (PDC) and Conservation Measures*** to further avoid and minimize adverse effects to spotted owls (Assessment, Appendix A).

- No vegetation treatments or road/landing construction would occur within Known Spotted Owl Activity Centers (KSOAC). KSOAC are the best 100 acres around northern spotted owl activity centers that were documented as of January 1, 1994 on Matrix and Adaptive Management Area (AMA) lands, and are managed as Late-Successional Reserves (LSR). LSR are managed to protect and enhance habitat conditions for late-successional and old-growth related species. These reserves are designed to maintain a functional, interacting late-successional and old-growth ecosystem. The criteria for mapping these areas are identified on pages C-10 and C-11 of the Northwest Forest Plan Standards and Guidelines (USDA/USDI 1994b).

- Seasonal restrictions will be implemented from March 1 through June 30, unless surveys, following recommended protocols, indicate either non-occupancy or non-nesting of spotted owls.

- No-treatment buffers for protecting mollusks, great gray owls, meadows, Siskiyou Mountains salamander talus habitat, and sensitive plant sites will provide untreated patches of spotted owl habitat throughout the action area which will facilitate spotted owl dispersal and provide refugia for spotted owl small mammal prey species.

- The District identified up to 20 acres in three patches (5 to 10 acres) that meet the characteristics of Recovery Action 32 habitat (USDI FWS 2011 and USDA FS/USDI BLM 2010). The District is not planning any activities (i.e., harvest, temporary route construction, yarding corridors, or skid roads) within these Recovery Action 32 characterized stands.

- Large standing (snags and live trees) and down wood will be retained in all project areas to meet RMP (USDI BLM 1995) guidelines. Generally the marking guidelines require the retention of large hardwoods and large (> 20 inches DBH), broken, forked-top, and deformed trees, which provide nesting opportunities for spotted owls. Some snags may be felled for safety reasons or logging systems (skyline corridors), but will be left on-site to provide additional down woody material.

- In the large patches of habitat identified outside known home ranges (see Environmental Baseline section), the District will conduct spotted owl pre-project protocol surveys (USDI FWS 2012b), as appropriate, to determine occupancy of the area (Assessment, p. 21). If resident spotted owls are located during the surveys, the District will modify the proposed action to avoid incidental take of spotted owls or reinitiate consultation.

- The District will conduct spotted owl pre-project protocol surveys (USDI FWS 2012b) at the known spotted owl sites, as appropriate, to determine occupancy of the site (Assessment, p. 39). If resident spotted owls are located during the surveys, the District will modify the proposed action to avoid incidental take of spotted owls or reinitiate consultation.

In addition to the PDC and Conservation Measures detailed above, the District has developed the Nedsbar Project according to their Implementation Guide and Quality Control Plan (USDI BLM 2015b). The District will also monitor implementation of the Nedsbar activities according to their Plan.

The District expects the Nedsbar Project (per Table 1) to be implemented soon after the Biological Opinion is received and compliance with the National Environmental Policy Act (NEPA) is completed, most likely in Fiscal Year 2016. For consultation tracking and monitoring purposes, the Level 1 team defines implementation of timber sales as the date a project is sold or when a task order is issued for a non-timber sale action (stewardship and fuels contracts). It is anticipated the project could take multiple years to complete. For purposes of this consultation, project completion includes stand treatments for slash and reforestation post-harvest.

ANALYTICAL FRAMEWORK FOR THE JEOPARDY AND ADVERSE MODIFICATION DETERMINATIONS

Jeopardy Determination for the Spotted Owl

The analysis in the following sections relies on four components to support the jeopardy determination for the spotted owl: (1) the *Status of the Species*, which evaluates the spotted owl's range-wide condition, the factors responsible for that condition, and its survival and recovery needs; (2) the *Environmental Baseline*, which evaluates the condition of the spotted owl in the action area, the factors responsible for that condition, and the relationship of the action area to the survival and recovery of the spotted owl; (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 spotted owl; and (4) *Cumulative Effects*, which evaluates the effects of future, non-Federal activities in the action area on the spotted owl.

In accordance with the implementing regulations for section 7 and Service 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 spotted owl's current status and, for non-Federal activities in the action area, those actions likely to affect the spotted owl in the future, 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 spotted owl in the wild.

The Nedsbar action area is located in the Oregon Klamath Mountains Physiographic Province, which is recognized as a recovery unit in the Revised Recovery Plan for the Northern Spotted Owl (USDI FWS 2011). When an action materially impairs or precludes the capacity of a recovery unit from providing both the survival and recovery function assigned to it, that action may represent jeopardy to the species. To determine this, the biological opinion describes how the action affects not only 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.

The analysis in the following sections places an emphasis on consideration of the range-wide survival and recovery needs of the spotted owl and the relationship of the action area to the survival and recovery of the spotted owl at the range-wide and provincial scales 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 jeopardy determination.

Adverse Modification Determination for Spotted Owl Critical Habitat

Section 7(a)(2) of the ESA requires that Federal agencies ensure that any action they authorize, fund, or carry out is not likely to destroy or to adversely modify designated critical habitat. A final rule revising the regulatory definition of "destruction or adverse modification of critical habitat" was published on February 11, 2016 (81 FR 7214). The final rule became effective on March 14, 2016. The revised definition states: "Destruction or adverse modification means 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 destruction or adverse modification analysis in this biological opinion relies on four components: (1) the *Status of Critical Habitat*, which describes the range-wide condition of designated critical habitat for the spotted owl in terms of the key components of the critical habitat that provide for the conservation of the listed species, the factors responsible for that condition, and the intended value of the critical habitat overall for the conservation/recovery of the listed species; (2) the *Environmental Baseline*, which analyzes the condition of the critical habitat in the action area, the factors responsible for that condition, and the value of the critical habitat in the action area for the conservation/recovery of the listed species; (3) the *Effects of the Action*, which determines the direct and indirect impacts of the proposed Federal action and the effects of any interrelated and interdependent activities on the key components of critical habitat that provide for the conservation of the listed species, and how those impacts are likely to influence the value of the affected critical habitat units for the conservation/recovery of the listed species; and (4) *Cumulative Effects*, which evaluate the effects of future non-Federal activities that are reasonably certain to occur in the action area on the key components of critical habitat that provide for the conservation of the listed species and how those impacts are likely to influence the value of the affected critical habitat units for the conservation/recovery of the listed species.

For purposes of making the destruction or adverse modification determination, the effects of the proposed Federal action, together with any cumulative effects, are evaluated to determine if the value of the critical habitat rangewide for the conservation/recovery of the listed species would remain functional or would retain the current ability for the key components of the critical habitat that provide for the conservation of the listed species to be functionally re-established in areas of currently unsuitable but capable habitat.

Please note that a “may affect, likely to adversely affect” determination for spotted owl 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 spotted owl nesting, roosting, foraging, or dispersal 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 spotted owl; (2) result in the removal or degradation of a known spotted owl nest tree when that removal reduces the likelihood of owls nesting within the stand; or (3) prevent or appreciably slow the development of spotted owl 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 spotted owl critical habitat because older forested stands are more capable of supporting spotted owls than younger stands. Effects to an individual tree within spotted owl critical habitat may not trigger the need to complete an adverse modification analysis under formal consultation if those effects are not measurable at the stand level.

In the following sections the jeopardy analysis for the spotted owl is presented first, followed by the adverse modification analysis for spotted owl critical habitat. The CONCLUSION section is then presented that provides the section 7(a)(2) determinations based on each of these analyses.

RANGE-WIDE STATUS OF THE SPOTTED OWL

Demographic Information

Because current range-wide survey data are insufficient to produce reliable range-wide estimates of the spotted owl's population size, demographic data are used to evaluate trends in spotted owl study area populations, and these trends are used as a surrogate to inform a characterization of the range-wide status of the spotted owl.

The most recent meta-analysis of spotted owl data was conducted in January of 2014 per a spotted owl demography workshop that was subsequently published (Dugger et al. 2016). The analysis incorporated the long history of spotted owl data, which includes survey and banding data for the past 22 to 29 years (see Anthony et al. 2006 and Forsman et al. 2011).

The 2014 workshop included the following objectives: 1) estimate northern spotted owl vital rates (e.g., survival, fecundity, population change [lambda], etc.), 2) evaluate the range-wide status and trends of spotted owls and 3) determine factors associated with the trends. Eleven individual study areas were included in the analysis (either analyzed individually and/or combined in the meta-analysis). Individual study areas provided survey and banding data that ranged from 22 to 29 years. Acronyms are used below in noting the study areas and are defined as: for Washington: Cle Elum (CLE), Rainer (RIA) and Olympics (OLY), for Oregon: Coastal Oregon (COA), H.J. Andrews (HJA), Tyee (TYE), Klamath (KLA), and South Cascades (CAS), and for California: Northwest California (NWC), Hoopa Tribe (HUP) and Green Diamond (GRD and extensions).

Across the 11 individual study areas, rate of population change point estimates were below 1.0 for each area. For the three areas in Washington (CLE, RAI and OLY), the upper 95 percent confidence limits were also below 1.0, indicating declining populations in Washington. Of the five study areas in Oregon (COA, HJA, TYE, KLA, and CAS), two of the areas (COA and HJA) had declining populations as represented with upper confidence limits below 1.0. The other three areas, located in southern Oregon (TYE, KLA and CAS) had point estimates lower than the previous analysis (Forsman et al. 2011) but still had upper confidence intervals overlapping 1.0, suggesting spotted owl populations were either stable or the precision of the demographic estimates were not sufficient to detect declines. In the northern California, two study areas (NWC and HUP) had declining populations whereas GRD had a stationary population.

For the meta-analysis, that is all 11 areas combined, the lambda estimate for the past 20 plus years of monitoring was 0.962. This value represents as 3.8 percent average annual decline during the 20 plus year time period, and an increased rate of decline (3.8 percent vs. 2.9 percent) since the last meta-analysis was conducted in 2009 (see Forsman et al. 2011 and Appendix B herein).

Another way to evaluate population trends is through realized population change estimates. This analysis compares the spotted owl population remaining at each study area in 2011 relative to the starting population (i.e., year of initial survey). For the individual study areas combined per state, Washington's realized population change showed a decline of 55 to 77 percent. For Oregon, the decline was 31 to 64 percent and for California the decline was 32 to 55 percent.

For the 2014 workshop, it was the first time that an occupancy analysis had been conducted compared to previous workshops. This is because the occupancy estimators recently became available for use. Modeled occupancy estimates showed 44 to 74 percent, 22 to 47 percent and 32 to 37 percent declines in spotted owl occupancy in Washington, Oregon and California, respectively, from 1995 to 2013. As demonstrated in the individual study area annual reports, the empirical occupancy rates across individual territories have been in decline for the past several

years on most of the areas throughout the range of the northern spotted owl. Factors likely influencing occupancy included competition with barred owls and/or the interactive effects of barred owls and habitat loss on a spotted owl territory.

In summary, the key findings include:

- Spotted owl populations range-wide are declining at an average annual rate of 3.8 percent.
- Barred owls have a strong negative effect on spotted owl survival, on some but not all of the individual study areas.
- Occupancy is declining on all individual study areas but at differing rates among the areas. Barred owls have a strong positive effect on spotted owl site extinction rates on all areas. Barred owls also have a strong negative effect on spotted owl colonization on some but not all study areas.
- Effects of climate/weather are variable on spotted owl vital rates. The effects are more evident range-wide in this analysis relative to the results of Forsman et al. (2011).
- Habitat loss is still concerning, with effects on spotted owl survival, extinction and colonization rates on some individual study areas.

Recent range-wide spotted owl habitat trends reported by Davis et al. (2015) estimated a range-wide gross loss of about 650,200 acres of nesting/roosting habitat on federal lands (Davis et al. 2015, Table 6), which represents 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 7.6 percent of the habitat reserved by the NWFP (Davis et al. 2015). Of the habitat losses on reserved lands, most of it was due to natural distubances (e.g., fire) (Appendix B, Tables B-2 and B-3). Non-reserved federal land use allocations experienced a 6.4 percent range-wide loss of habitat that existed in 1993. Most of the habitat losses on non-reserved lands was due to timber harvest activities (Appendix B, Tables B-2 and B-3). Range wide, the rate of habitat loss from wildfires represents what was expected when the NWFP was written. However, higher amounts of habitat loss have occurred in fire prone portions of the range. Habitat loss on federal lands from timber harvesting represents 25 percent of what was anticipated. Forest succession is resulting in habitat recruitment that has compensated somewhat for some of these losses from disturbances; therefore, the net decrease of habitat is less than the gross decrease as represented by the values presented above (Davis et al. 2015).

Threats to the Continued Existence of the Spotted Owl

The effects of extensive past habitat loss and degradation caused by timber harvest, past and ongoing effects of wildfires and the past and ongoing effects of barred owl competition are the primary factors influencing the current range-wide condition of the spotted owl (USDI FWS 2011). However, the recent best available information strongly indicates barred owls may be the most pressing overall threat (USDI FWS 2011, USDI FWS 2013, Dugger et al. 2016 and Diller et al. 2016) followed by wildfire in the drier portions of the spotted owl's range (USDI FWS 2011 and Davis et al. 2015).

Climate change is likely to further exacerbate some existing threats such as the effects of past habitat loss as a result of tree mortality caused by drought-related fires, insects and disease, and increases in extreme flooding, landslides and wind-throw events in the short-term (10 to 30

years). Although such effects appear to be likely (see Doppelt et al. 2008), it is not yet possible to quantify how those environmental changes are likely to affect the spotted owl (USDI FWS 2011).

While a change in forest composition or extent is likely a result of climate change, the rate of that change is uncertain. In forests with long-lived dominant tree species, mature individuals can survive these stresses, so direct effects of climate on forest composition and structure would most likely occur over a longer time scale (100 to 500 years) in some areas than disturbances such as wildfire or insect outbreaks (25 to 100 years) (McKenzie et al. 2009).

The presence of high-quality habitat, such as Recovery Action 32 type habitat, may buffer the negative effects of cold, wet, springs and winters on survival of spotted owls as well as ameliorate the effects of heat. This habitat might help maintain a stable prey base, thereby reducing the cost of foraging during the breeding season when energetic needs are high (Franklin et al. 2000).

Although the scientific literature has explored the link between climate change and the invasion by barred owls, changing climate alone is unlikely to have caused the invasion (Livezey 2009). In general, climate change can increase the success of introduced or invasive species in colonizing new territory. Invasive animal species are more likely to be generalists, such as the barred owl, than specialist, such as the spotted owl and adapt more successfully to a new climate than natives.

Survival and Recovery Needs and Considerations of the Revised Recovery Plan for the Northern Spotted Owl

Based on best available information, the conservation of the spotted owl mostly likely depends on reducing the competitive effects of barred owls on the spotted owl (USDI FWS 2011, USDI FWS 2013, Dugger et al. 2016 and Diller et al. 2016). Recovery also continues to depend on increasing the distribution and abundance of *high quality* nesting, roosting, and foraging habitat throughout the spotted owl's range.

<u>Spotted Owl Revised Recovery Plan</u>

The *Revised Recovery Plan for the Northern Spotted Owl* (USDI FWS 2011) identifies discrete recovery units throughout the entire range of the spotted owl. These recovery units are based on physiographic provinces defined by unique biological and physical factors that provide essential survival and recovery functions for the spotted owl. As discussed above, under Service national ESA section 7 policy, when a proposed Federal action is likely to impair or preclude the capacity of a recovery unit, defined in a final recovery plan, to provide for both the survival and recovery function assigned to that unit, that action may represent jeopardy to the species, provided the analysis describes not only how the action affects the recovery unit's conservation capability but also the relationship of the recovery unit to both the survival and recovery of the listed species as a whole (USDI FWS 2011, p. III-1). In this way, analysis of proposed project effects at the recovery unit scale helps inform the range-wide jeopardy analysis/determination at the range-wide scale for the listed species.

The Nedsbar Project is located within the Oregon Klamath Province which serves as a recovery unit for the northern spotted owl. Recovery units are intended to assist land managers in re-establishing or maintaining: (1) historical or current genetic flow between spotted owl populations; (2) current and historic spotted owl population and habitat distribution; and (3) spotted owl meta-population dynamics. To accomplish this, the recovery plan recommends continued application of the reserve network established under the NWFP, and the restoration of more occupied and high-value spotted owl habitat, including increased conservation of high quality habitat on some Federal "Matrix" lands (USDI FWS 2011, p. III-41). As noted below, under the Recovery Plan, the conservation of occupied and high value spotted owl habitat is expected to be accomplished through implementation of Recovery Actions 10 and 32 on all lands containing such habitat (USDI FWS 2011, p. III-41). The Plan recognizes that habitat is necessary, but not sufficient alone, to recover the spotted owl because of interference competition from barred owls (as cited above).

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

To the extent practicable, the development of the Nedsbar Project followed principles in the Southwest Oregon Recovery Action 10 Guidance Document (USDA FS/USDI BLM 2013 and USDI FWS 2011) so as to reduce impacts to spotted owls at sites with recent pair and/or reproduction activity within the action area (see Consistency with the Recovery Plan section below).

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

Field evaluations by District staff identified forest stands that meet the characteristics of Recovery Action 32 (USDI FWS 2011 and USDA FS/USDI BLM 2010). This resulted in the identification of approximately 20 acres (which occur in three patches ranging in size from five to 10 acres) of forest habitat, none of which will include any harvest or associated acitivites.

Additional details on the range-wide status of the spotted owl, spotted owl population trends, and threats to the spotted owl's continued existence are provided in Appendix B and in the Service's *Revised Recovery Plan for the Northern Spotted Owl* (USDi FWS 2011).

STATUS OF SPOTTED OWL CRITICAL HABITAT

As noted above, this Opinion does not rely on the regulatory definition of "destruction or adverse modification" of critical habitat at 50 CFR 402.02. Instead, we have relied upon the new regulatory definition of "destruction or adverse modification" of critical habitat at 50 CFR 402.02 (81 FR 7214, published February 11, 2016), which defines destruction or adverse modification as "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."

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 2012a, p. 71897). 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 2012a, p. 71897). The final rule for spotted owl critical habitat defined the PBFs essential to the conservation of the spotted owl as forested areas that are used or likely to be used for nesting, roosting, foraging, or dispersing" (Service 2012, p. 71897). The final rule provides an in-depth discussion of the PBFs; that discussion is herein incorporated by reference (USDI FWS 2012a, pp. 71897-71906).

The primary constituent elements (PCEs) of spotted owl critical habitat are the specific elements of the PBFs that are considered essential to the conservation of the spotted owl and are those elements that make areas suitable as spotted owl nesting, roosting, foraging, and dispersal habitat (USDI FWS 2012a, p. 71904). The PCEs should be arranged spatially such that it is favorable to the persistence of spotted owl populations by promoting the survival and reproductive success of resident pairs, and the survival of dispersing juvenile spotted owls until they are able to recruit into a breeding population (USDI FWS 2012a, p. 71904). Within the areas considered essential for the conservation of the spotted owl, the USDI FWS (2012a, pp. 72051-72052) has defined the PCEs of spotted owl critical habitat as:

1) Forest types that may be in early-, mid-, or late-seral stages and that support the 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 transient and colonization phases of spotted owl dispersal, which 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 nesting, roosting, or foraging habitat.

In general, spotted owl critical habitat is intended to protect and restore high quality NRF habitat and good quality dispersal habitat to promote viable/persistent populations of the spotted owl throughout its historic range. See Appendix B for a detailed description of spotted owl critical habitat and a detailed discussion of the range-wide status of that critical habitat.

As discussed in the Environmental Baseline for Spotted Owl Critical Habitat section below the Nedsbar action area overlaps the Klamath East (KLE) spotted owl critical habitat unit10, subunit KLE 6. The intended conservation function of this unit is to provide demographic support to the overall spotted owl population, and to provide for north-south and east-west connectivity between spotted owl critical habitat units and subunits.

ENVIRONMENTAL BASELINE

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. The specific factors that form the environmental baseline are given in the definition of "effects of the action…"

Under the regulatory definition of "Effects of the action" at 50 CFR 402.02, it states: "…The environmental baseline **includes** [emphasis added] 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 section 7 consultation, and the impact of State or private actions which are contemporaneous with the consultation in process." Use of the term "includes" referenced above acknowledges that the environmental baseline considers the present range-wide environment in which the species or critical habitat exists as well as the specific environmental conditions in the action area.

The discussion of Environmental Baseline below addresses the current condition of the spotted owl in the action area, the factors responsible for that condition, and the role of the action area in the survival and recovery of the spotted owl. The findings presented under the *Range-wide Status of the Spotted Owl* (Appendix B) and the *Environmental Baseline for the Spotted Owl* sections of this Opinion provide essential 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 for this consultation.

<u>Oregon Klamath Mountains Physiographic Province – Spotted Owl Habitat and Spotted Owls</u>

The Nedsbar Project is located within the Oregon Klamath Mountains Province (Province), which is generally 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. Summer temperatures are high, and northern spotted owls occur at elevations up to 5,800 feet (1,768 m). Western portions of this Province, within which the action area occurs, 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.

Throughout their range, spotted owls select old-growth and mature forests for nesting, foraging and roosting and use 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; plus see summary in Courtney et al. 2004). Recent landscape-level analyses in portions of the Oregon Coast and California-Oregon Klamath provinces suggest that a mosaic of late-successional forest habitat interspersed with other seral forest habitat 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, and Olson et al. 2004). Habitat association models for this Province suggest that vegetation structure and topographic features are nearly equally important in influencing spotted owl population performance, particularly in the Klamath Province. For example, high canopy cover, high levels of canopy layering, and the presence of very large dominant trees are all important features of spotted owl nesting and roosting habitat (USDI FWS 2011 and USDI FWS 2012a). Spotted owls primarily use cavities in large diameter trees for nesting structure in the Klamath Province (Courtney et al. 2004, Habitat Associations section).

Across its range, spotted owl habitat use is strongly influenced by prey availability. Ward (1990, p. 62) found in the California Klamath Province 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. Within the Oregon Klamath Mountains Province, including the Nedsbar action area, we would expect a similar relationship to that reported by Ward (1990) because of similarity in vegetation types. Further, the diet of the spotted owl is likely similar across the Klamath Province and dominated by species associated with mature to late-successional forest such as flying squirrels (*Glaucomy sabrinus*), and species associated with late- and early successional forest habitat stages, such as woodrats (*Neotoma* spp) (Ward 1990 and Forsman et al. 2004).

The Province consists of a mix of heavily managed, non-Federal ownership where past timber harvest activities have eliminated, reduced or fragmented spotted owl habitat sufficiently to decrease overall spotted owl population densities (USDI FWS 2011b, pp. B-1 to B-4; Thomas and Raphael 1993). Approximately 864,953 acres of spotted owl nesting, roosting, and foraging (NRF) habitat is currently estimated to exist within this Province (calculated using data in Appendix B, Table B-2) and primarily on Federal lands. Since 1994, there has been a reduction of about 19,347 acres (or 2.19 percent) of NRF habitat on Federal lands within the Province and this reduction represents about 15 percent of the NRF habitat effects range-wide (Appendix B, Table B-2). This reduction consists of up to approximately 2,999 acres of nesting/roosting habitat removed within reserve areas and an additional approximately 6,772 acres removed or downgraded outside of reserves by timber management activities (Appendix B, Table B-2). In addition, natural events (i.e., wildfires) resulted in the loss of 5,736 acres of NRF habitat in reserve areas, and 3,840 acres of NRF habitat outside of reserves. Overall across the Oregon Klamath Province, the cause in the reduction of habitat acres is similar between reserves and non-reserves in that timber harvest accounts for over 9,700 acres and losses due to natural disturbance approximates 9,500 acres (Appendix, Table B-2).

Demographic data are used to evaluate trends in spotted owl populations throughout its range (Appendix B). The Klamath Demographic Study Area (KLA) occurs within the Province and is located to the north of the Nedsbar action area. For purposes of this analysis, we assume demographic data from the KLA are likely representative of the condition of the spotted owl population in the action area (see Anthony et al. 2006) because of its Provincial co-location and similar ownership patterns and forest conditions. Of the 158 spotted owl sites surveyed within the KLA during 2015, spotted owls were detected at 37 percent of the sites. This consisted of 33 sites occupied by a pair, 10 by a single, and 16 occupied by one or two spotted owls of unknown breeding status (Hollen et al. 2015).

Although the number of sites surveyed on the KLA has remained relatively constant through time, the number of pairs detected at sites has declined from a high of 98 pairs in 2005 to a low

of 33 pairs in 2015. The total number of occupied sites ranged from a high of 123 in 2002 to a low of 59 in 2015. Hollen et al. (2015) inferred that 82 sites were unoccupied by spotted owls and this number has increased temporally.

The number of sites where barred owls were detected exceeded the number of sites where spotted owls were detected for the first time since 2014 on the KLA. Barred owls were detected on the highest percentage of sites during 2015 and the percentage of sites where spotted owls were detected was the lowest of any year (Hollen et al. 2015, Figure 6) .

Olson et al. (2005) determined that barred owl presence positively affected local-extinction probabilities or negatively affected colonization probabilities of spotted owls. They concluded further that a decline in the proportion of sites occupied by spotted owls is expected. Dugger et al. (2016) reported that the presence of barred owls resulted in an increase in local extinction rates for all 11 study areas analyzed, the KLA included. The steady decline in spotted owl occupancy indicates that the KLA population may be experiencing these effects (Hollen et al. 2015, p. 11).

The recent meta-analysis of spotted owl demographic study areas did not detect a trend with respect to apparent spotted owl survival (for the KLA), whereas fecundity was declining on the KLA (Dugger et al. 2016). The rate of spotted owl population change, lambda, reported by Dugger et al. (2016) for the KLA showed a decline in the average estimate (0.972) from an earlier period (Forsman et al. 2011 – 0.990). However, the upper confidence interval for the spotted owl population on the KLA (Dugger et al. 2016 95% CI – 0.940 – 1.005) overlaps 1.0 in both studies, which suggests the population could be stationary or the precision of the demographic estimates were not sufficient to detect declines. The KLA's realized population change of approximately 34 percent (up to 2011), corresponds somewhat, with the declines in the empirical estimates of spotted owl occupancy as reported by Hollen et al. (2015).

Recent modeling information supports a finding that the Oregon Klamath Province is currently supporting a source population of spotted owls (Shumaker et al. 2014). Shumaker et al. (2014) describe source-sink dynamics as an "emergent property of complex species–landscape interactions," that has the potential to "inform and improve the management of species of conservation concern," such as the spotted owl. The results of Shumaker et al. (2014) suggest that, range-wide, over half of the spotted owl population exists in demographic sinks that are dependent to varying degrees on source populations to persist. In particular, the Oregon Klamath Mountain region (Shumaker et al. 2014: Figure 3), within which the action area for the Nedsbar project occurs, currently serves as a spotted owl source population for the Oregon Cascades (west) and California Coast Range (east) Provinces (Shumaker et al. 2014: Figure 4), which suggests a relatively productive spotted owl population currently exists in southern Oregon.

Spotted Owl Habitat within the Action Area

According to the District's estimates, approximately 32 percent (16,368 acres) of the 51,440 acres comprising the Nedsbar action area consists of spotted owl NRF habitat, with the majority (14,326 acres) of NRF habitat occurring on Federal lands (Assessment, pp. 18-19; Table 2 below). Total spotted owl habitat, which includes both NRF and dispersal-only habitats, accounts for approximately 54 percent (27,843 acres) of the action area (Table 2).

Table 2. Spotted Owl Habitat Environmental Baseline within the Nedsbar Action Area, Medford District BLM (Assessment,Table 4, p. 19) (FWS Ref. # 01EOFW00-2016-F-0283).

		Total Acres	NRF[1] Habitat Acres (% Total)	Capable Habitat Acres (% Total)	Reserved Acres[2] (% Of Total)	Non-Reserved Acres (% Of Total)	Dispersal[3] Acres (% Of Total)
OWNERSHIP							
-All Ownerships		51,440	16,368 (32%)	16,474 (32%)	1,128 (2%)	50,312 (98%)	27,843 (54%)
- Non-Federal (Private, State)		15,492	2,042 (13%)	5,661 (37%)	0	15,492 (100%)	6,820 (44%)
-Federal (BLM, USFS)		35,948	14,326 (40%)	10,813 (30%)	1,128 (3%)	34,820 (97%)	21,023 (58%)
LAND ALLOCATION—FEDERAL (*hierarchal, no acres double-counted*)							
Late-Successional Reserves (mapped)		0	0	0	1,128 (100%)	33,692 (97%)	0
100-Acre Spotted Owl Core Areas in the Matrix/AMA		1,128	880 (78%)	230 (20%)			898 (80%)
Matrix/AMA[3]		35,948	14,326 (40%)	10,813 (30%)			21,023 (58%)
SPOTTED OWL CRITICAL HABITAT							
CHU -10	**Sub Unit KLE-6**	18,934	10,464 (55%)	4,117 (22%)	1,024 (4%)	17,910 (96%)	13,395 (71%)

[1] NRF Habitat: consists of habitat used by owls for nesting, roosting, and foraging. Generally, this habitat is multistoried, 80 years old or older (depending on stand type and structural condition), has high canopy cover, and has sufficient snags and down wood to provide opportunities for nesting, roosting, and foraging. This includes R/F habitat as consulted on herein.
[2] Reserved Acres = land allocation with no programmed timber harvest which includes Congressionally Reserved land, LSRs, Owl Cores and Wild and Scenic River Corridors.
[3] Dispersal Habitat: Dispersal-only habitat (generally defined as forest stands with canopy cover of 40 percent or greater and an average diameter at breast height (DBH) of 11 inches or greater. It provides temporary shelter for owls moving through the area between NRF habitats and some opportunity for owls to find prey) plus NRF habitat.
[4] Capable Habitat: forestland that currently does not function as dispersal or NRF habitat for spotted owls, but has the potential to develop into functioning NRF or dispersal habitat as trees mature and the canopy closes.

Recently, timber harvest implementation errors were detected by the District within the action area for the Nedsbar project. In response to those errors, an evaluation of the current baseline habitat conditions within the action area and Provinces (overlapping the District) were completed by the District and reported to the Service via a memorandum (USDI BLM Medford District 2016b) and report (USDI BLM Medford District 2016c).

The Service has reviewed the available post-timber harvest implementation monitoring information provided by the District as cited above. Based on that review, we concluded that the overall impacts to the spotted owl and its habitat caused by these errors at the Recovery Unit (Province) scale, including an analysis assuming a worse case scenario that 100 percent of timber harvest actions had implementation errors, was not likely to jeopardize the spotted owl or adversely modify its critical habitat at the rangewide scales (USDI FWS, April 5, 2016). However, in light of the implementation errors the Service requested that the District strive to avoid or minimize adverse effects to, and incidental take of, spotted owls across the District (USDI FWS, April 5, 2016), including for timber harvest activities proposed under the Nedsbar project.

To ensure that the current forest-habitat baseline for the action area at issue herein is accurate for purposes of completing this consultation, the District has taken the following steps to utilize best available information in updating the local baseline (Assessment, p. 18 and R. Snider pers. comm. May 13, 2016).

- The majority of the 2,599 acres of project units have been field verified by District staff. Some of the field work was supplemented with staff's judgements made from recent aerial imagery. As a result of this work, the District is confident in what types and how many acres of spotted owl habitat are proposed for treatment in the action area.

- 100 percent of the units from the previous timber sales (i.e., Bald Lick, O'Lickety, Lick Stew and Wagner Anderson) that co-occur in the Nedsbar action area, were field reviewed to determine the appropriate categorization of spotted owl habitat (Assessment, p. 18). As a result, this revised information is part of the updated baseline for the action area.

- Additional updates to forest habitat conditions within the action area for the Nedsbar project, as well as updates to the overall forest habitat baseline across the District, were included in the District's post-harvest implementation monitoring report (USDI BLM Medford District March 2016c). This work was used to update the Provincial habitat baseline.

- District lands outside of timber harvest units but within the 13 known spotted owl home ranges that have proposed Nedsbar projects were also reviewed. This work was conducted by District staff using recent aerial photographs. As needed, habitat polygons were updated and this information was used to update the habitat baseline in the action area, specific to the spotted owl sites, for purposes of this consultation.

- The District reviewed third party observations that were recently made available for stands in/near the action area. The third party was primarily identifying past harvested units where they assumed more habitat had been removed as a result of recent blowdown. Based on the District's review of the third party observations, the District has informed the Service the third party's assumptions on current habitat conditions and do not require additional habitat baseline udpates (USDI BLM 2016e).

As part of successful implementation of the Nedsbar Project, the District will take steps to develop the project consistent with its Implementation and Quality Control Plan (USDI BLM 2015). The District will implement followup monitoring, consistent with its implementation plan (USDI BLM 2015).

Spotted Owls within the Nedsbar Action Area

Historic information, surveys, or incidental observations led to the identification of spotted owl sites analyzed for this proposed action. In some situations, the terms spotted owl sites and territories are used interchangeably herein when several alternate nest locations are associated with an individual site. Spotted owls are generally monogamous for life and exhibit high site fidelity (Forsman et al.1984 and Courtney et al. 2004). However, spotted owls often switch nest trees and use multiple core areas over time, possibly in response to fluctuations of prey availability, loss of a particular nest tree, or more recently, due to the presence of barred owls.

District biologists used existing survey history to determine whether the original or alternate nest locations would be used to represent the site analyzed in the Assessment (Assessment, p. 20). There are 13 known sites (including two sites with an Original and Alternate site location) with home ranges that overlap proposed Nedsbar units. Therefore, these home ranges are completely contained within the Nedsbar action area. There are 24 site centers outside of the action area

with portions of home ranges that overlap the action area. However, no proposed units are within these home ranges, so no effects are anticipated (Assessment, p. 20). As a result, these 24 sites are not carried forward in the effects analysis (Assessment, p. 20). The District chose to conduct their effects analysis to the 13 spotted owl home ranges within which proposed treatment units are planned. The Service based our Effects analysis on the 13 sites/territories identified by the District.

The 13 affected home ranges in the Nedsbar action area respresent historic sites, three of which are located on lands manged by the Rogue River-Siskiyou National Forest (Assessment, pages 20-21). Most of these sites have not been surveyed/monitored consistently in the past decade (Assessment, pp. 19 - 20 and Appendix D). In anticipation of the Nedsbar Project, in 2014, the District initiated pre-project protocol surveys (USDI FWS 2012b) at the spotted owl sites and spotted owl habitat between known home ranges (see below). This protocol accounts for barred owl effects on spotted owl detectability and represents best available information as related to current spotted owl occupancy. Spotted owls were detected at a up to three sites during the surveys (Assessment, Appendix D). However, none of the detections were enough to meet resident status (Assesment, Appendix D) and therefore these sites are not considered as currently occupied. From 2014 to 2016, the District conducted, cumulatively, the recommended number of visits to 9 of the 13 sites. Per the PDC noted above, pre-project surveys will continue, as appropriate, depending on responses and timing of harvest. Occupancy status of the known spotted owl sites will be discussed in the Effects to Resident Spotted Owl section below.

Approximately 6,148 acres of NRF habitat occurs outside of known spotted owl home ranges on Federal lands within the Nedsbar action area, the majority of which occurs primarily in small patches unlikely to support owl occupancy (Assessment, p. 21). Within these acres though, the District identified four larger-sized patches of habitat, three in the western edge and one in the center of the action area (see the analytical procces in the Assessment, pp. 21-23), which may potentially support spotted owls. The District has conducted spotted owl pre-project protocol surveys in these areas (with no responses) and plan to continue the surveys, as appropriate in the outyears depending on responses and timing of harvest (see PDC above).

Barred Owls

The District does not conduct surveys designed to detect barred owls. However, opportunistic barred owl detections occurred during spotted owl surveys in 2014 through 2016 within the home ranges of at least four of the known sites (Assessment, Appendix D) in the action area. A study in the Oregon Coast Range suggests that over the course of a season, spotted owl surveys allow approximately 85 percent of the barred owls present in the area to be detected (Wiens et al. 2011).

Observational data suggests barred owl presence may result in direct competition with and aggressive displacement of spotted owls from nesting habitat (USDI FWS 2013). Forsman et al. (2011), Dugger et al. (2011), Singleton (2013) and Wiens et al. (2014) suggest that habitat and barred owls are important drivers of spotted owl distributions and population dynamics. USDI FWS (2011 and 2013) indicate that barred owls need to be addressed in order to recover the spotted owl (see Effects and Conservation Recommendations sections).

Role of the Action Area in the Survival and Recovery of the Spotted Owl

As noted above, the Nedsbar action area is located within the Oregon Klamath Mountains Province, which serves as a Recovery Unit as identified in the final *Revised Recovery Plan for the Northern Spotted Owl* (USDI FWS 2011, p. III-1). The Province provides north-south connectivity with the California Klamath Mountains province to the south, as well as east-west connectivity with the Oregon Western Cascades Province to the east.

Northwest Forest Plan (NWFP)

The District manages its lands according to NWFP Standards and Guidelines, which were designed to address the conservation needs of the spotted owl. Under the conservation strategy set forth in the NWFP, the Federal forest lands are intended to provide: (1) habitat blocks in late-successional reserves (LSRs) for breeding spotted owls; and (2) sufficient habitat amounts and distributions in the Matrix/Adaptive Management Area (AMA) land use allocation (LUA) to facilitate spotted owl dispersal between LSRs. Under the NWFP, the Matrix LUA represents the area within "which most timber harvest and other silviculture activities will be conducted." Activities associated with the Nedsbar proposed action are planned within the Matrix, AMA and Riparian Reserve LUAs.

Although some proportion of the spotted owls in the Matrix LUA and on private lands within and adjacent to the action area are likely to be nesting and rearing young, the NWFP conservation strategy for the spotted owl does not rely on these nesting pairs and this nesting habitat to maintain the spotted owl population on Federal lands. However, as noted above, in recognition of the declining status of the spotted owl, Recovery Action 10 of the *Revised Recovery Plan for the Northern Spotted Owl* recommends conserving prioritized spotted owl sites and high value spotted owl habitat in the Matrix LUA to provide additional demographic support to the spotted owl population.

As discussed above under the *Status of the Species* section (and Appendix B), the NWFP assumed that about 2.5 percent of the Matrix/AMA LUA would be subject to timber harvest per decade. In the first decade of the NWFP and subsequent 15-, and 20-year monitoring reports (e.g., Davis et al. 2015) on NWFP implementation, consultation records show timber harvest in the Matrix/AMA LUA was consistent with (and lower than) that assumption. Range-wide habitat for spotted owls to disperse between LSRs does not appear to be limiting (Davis et al. 2015), although there are places where federal habitat changes, in conjunction with harvest on non-federal lands have resulted in loss of dispersal connectivity between (i.e., not within the Klamath Province). Spotted owl occupancy data from local demographic study areas suggest reduced spotted owl demographic performance in LSRs and other LUAs (e.g., Hollen et al. 2015, Dugger et al. 2015, and Forsman et al. 2015) likely due to the presence of barred owls.

ENVIRONMENTAL BASELINE FOR SPOTTED OWL CRITICAL HABITAT

The Nedsbar action area overlaps portions of spotted owl critical habitat unit (CHU) 10, including 18,934 acres of subunit KLE 6 (Table 2). Overall, there is approximately 13,395 acres of spotted owl habitat (NRF and dispersal-only) within the subunit (Table 2).

Critical Habitat Unit 10 Klamath East

CHU 10 encompasses 1,052,731 acres and consists of seven designated subunits. A long north-south trending system of mountains (particularly South Fork Mountain) within this unit creates a rain-shadow effect and more xeric conditions in the eastern portion of the unit. More mesic conditions occur in the western portion of the unit. The region containing CHU 10 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 tanoak, and mixed evergreen forest interspersed with more xeric forest types.

The Oregon Klamath Mountains Province has approximately 911,681 acres of spotted owl critical habitat, of which, as of May 12, 2016, 481,577 acres consist of spotted owl NRF habitat (see Appendix B, Table B-5). These baseline acres account for the removal and downgrade of up to 1,306 and 1,215 acres of spotted owl NRF habitat within LSRs and outside of reserves, within the critical habitat designation associated with projects consulted on previously. Combined with 3,011 acres of habitat lost to natural events, the 5,532 acres represent 18.6 percent of the 29,758 total acres of spotted owl NRF habitat removed or downgraded in spotted owl critical habitat at the range-wide scale (Appendix B, Table B-5).

Subunit KLE- 6

The KLE-6 subunit consists of Federal lands managed by the BLM and U.S. Forest Service (FS) per the NWFP (USDA FS/USDI BLM 1994, entire) in Jackson County, Oregon, and Siskiyou County, California. 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. Per updated information, the NRF habitat baseline for KLE 6 is approximately 46,934 acres (Table 3). There are approximately 80 total known spotted owl sites on BLM and FS lands in Oregon in this entire critical habitat subunit (Assessment, p. 26).

Table 3. Environmental Baseline of Critical Habitat Subunit KLE 6 (FWS Ref. # 01EOFW00-2016-F-0283) (May 12, 2016).

CHU Subunit	Total Acres	NRF Habitat Baseline[1]	Dispersal Habitat Baseline[1]	NRF Habitat Effects[2]			Dispersal Habitat Effects[2]		Updated NRF Habitat Baseline[3]	Updated Dispersal Habitat Baseline[3]
				REM[4]	DWN[5]	MTN[6]	REM[4]	MTN[6]		
KLE 6	167,849	48,370	88,708	144	1,292	6,025	481	2,558	46,934	88,227

[1] Baseline data calculated using habitat amounts from Davis et al 2011 clipped to the 2012 spotted owl critical habitat units/subunits (USFWS DEC 19, 2012).
[2] Habitat effects retrieved from the NWFP tracking database on May 12, 2016.
[3] Updated habitat baselines calculated by subtracting acres of NRF habitat removal and downgrade from the NRF Habitat Baseline column (column 3), or by subtracting the acres of Dispersal habitat removed from the Dispersal Habitat Baseline column (column 4).
[4] REM= Remove, [5] DWN = Downgrade, 6 MTN= Treat and Maintain

SPOTTED OWL RESOURCE USE

This section is provided in advance of the *Effects of the Action on the Spotted Owl* section to provide some important contextual information that helps to inform that analysis.

Because complete range-wide population surveys for the spotted owl are not available, it is a well-established analytical approach to analyze the effects of proposed activities on the spotted

owl based on the extent, duration, and timing of habitat-altering activities and how those alterations are likely to affect spotted owl nesting, roosting, foraging, and dispersal behavior based on known spatial and habitat use relationships exhibited by the spotted owl (see USDI BLM et al. 1994, Lehmkuhl and Raphael 1993, Raphael et al. 1996, Meyer et al. 1998, and Courtney et al. 2004). The anticipated amount of forest habitat likely to be used by spotted owls is based on the known range of habitat conditions used by spotted owls for nesting, roosting, and foraging (see Thomas et al. 1990 and Courtney et al. 2004). In addition, the basis for a finding that a proposed action is likely to significantly impair the breeding, feeding, sheltering and/or dispersal of affected spotted owls relies on the scientifically-recognized range of habitat conditions that are known to adequately provide for spotted owl life history requirements.

Spotted owls exhibit clear, consistent patterns of habitat association, and these patterns can provide the foundation for assessing the potential effects caused by land management activities. In the 1990 *Conservation Strategy for the Northern Spotted Owl*, the Interagency Scientific Committee (Thomas et al. 1990) stated that:

> "With the exception of recent studies in the coastal redwoods of California, all studies of habitat use suggest that old-growth forests are superior habitat for northern spotted owls. Throughout their range and across all seasons, spotted owls consistently concentrated their foraging and roosting in old-growth or mixed-age stands of mature and old-growth trees....Structural components that distinguish superior spotted owl habitat in Washington, Oregon, and northwestern California include: a multilayered, multispecies canopy dominated by large (>30 inches dbh) conifer overstory trees, and an understory of shade-tolerant conifers or hardwoods; a moderate to high (60-80 percent) canopy cover; substantial decadence in the form of large, live coniferous trees with deformities- such as cavities, broken tops, and dwarf mistletoe infections; numerous large snags; ground cover characterized by large accumulations of logs and other woody debris; and a canopy that is open enough to allow owls to fly within and beneath it."

Fifteen years later, the conclusions of the Interagency Scientific Committee were echoed in the *Scientific Evaluation of the Status of the Northern Spotted Owl* (Courtney et al. 2004), which found that the habitat attributes identified by Thomas et al. (1990) remain important components of spotted owl habitat. Notably, positive relationships were found with the aforementioned attributes whether the samples of spotted owl and random locations were within old-growth forest, non-old growth forest, National Parks, public land, or private land. In 2011, the *Revised Recovery Plan for the Northern Spotted Owl* (USDI FWS 2011) again reiterated the association of spotted owls with older forest conditions, stating: "Spotted owls generally rely on older forested habitats (Carroll and Johnson 2008) because such forests contain the structures and characteristics required for nesting, roosting, and foraging (NRF)."

Spotted Owl Spatial Use of Forest Landscapes

A major advance in our understanding of spotted owl habitat relationships from Thomas et al. (1990) to the present is that we now have a much better understanding of the spatial scale of habitat selection (see Hunter et al. 1995, Meyer et al. 1998, Zabel et al. 2003) and the relationships of habitat to spotted owl fitness (Franklin et al. 2000, Olson et al. 2004, Dugger et al. 2005). Management activities addressing territorial organisms are typically spatially explicit and such activities are applied to an area corresponding to the movements and activity patterns of

the individuals of the organism occupying the territory(ies). Spotted owls are territorial raptors that range widely in search of prey but are 'anchored' during the breeding season to a nest site (Rosenberg and McKelvey 1999). That is, spotted owls are central-place foragers. Foraging close to the nest reduces travel time and energetic expenditures of adults and also increases the ability of the adults to remain nearby and protect their young. Several studies have shown that spotted owls optimize selection of their nest sites to maximize the amount of older forest habitat close to the nest (see Ripple et al. 1991, Ripple et al. 1997, Swindle et al. 1999, and Perkins 2000) in addition to selecting habitat on a larger landscape basis (Ripple et al. 1997 and Swindle 1999). On that basis, evaluations of spotted owl spatial use of an area and habitat are most meaningfully conducted at two spatial scales: the home range and core-use area, recognizing that habitat selection at a larger home range scale is likely dependent on the smaller core-use area (see Johnson 1980 for hierarchy of habitat selection).

The home range is the "area traversed by the individual in its normal activities of food gathering, mating, and caring for young" (Burt 1943:351). Within home ranges, areas receiving concentrated use, typically surrounding the nest site and favored foraging areas, are called core areas (Bingham and Noon 1997). Establishing the exact spatial extent of a spotted owl's home range and core area based on relative use within a home range typically requires use of radio-telemetry. Because of the intensity and high cost of radio-telemetry, action agencies are not able to conduct this type of study for specific projects. Therefore, for the purposes of assessing a project's potential impacts to the spotted owl, the Service approximates circles of similar size to the provincial median home range and core-use area estimates of spotted owls (see home range estimates in Thomas et al. 1990 and reaffirmed in Courtney et al. 2004), centered on spotted owl nest sites or activity centers (see below).

There are numerous analytical techniques for estimating home range sizes based on animal locations (reviewed in Powell 2000). For estimating median annual home range size of spotted owl pairs in Oregon (and elsewhere in the spotted owl's range), the estimator typically used was the minimum convex polygon or MCP method (Thomas et al. 1990 and USDI FWS 1992). Because the MCP estimates are generally large (as compared to other methods), they provide relatively conservative values on which to base the outer habitat-analysis area in that they include distant but likely important patches of habitat in such home ranges.

Resources such as food and breeding and resting sites can be patchily distributed in heterogeneous landscapes, such as those prevalent throughout the NWFP provinces. In such landscapes, animals are likely to disproportionately use areas that contain relatively high densities of important resources (Powell 2000), with concentrated use close to their nests. These disproportionately-used areas are referred to as "core areas" (Bingham and Noon 1997) (core-use areas hereafter). Thomas et al. (1990) found that amounts of suitable habitat within 0.7 miles (986 acres) of spotted owl activity centers were important to spotted owl life history functions, and that the amount of suitable habitat around nest sites was significantly greater than the amount of suitable spotted owl habitat in random circles. The findings of Thomas et al. (1990) illustrate the importance of the amount of suitable habitat within a spotted owl territory to support the life history requirements of the spotted owl. The results of subsequent studies (see below) have also indicated that a 0.5-mile radius circular area encompassing 500 acres around spotted owl activity centers is likely a more appropriate scale at which to evaluate the amounts of suitable habitat required by breeding spotted owls (USDI FWS 2009 and USDI FWS 2011 Appendix C). These studies relied on three primary sources of information to support the 500-

acre core area size: (1) the distribution of locations of radio-telemetered spotted owls; (2) the territorial spacing patterns of spotted owls; and (3) the results of studies comparing relative habitat selection by spotted owls at different scales.

Based on best available information, we are utilizing the documented spotted owl spatial use patterns of home range and core-use areas to inform potential project effects to the species. However, because of the impracticality of conducting radio-telemetry on each individual owl potentially affected, the Service uses circles as surrogates for approximating spotted owl home range and core–use areas to inform impacts to the species. It is recognized that spotted owls may adjust the shape of their home ranges to encompass as much older forest habitat as possible (Carey et al. 1992). As such, these circle surrogates may not correspond exactly with the areas used by spotted owls which may be more defined by other factors such as topographic features (e.g., drainages), abundance and availability of prey species, and the distribution and/or abundance of competitors and predators (Anthony and Wagner 1998 and Courtney et al. 2004). However, the practice of using circles has a biological basis (Lehmkuhl and Raphael 1993), and has been utilized by many researchers (Thomas et al. 1990, Ripple et al. 1991, Lehmkuhl and Raphael 1993, Ripple et al. 1997, Swindle et al. 1999, Perkins 2000, Franklin et al. 2000, Olson et al. 2004, Dugger et al. 2005, and see summary in Courtney et al. 2004) as a uniform method for quantifying (comparing/contrasting) spotted owl habitat. The use of circles, as opposed to other shapes (i.e., square, rectangles, etc.) imposes no bias on what is included or excluded for analysis. The use of circles also seems appropriate for species, like the spotted owl, characterized as “central-place foragers” and provides a simple unbiased measure of habitat availability at multiple ecologically-relevant scales surrounding spotted owl sites. The circles described and used herein that correspond to MCP estimates (and are used interchangeably) should be large enough to include enough habitat to meet all major life history needs and include areas important to both members of most pairs.

Based on the median MCP home range estimate for spotted owl pairs, the following estimates by NWFP Province help inform a spotted owl spatial analysis for Oregon: Coast Ranges Province = 4,524 acres or a circle with a 1.5-mile radius; West Cascades Province = 2,895 acres or a circle with a 1.2-mile radius; and the Klamath Province = 3,398 acres or a circle with a 1.3- mile radius. Within a home range, the smaller core-use area estimate of 500 acres or a circle with a 0.5 mile radius inform the spotted owl core-use area analysis for each of the aforementioned provinces (Thomas et al. 1990, USDI FWS 1992, USDI BLM et al. 1994, Carey et al. 1992, Anthony and Wagner 1998, Irwin et al. 2000, Courtney et al. 2004, Glenn et al. 2004 and USDI FWS 2011). For purposes of this analysis, the core-use/home range area circle(s) will be centered on a spotted owl activity center that represents the area that spotted owls are likely to use for nesting and foraging in any given year. In situations where there is local information available on home range and core-use areas, those estimates should be given consideration for use.

Habitat Availability in Spotted Owl Core Areas and Home Ranges

Best available information indicates that spotted owl sites that are occupied over the long-term are positively associated with mosaics of forest habitat at the provincial core-use area and home range scales that are capable of providing the resources necessary to meet the essential life functions of individual spotted owls.

Core-Use Area

Recently developed habitat-fitness (see below) and landscape models and other publications have demonstrated the validity of the core-use area and the importance of having sufficient amounts of NRF habitat within spotted owl core areas to adequately provide for spotted owl survival and reproduction, and access to prey (Franklin et al. 2000, Olson et al. 2004, Dugger et al. 2005, Zabel et al. 2003). Best available information to date indicates that spotted owl survival and fitness are positively correlated with large patch sizes of older forest or large forest patches containing a high proportion of older forest (Franklin et al. 2000, Olson et al. 2004 and Dugger et al. 2005). Habitat-based fitness, or habitat fitness potential (HFP), is the "fitness conferred on an individual occupying a territory of certain habitat characteristics" (Franklin et al. 2000). HFP is a function of both the survival and reproduction of individuals within a given territory. For example, the data sets analyzed by Franklin et al. (2000) were re-analyzed to evaluate the relationship between HFP and the simple proportion of older forest within spotted owl core areas. The results of that analysis (USDI FWS 2007, Appendix D), indicate a quadratic relationship between spotted owl HFP and older forest conditions, with optimum HFP occurring when 53 percent of the estimated core area consisted of older forest (Franklin et al. 2000). More than half (55 percent) of the high-quality (with a HFP greater than 1) spotted owl territories had core areas comprised of 50 to 65 percent older forest. In a similar study in southern Oregon, Dugger et al. (2005) found that spotted owl HFP was positively related to the proportion of older forest in the core area, although the strength of the relationship decreases with increased proportions. Roughly 72 percent of core areas with a HFP greater than 1.0 had more than 50 percent older forest; whereas core areas with a HFP of less than 1.0 never contained more than 50 percent older forest.

Collectively, researchers (Hunter et al. 1995, Ripple et al. 1997, Gutiérrez et al.. 1998, Meyer et al. 1998, Franklin et al. 2000 and Dugger et al. 2005) have reported a wide range (ca. 35 to 60 percent) of mean proportions of older forest at the core area scale around spotted owl nests in southwest Oregon and northwest California. It is difficult to assess how much of this variation was due to differences in ecological setting, spatial scale, habitat classification, and individual variation among owls. Nonetheless, the central tendency of these results was roughly 50-60 percent older forest habitat within spotted owl core areas. The best available information suggests that older forest is more likely than other vegetation classes to provide the spotted owl with suitable structures for perching and nesting, a stable, moderate microclimate at nest and roost sites, and visual screening from both predators and prey.

Annual Home Range

Bart (1995) evaluated the suggestion in the 1992 draft recovery plan for the spotted owl (USDI FWS 1992) that at least 40 percent of the estimated home range be retained as NRF habitat. Using demographic data from throughout the spotted owl's range, including Oregon, Bart (1995) calculated that spotted owl populations are stable when the average proportion of NRF habitat in the home range is 30 to 50 percent. Olson et al. (2004) found for their Oregon Coast Ranges study area that mid and late-seral forest is important to spotted owls, but also found that a mixture of these forests with early seral forest improved spotted owl productivity and survival. Spotted owl demography and the presence of spotted owls appear to be positively associated with an intermediate amount of horizontal heterogeneity in forest habitat at the home range scale

(Schilling et al. 2013); findings reported in more recent papers (see USDI FWS 2009) have been consistent with those of Bart (1995).

Site Occupancy

Habitat-based assessments and/or modeling have been used in various studies to estimate the presence (occupancy) of breeding spotted owls; these tools are important for evaluating the species-habitat relationships. Bart (1995) reported that occupied spotted owl core-use areas contained at least 30 to 50 percent mature and old growth forest and spotted owl demographic performance, particularly occupancy, increases with increasing amounts of NRF habitat in the core-use area. Meyer et al. (1998) examined landscape indices associated with spotted owl sites versus random plots on BLM lands throughout Oregon. Across provinces, landscape indices highly correlated with the probability of spotted owl occupancy included the percent of older forest (approximately 30 percent) within the 500 acres (analogous to a core-use area) surrounding the site (and this predictive value decreased with increasing distance) and that site occupancy decreased following the harvest of NRF habitat in the vicinity of the affected core-use area. Zabel et al. (2003) found for their northwest California study area that the highest probability of spotted owl occupancy occurred when the core-use area is comprised of 60 to 70 percent nesting/roosting habitat. Stepping up to the larger home range scale, Thomas et al. (1990), Bart and Forsman (1992), Bart (1995), Olson et al. 2004, and Dugger et al. (2005) suggest that when spotted owl home ranges are comprised of less than 40 to 60 percent NRF habitat, they were more likely to have lower occupancy and fitness.

The Service recognizes that many different combinations of forest habitat structure and amount at various spatial scales may support viable spotted owl territories sufficient for the survival and reproduction of individual owls. Despite consistent patterns of habitat selection by spotted owls, structural conditions of forest habitats occupied by spotted owls are highly variable. However, overall, the best available information suggests that: (1) the probability of spotted owls occupying a given patch of forest habitat is increased when core-use areas contain a range of forest habitat conditions that support the essential life history requirements of individual spotted owls; and (2) the survival and fitness of spotted owls are positively correlated with larger patch sizes of older forest or larger patches of forest habitat with a high proportion of older forest (Franklin et al. 2000, Olson et al. 2005 and Dugger et al. 2005).

Dispersal Habitat

As for dispersal habitat considerations, the effects analysis for the spotted owl in this Opinion is informed at a landscape scale, as suggested by Thomas et al. (1990) along with Lint et al. (2005) and Davis et al. (2015). Typical dispersal-only habitat is characterized as forest stands less than 80 years old, of simple structure, and providing some foraging structure and prey base for spotted owls as they disperse across the landscape (Miller et al. 1997 and Courtney et al. 2004). However, dispersal habitat not only includes the forests as previously described but also forests greater than 80 years old which provides better dispersal conditions due to stand structure and available prey (Miller et al. 1997, Courtney et al. 2004 and Sovern et al. 2015). An assessment of dispersal habitat condition was recommended on the quarter-township scale by Thomas et al. (1990); the Service has subsequently used a fifth field or larger landscapes for assessing dispersal habitat conditions because watersheds or provinces offer a more biological meaningful way to conduct the analysis.

Role of Forest Canopy in Spotted Owl Habitat Selection

Because the terms canopy cover and canopy closure are often used inter-changeably in the literature and among resource professionals despite technically being considered different measurements (Jennings et al. 1999), we believe it important to make the distinction that in this Opinion the Service and District are using canopy cover to characterize pre- and post- treatment characterization of spotted owl habitat. When measured in the field, closure or cover is expressed as percent coverage of an area intercepted by foliage. Cover is considered the area of the ground covered by a vertical projection of the canopy, while closure is an estimate of the angular projection of the canopy (Jennings et al. 1999). Cover is also evaluated using aerial photography (and used interchangeably with closure in some studies) and measures the canopy surface and between-crown gaps. These remotely sensed efforts are generally reported as categorical conditions (e.g., open to fully closed) or as an overall emipircal value for a stand and likely reflects the dominate and co-dominate trees, depending on the study. Each of the methods, within stand measures of cover or closure and aerial photography, can provide very different values (Jennings et al. 1999, Fiala et al. 2006, Ganey et al. 2008, and Korhonen et al. 2006). Characterizing canopy by using "cover" has relied on Rogue Basin Level 1 Team's determination of the best available information for this consultation. However, the use of "canopy cover" may not be applicable for other biological opinions or elsewhere in the range of the spotted owl. ,

There is little dispute in the literature that canopy cover or closure is just one of several stand level indicators in estimating the likelihood of use of a stand by spotted owls and that relatively high canopy cover or closure correlates with presence and use by spotted owls. In some studies, vertical canopy layering, which is correlated with total overhead canopy cover, is also shown to be a good predictor of spotted owl use (Mills et al. 1993 and North et al. 1999). Overall though, because of inconsistent methodologies and estimation methods (and their associated biases) within and between cover and closure, there is little distinction that one method is better than the other for determining the use of an area by spotted owls.

Canopy is believed to be important to spotted owls because of prey associations (Forsman et al. 1984:55-56 and Lehmkuhl et al. 2008), acting as a thermal mediator (Forsman et al. 1984:29-30, Barrows 1981, Thomas et al. 1990:171 and 278 and Weathers et al. 2001) and providing concealment cover for predator protection (Thomas et al. 1990: 299-300). However, canopy alone is unlikely to provide good insight into a stands ability to provide owl habitat and while a single canopy value is often presented, a range of values is most likely representative of stand conditions and use by spotted owls (e.g., Zabel et a. 1992a). Rather, the combination of several structural factors (e.g, layering, basal area, downwood, snags, shrub cover, etc) in variable quantities influence the likelihood of occupancy and use. Lower quanties of one factor may be ameliorated by higher quanties of other. NRF habitat function evaluation has to take ***all*** of the fundamental structural elements into consideration, and none should be considered in isolation.

EFFECTS OF THE ACTION ON THE SPOTTED OWL

The implementing regulations for section 7 of the ESA define "effects of the action" as the "…direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated or interdependent with that action, that will be added to the environmental baseline…" (50 CFR 402.02). "Indirect effects" are defined in the regulations as "…those that are caused by the proposed action and are later in time, but still are reasonably certain to occur…" (50 CFR 402.02).

This section presents an analysis of the effects of the proposed activities, as described in the Assessment and this Opinion and informed by the best available information cited in the *Spotted Owl Resource Use* section above, other sources of information cited herein and Appendix B. As noted above, the analysis below does not rely on the Owl Estimation Methodology (USDI/USDA 2008).

Analytical Approach

For the purposes of this effects analysis and as described in the Action Area section above, the area within 1.3 miles of project units were analyzed, as this distance reflects the best available approach to analyzing habitat modification impacts to spotted owls (see the *Spotted Owl Resource Use and Selection* section above). The District utilized habitat data based internal GIS data; aerial photos; stand exams; and field verification to assist in their characterization of spotted owl habitat within 1.3 miles of the project units and to inform the habitat baseline at the action area scale (Assessment, p.18). As covered in the Environmental Baseline section, within the action area, stands with past harvest history have been reviewed and their current habitat type is reflected in the action area habitat baseline. Therefore, habitat conditions in the action area reflect best available information.

Specific terms are used herein to categorize the estimated degree of change (potential effect) to spotted owls and spotted owl habitat elements that may or are likely to be caused by the proposed Project. For example, the term *treat and maintain* indicates that changes in affected spotted owl habitat may be neutral or beneficial to habitat function in some cases, while in others they are expected to be negative. However, the end result of this potential range of impacts is not expected to change the <u>type</u> of habitat function occurring in the affected stands. Affected stands which provided nesting, roosting, foraging opportunities pre-treatment are expected to provide the same type of opportunities post-treatment, though could be in a somewhat diminished capacity. The term *remove* signifies that the proposed treatments may have a negative influence on the quality of affected spotted owl habitat as well as changing the <u>type</u> of habitat function provided by removing or reducing habitat elements that support spotted owl life history requirements. In addition, NRF (or R/F) habitat can be *downgraded* to dispersal-only quality due to some activities addressed herein. Determination of the significance of changes to spotted owl habitat likely to be caused by proposed activities, and whether these changes are likely to adversely affect spotted owls or their critical habitat, must also be based on an analysis of site-specific conditions, type of treatment(s), and the scale of dependent factors (e.g., nesting, foraging, or dispersal).

Because calling surveys for spotted owls and habitat composition are the primary ways of informing spotted owl site occupancy by spotted owls, the question of spotted owl site occupancy in this consultation is addressed and can be found in the Effects to Resident Spotted Owls section, below.

As noted above, traditionally, spotted owl habitats are delineated by groups of structural elements (i.e., basal area, number of large trees, canopy layers, etc) which provide function (e.g., nesting/roosting/foraging or nesting/roosting, or roosting/foraging, or foraging, or dispersal, etc). However, distinguishing the lines between these habitat groupings can be challenging and do not always consistently predict use (USDI FWS 2011, Appendix C). In the Recovery Plan (USDI FWS 2011) the Service provided modeling to better predict spotted owl habitat suitability for

conservation planning. The "relative habitat suitability" (RHS) model more accurately predicts spotted owl use (i.e. suitability) than previous models by combining biotic and abiotic features of distinct modeling regions (USDI FWS 2011 Appendix C and Dunk et al. 2015). While not designed to be a fine-scale habitat evaluation tool, important area/region specific information about what characteristics make habitat more or less suitable can be obtained. For these reasons, while general threshold values of amount of habitat are provided below for spotted owl core-use areas and home ranges, another driver of our evaluation in this consultation will be the effects to the structure and function of habitat based on a range of variables (and not necessarily single threshold values). For example, habitat structure pre and post project are some of the considerations for effects of thinning activities to spotted owls.

According to the Assessment (p. 27), it is likely the effects to habitat described below would be reduced at the time of the NEPA Decision Record because it is anticipated that acres would be deferred for various reasons including economics or logging feasibility issues, resulting in fewer acres offered for sale.

Effects of the Proposed Action on Spotted Owl NRF (R/F) and Dispersal-only Habitats

Overstocked forest stands or those impacted by disease, drought, or insects were selected for treatment (Assessment, p. 8) and under the Nedsbar proposed action this consists of up to 1,847 acres of spotted owl habitat. No forest habitat characterized as Recovery Action 32 (see PDC above) is proposed for harvest under the proposed action. A subset of NRF habitat -394 acres of Roosting/Foraging (R/F) habitat (definition in Description of the Proposed Action section above) - is proposed for removal/downgrade (Assessment, Table 8 and Table 4 below). Also included in the proposed 1,847 acres is the removal of up to 240 acres of dispersal-only habitat and the thinning of up to 1,213 acres of R/F and dispersal-only habitats combined. Collectively, these 1,847 acres of treatments represent approximately three percent of the 51,440 acre Nedsbar action area (Table 4).

Table 4. Summary of spotted owl habitat acres affected due to the Medford District BLM's proposed Nedsbar Project (Assessment, Table 8, p. 27) (FWS Ref. # 01EOFW00-2016-F-0283).

Action Area NRF Habitat Baseline	**(16,368)**			**(27,843)** (NRF + Dispersal-only)		**51,440[1]** (total AA)
	NRF[2] Remove (acres)	**NRF Downgrade (acres)**	**NRF T&M (acres)**	**Dispersal-only Remove (acres)**	**Dispersal-only T&M (acres)**	**Total Acres Treated**
	RF[2,5]	**RF[2,5]**	**RF[2,5]**			
Nedsbar Project Project Total	110	284	277	240[3]	936	**1,847**
% Change to the Nedsbar Action Area Baseline Habitat	**-0.7% of NRF**	**-1.7% of NRF**	**No Change[4]**	**-0.9% of dispersal quality**	**No Change[4]**	**3.5% treated**

1 – Total Action Area across all ownerships, including 7,123 acres of non-habitat and 16,474 acres of capable habitat. 2 – RF = roosting/foraging habitat (McKelvey 2 rate), a subset of NRF habitat. 3 – Total dispersal-only acres but only the 220 acres outside of critical habitat as discussed below. 4- No Change indicates that treatments will retain similar habitat function post-as pre-treatment conditions and therefore no reduction in habitat. 5 - For consultation tracking purposes, the proposed action in R/F habitat will be recorded as treatments in NRF habitat.

<u>Roosting/Foraging Habitat Removal and Downgrade</u>

Adverse effects to spotted owl habitat and therefore the species are anticipated by removing (110 acres) and downgrading (284 acres) a total of 394 acres of R/F habitat. This is because the removal/downgrading of R/F habitat, through Selective Thinning, Group Selection and road/ landing construction actions, will result in a reduction of habitat and reduced habitat function. In other words, habitat complexity and that complexity combined with age/size metrics are associated with likelihood of use and presumed quality.

For example, in the case of 110 acres of R/F habitat removal, which is approximately 0.7 percent of the NRF habitat available in the action area, the harvest would reduce stands having generally 60 percent or more canopy cover to post-project canopy condition much below 40 percent (which is associated with dispersal-only habitat). This is because in some prescription areas, large diameter trees (generally greater than 16 inches dbh) will be removed and other key habitat features, such as layering and uneven age tree structure are not likely to remain post-harvest. Anthony and Wagner (1998, p. 18) and North et al. (1999, pp. 524-526) indicated that stands with two or more canopy layers provide conditions for spotted owl use. While most of these stands are currently characterized as single story, proposed treatments will likely further reduce any secondary canopy layers. Roosting and foraging opportunities for spotted owls are likely to decrease and may increase the likelihood of predation on adult and juvenile owls as a result of the R/F habitat removal.

For prescriptions that downgrade 284 acres of R/F habitat, which is approximately 1.7 percent of the NRF habitat available in the action area, treatments will result in dispersal-only quality habitat because canopy cover will be reduce from around 60 percent to at least 40 percent, post-project. Though 60 percent and 40 percent are not absolute values, they are commonly accepted values (e.g., Davis et al. 2011, p. 40 and USDI FWS 2012a) in distinguishing between spotted owl habitats and evaluating effects. Besides a reduction in canopy, other key habitat features such as layering and uneven tree structure may be reduced as well in some stands, which reduces perching/foraging opportunities for a wait and pounce predator like the spotted owl. However, because of the relatively higher canopy cover post-treatment, concealment cover for dispersing owls from predators is likely to be sufficient. Further, post-treatment, basal area retention is similar to what would be characterized as lower quality foraging habitat (see Thinning Effects section below). As such, some foraging opportunities for spotted owls are likely to remain post-harvest in downgraded stands.

Fragmentation or habitat heterogeneity affects prey species differently and is habitat and prey base specific. While habitat heterogeneity may benefit the spotted owl in areas where woodrats are the primary prey, it has been shown to increase spotted owl home range size in areas where flying squirrels dominate the diet (Zabel et al. 1995 and Courtney et al 2004; p. 4-27). As discussed in the Prey section below, both woodrats and flying squirrels are likely the primary prey items in the action area; however, flying squirrels are most likely to be negatively impacted for reasons discussed above. Because of the overall simplification of stand features and reduction of habitat due Nedsbar R/F habitat removal, spotted owl physical health will likely be impacted. This effect could lead to site abandonment or reduced survival or reproduction due to habitat removal and potentially similar effects due to downgraded R/F habitat.

The Revised Northern Spotted Owl Recovery Plan (USDI FWS 2011) recommends minimizing the removal and downgrading of spotted owl habitat. However, the Plan also recognized and encouraged longer-term forest-habitat restoration and resiliency goals, when conducted strategically on the landscape and to be reconciled in Section 7 consultation. As provided in the

Project Description and Project Development Strategies sections, the District planned portions of the Nedsbar Forest Management Project to achieve both within-stand and landscape goals of improving overall long-term forest health and reducing forest fuels continuity among stands within the priority watershed (e.g., Assessment, pp. 49-50 and Table 15). For example, R/F habitat that is downgraded is expected to be on a trajectory toward establishing multiple tree species, stand complexity and late-successional structure (Assessment, Appendix B). To help offset some of the more immediate impacts to spotted owls, the District incorporated Recovery Actions 10 (demographic support) and 32 (conservation of NRF high-quality habitat) principles into Nedsbar Project planning (see Recovery Plan section below). Both actions help to ameliorate (address inter-specific competition) barred owl effects through habitat retention that provides space and prey for spotted owls (see USDI FWS 2011). Retention of high quality habitat on the landscape is beneficial to spotted owls in areas with barred owls (Dugger et al. 2005, 2011 and 2016).

If there is no intervention in these simple and homogeneous stands, the stands will likely continue to stagnant, become more overcrowded and begin to breakdown due to density dependent competition. On some sites, the stands lack suitable natural regeneration of drought tolerant and fire resilient species. The value of the stands will likely become less to spotted owls because overall tree vigor would not improve and simple structure will remain. These treatments are intended to promote the development of forest stand conditions that meet long-term management objectives for northern spotted owl habitat and shift stand trajectories to encourage key habitat components for the future. For example, while canopy cover, trees per acre, and basal are reduced immediately post-treatment, in the first 30 years post-treatment, there are gains in basal area and other features indicating structural diversity (Assessment, Appendix B and Figure 1-a). In these downgraded stands, basal area and canopy cover will have values similar to relatively lower quality foraging habitat (see Thinning section below). As such, downgraded stands can still provide some foraging opportunities for spotted owl, most likely preying on woodrats and secondary prey items that respond positively to increased shrub cover (see Prey section below) that occurs immediately post-harvest in these stands. Through time, as the canopy becomes closed and interlocking, another primary prey item of the spotted owl, flying squirrels, are likely to become more abundant in these stands. This in turn provides more efficient and frequent foraging opportunities for spotted owls.

<u>NRF and Dispersal-only Habitat Treat and Maintain</u>

The Nedsbar Project is located within the Oregon Klamath Mountains Province and includes prescriptions that would treat through thinning, up to 277 acres of R/F habitat (less than two percent of the Federal NRF habitat on the action area) and 936 acres of dispersal-only habitat (Asessment Table 8 and Table 4 above), with the intent to retain the current function of those acres. Please note that this discussion does not include downgraded R/F habitat which was evaluated above and could be characterized as “heavy” thinning (as with some dispersal-only treat and maintain). Further, dispersal-only habitat impacts with treat and maintain prescriptions are likely to provide sufficient canopy cover post-treatment and spatially well distributed to facilitate successful dispersal by spotted owls (see Dispersal removal section below). As such, dispersal-only habitat thinning treatments will only be briefly mentioned here. Instead the following discussion is focused on treatments that are characterized as either “light to moderate” thinning of R/F habitat.

The best available information is varied relating spotted owl response to thinning in spotted owl habitat. For example, as overviewed in the Revised Recovery Plan for the Northern Spotted Owl (USDI FWS 2011), most of the data on thinning effects were collected incidental to larger research objectives and the studies were generally not designed or intended to develop future spotted owl habitat. A theme from Forsman et al. (1984) suggests that harvest, particularly higher intensity timber harvest, close to the nest and when the sites had low amounts of habitat, likely had negative impacts to spotted owls (e.g., decreased reproduction and site abandonment). Meiman et al. (2003) recommended that harvest operations not be conducted near spotted owl nest sites due to their results, which indicated that a spotted owl in their study moved its core-use area away from thinned areas. However, Anthony and Wager (1999) and Zabel et al. (1992b) found spotted owls using stands with some overstory removal and thinning from below. Irwin et al. (2015 p. 236) did not observe site abandonment as a result of thinning or partial harvest of young stands. Overall, given the small number of spotted owls studied, the information provided in these studies is insufficient for drawing firm conclusions about the effects of thinning prescriptions on spotted owls (USDI FWS 2011, III-15). Further confounding the ability to make definitive statements regarding the effects of thinning, is that none of the thinning in the studies was done with intent to maintain or enhance spotted owl habitat. Within home ranges *but outside core-use areas*, the Service suggests that opportunities exist to conduct vegetation management to enhance development of late-successional forest characteristics or meet other restoration goals in a manner compatible with retaining resident spotted owls (USDI FWS 2011, III-14); albeit weighing the trade-offs for the site specific circumstances.

Despite consistent patterns of habitat selection by spotted owls, structural conditions of forest habitats occupied by spotted owls are highly variable. This is particularly evident in the diverse conifer-hardwood forests of the Klamath Province, relative to the more northerly moist Douglas-fir-hemlock forests/Provinces, where spotted owl home ranges are larger (Zabel et al. 1995) and habitat preferences are narrower. This includes the use of foraging habitat (as under evaluation here), which is the most variable and spatially extensive of all habitats used by territorial spotted owls (USDI FWS 1992, p. 20). Descriptions of foraging habitat have ranged from complex structure (Solis and Gutierrez 1990, pp. 742-744) to forests with lower canopy (cover or closure) and smaller trees than forests containing nests or roosts (Gutierrez 1996, pp. 3-5). Forest structural features typically used to describe spotted owl foraging habitat include canopy cover (or closure), tree size and basal area. Other attributes such as tree species composition, canopy layering, presence of edges and small openings and landscape position were influential in several studies (Zabel et al. 1995, Ward et al. 1998 and Irwin et al. 2007 and 2012). It should be noted that a description of foraging habitat likely represents the range of stand conditions used by owls at night, and may not represent the specific habitat qualities of sites where spotted owls successfully obtain prey. However, researchers have concluded that spotted owls will select old forests for foraging at the landscape scale (Carey et al. 1992, pp. 236-237 and Carey and Peeler 1995, p. 235) but will also forage in younger stands with high prey densities and access to prey (Carey et al. 1992, p.247, Rosenberg and Anthony 1992, p. 165, and Thome et al. 1999, pp. 56-57). Irwin et al. (2012, pp. 209-10) found that spotted owls in the mix-conifer region would often forage within more open stands that contained brush or a low basal area of conifer trees, and that presence of a few scattered trees or snags likely facilitated hunting for prey such as woodrats. Hardwoods within stands are also an important structural element in some of the dry forest study areas; for example, such as the Medford area (Irwin et al. 2012, p. 209). Our evaluation of thinning effects to spotted owls is consistent with and based on the high degree of stand conditions and site variability in “foraging” habitat used by spotted owls.

The descriptions of foraging habitat in the Klamath Province rely on published and unpublished studies, including work conducted on the California spotted owl in the northern Sierra Nevada (e.g., Irwin et al. 2007, 2012, 2015 and Zabel et al. 1992a and b). Much of the California spotted owl studies were conducted in a mixed-conifer/hardwood forest similar to forest types used by northern spotted owls in the Klamath Province. Although spotted owls often selectively foraged in older forest, these telemetry studies show that they also use a relatively wide range of forest structure (Irwin et al. 2004 and 2007 and Zabel et al. 1992 a and b).

Most of the aforementioned studies suggested some degree of selection for higher basal areas (160 to 220 ft^2/ac) but a substantial amount of foraging (44 percent) occurred within stands with basal areas ranging from 80 to 160 ft^2/acre (USDI FWS 2009 and Irwin et al. 2007 and 2012). Residual basal area appears to be the most important part of the prescription (Irwin et al. 2015, p. 240: 25-35 m^2/ha basal area [109 to 152 ft^2]). For Nedsbar, the intended post-treatment basal area (160 ft^2/acre) target for the treat and maintain prescriptions for R/F habitat are well within the foraging structural conditions of known spotted owl foraging use patterns in mixed-conifer dry forests. This metric alone does not necessarily distinguish spotted owl habitat. However, as discussed elsewhere, the structural elements of spotted owl habitat, including a range of diameter distribution of trees along with canopy layering are expected post-treatment (Assessment, Appenidx B), as opposed to a more simple structure stand if left untreated.

Based on radio telemetry locations, Zabel et al. (1992a) considered stands with at least 40 percent canopy cover (Zabel et al call it closure but canopy interpreted from aerial photography) could considered as foraging habitat. Although, Zabel et al. (2003) found that from 18 to 40 percent of foraging locations occurred in stands with 20 to 39 percent canopy cover (as interpreted from aerial photography), Irwin et al. (2007) did not find significant relationships with canopy cover. Regardless, for Nedsbar, the intended post-treatment canopy cover target of 60 percent for R/F and 40 percent for dispersal-only habitats per stand average (the basic management unit here is generally the single forest operations inventory [FOI] unit, but may be a combination of very similar FOIs), are well within the structural (i.e., canopy) conditions of known spotted owl use patterns in the mixed-conifer dry forests . In 30 years post-treatment canopy cover (62 percent) is anticipated to be similar to the pre-treatment condition (68 percent) (Assessment, Appendix B, Table B-1). Overall, species diversity and vertical structure are anticipated to improve, providing more resilient stands.

Likewise, average tree diameter at foraging locations varied within and among studies, with selection for medium to large trees (> 20 inches dbh) and considerable use (41 to 87 percent of locations) of smaller size classes (Zabel et al. 1992a and USDI FWS 2009). As summarized by Irwin et al. (2012), silvicultural activities that create intermediate basal area dominated by 30 – 60 cm dbh (12 -24 inch dbh) Douglas-fir trees are likely to improve foraging habitat for spotted owls by supporting hardwoods and shrubs important to dusky-footed woodrats. Irwin et al. (2007 and 2012) found that habitat choice by spotted owls in the mixed-conifer area is influenced by hardwood trees and understory shrubs that produce fruit and mast materials for spotted owl small mammal prey. Carey and Peeler (1995) also found that understory shrubs are important to spotted owls and small mammal prey. Nonetheless, depending on site, presence of trees greater than 20 to 24 inches dbh is considered an important attribute of foraging habitat (USDI FWS 2009). For Nedsbar, prescriptions are intended to retain most hardwoods and retain or emphasize forest structure to the extent possible. For example, density management guidelines (Assessment) include having leave trees based on crown spacing of the healthiest

dominant and co-dominant trees to achieve canopy cover of 60 percent or greater at the stand level. Unique stand features such as snags, coarse woody debris, large hardwoods, and trees exhibiting older characteristics will remain to maintain desired structural components for wildlife. Smaller trees would be targeted for removal over larger trees. Trees targeted for removal will include those exhibiting crown decline, narrow crown widths, and those that contribute the least to the canopy layer or structural components (Assessment, Appendix B, p. 62). Decadent components and gaps will adhere to guidance in the Assessment (p. 28).

It should be noted that Tempel et al. (2014, p. 2101) found that both large diameter trees and high canopy cover (> 70 percent) forests (measured via aerial photography) were important factors/predictors in California spotted owl demographic rates. These results are similar to findings for the northern spotted owl (see Franklin et al. 2000, Blakesley et al. 2004 and Dugger et al. 2005). However, direct comparisons between thinning prescriptions for Nedsbar and Tempel et al. (2014) are difficult because of the broad categories listed in Tempel et al. (2014) versus the more site specific manner in which Nedsbar thinnings were developed (R.Snider pers. comm. 6-27-16). As such, we cannot directly compare the effects of Nedsbar to modeled results of Tempel et al. (2014).

As mentioned elsewhere in the Opinion, there are distance relationships that spotted owls display (Rosenberg and McKelvey 1999, Schilling et al.2013, Swindle et al. 1999, Irwin et al. 2015). In that: spotted owls will use parts of their home ranges more intensively than other areas and use certain topographic locations, such as upper slopes and ridgetops, less than expected (Irwin et al. 2012); when projects are located outside of nest patches and core-use areas, and toward the outer portions of the home range, the actual use of stands will likely vary depending on relative habitat quality and abiotic factors; and, as mentioned above, it has been recommended that harvests, such as thinning, should occur outside spotted owl core-use areas because of relatively less impact to the owl when projects are located farther to the perimeter of the home range.

Based on the spatial relationships and to mimize impacts to spotted owls, the District has attempted to locate most of the treat and maintain thinning projects in stands with restoration needs and coinciding with outer portions of the home ranges and/or along ridgelines and/or in relatively lower quality spotted owl habitat (Assessment, pp. 41 and 49 and Tables 13 and 15). For example, four sites (0097O, 1836O/A, 2232O, and FS1993) each only have from two to six acres of R/F and dispersal-only habitat thinning proposed in their core-use areas; otherwise, the majority of the treat and maintain prescriptions are in the outer portions of the home range (Assessment, Appendix C, Table C-2).

As provided above in this section, the District's prescriptions are intended to retain structural features of spotted owl habitat, such as basal area, canopy cover and large trees within ranges provided for in the best available information, along with other elements such as shrubs and decadent features, to the extent possible. Therefore, the function of the habitat, post-treatment, is anticipated to be maintained. However, to some extent, hardwoods will likely be reduced, canopy cover diminished, canopy layering simplified, and shrub layers disturbed. This reduction in quality will likely vary site by site and dependent on respective conditions and prescriptions, resulting in a temporary reduction habitat complexity and quality. Because of these factors, we conclude the effects of R/F thinning to be variable (unless otherwise indicated herein).

Dispersal Habitat Removal

The District will conduct selective thinning, structural retention and road/landing construction within dispersal habitat. Post-treatment removal will result canopy cover being reduced to below 40 percent, which is a commonly accepted value for dispersal-only habitat (Davis et al. 2015, pp. 9-11). However, spotted owl dispersal function is generally considered to be best approximated through an evaluation of landscape condition in which habitat connectivity is evaluated (Thomas et al. 1990, p. 27; Forsman 2002, p. 30; Davis et al. 2015, p. 11). However, the stand-level and landscape-level attributes of forests needed to facilitate successful dispersal have not been thoroughly evaluated (Buchanan 2004, p. 1341). Sovern et al. (2015; pp. 259-60) found that dispersing spotted owls tend to use older forest stands consisting of high canopy cover amounts. This result is not surprising given that best available information indicates that spotted owls preferentially use forest that most closely resemble NRF habitat and dispersing owls are after all prospecting for a suitable nesting area (see Miller et al. 1997 and Courtney et al. 2004). However, dispersal success is the ability to move across the landscape and survive more often than not for a period of time, as dispersing owls are recruited into the territorial population. Davis et al. (2015) utilized dispersal success of banded spotted owls (via Forsman et al. 2002) and dispersal-habitat condition of a landscape having 40 percent or more habitat (which includes both young and older forest) (and 40 percent canopy cover at the stand scale) as likely sufficient and functioning for spotted owls to disperse across the landscape.

Post-harvest, approximately 54 percent of the overall action area (calculated per Table 2) is anticipated to comprise dispersal-quality habitat (NRF plus dispersal-only habitat) and over 40 percent of the surrounding fifth-field watersheds (Bear Creek, Little Appleagte River and Upper Applegate River) will also have dispersal quality habitat (Assessment, Table 5, p. 19). In the Service's view, the removal of up to 350 acres of dispersal-quality habitat (110 R/F acres and 240 dispersal-only acres; Table 4) is not anticipated to reduce the capability of spotted owls from moving across the landscape in the Nedsbar action area or surrounding watersheds. This is because these landscapes will have above 40 percent dispersal quality habitat to facilitate successful dispersal (see above) and 350 acres is only two percent of the total dispersal quality habitat across all ownerships of the action area. The total acre figure represents multiple smaller units that will be embedded in the matrix of dispersal habitat, distributed across the watersheds (Assessment, p. 29) and therefore should not interfere with movement across the landscape. Forsman et al. (2002) noted that forested landscapes traversed by dispersing spotted owls, typically included fragmented mosaic of roads, clear-cuts, non-forested areas and a variety of forest age classes.

Effects of the Proposed Action on Resident Spotted Owls

Because calling surveys for spotted owls and habitat composition are the primary ways of informing the likely occupancy of sites by spotted owls, the question of site occupancy by spotted owls in this consultation is addressed here. Barred owls can have negative effects on spotted owl detectability (Appendix B); although relatively few barred owls have been detected in the action area (see Barred Owl section below). The 13 affected home ranges in the Nedsbar action area represent known sites (Assessment, pp. 20-21), many of which were established in the 1990s through surveys. As discussed above, many of the sites have not been surveyed or monitored consistently in the past decade. However, beginning in 2014, the District initiated protocol surveys (USDI FWS 2012b; which accounts for barred owls presence on spotted owl

detectability) and cumulatively, the recommended number of visits have been conducted to nine of the 13 known sites through 2016 (Assessment, Appendix D and R. Snider, pers. comm. June 17, 2016 and July 15, 2016). While a few detections of spotted owls have occurred during the recent surveys, follow-up surveys have not resulted in the detections becoming resident spotted owls (Assessment, Appendix D and R. Snider, pers. comm. July 15, 2016).

Based on best available habitat and survey information provided by the District, we conclude the following regarding resident spotted owl occupancy on the Nedsbar action area. Nine of the 13 sites are inferred to be unoccupied for the purposes of this analysis, based on the surveys. These sites include: 0097O, 0875O, 0973O, 1836O/A, 2232O, 2401O, 3648O, 3941O, and 4066O/A. The remaining four sites: 0957O, FS1993 FS2001 and FS2002, did not receive sufficient surveys to ascertain occupancy. However, for sites 0957O and FS1993, the amount of NRF habitat at the core-use area and home range are extremely low (Table 5), below what best available information suggests is necessary to support occupancy (see Resource Use section above). The habitat values are particularly low at each of the core-use areas, which serves as ananchor area for spotted owl nesting and foraging functions. For site 0957O, a contributing factor to lack of habitat is the Quartz Creek fire which burned large areas of NRF habitat. For these reasons, the Service believes it is not reasonably certain for these two sites, 0957O and FS1993, to be occupied by spotted owls. Lastly for sites FS2001 and FS2002, in giving conservation deference to the species, we will presume these two sites are occupied for the purposes of this analysis.

As per the PDC above, the District intendes to continue with surveys, as appropriate, depending on spotted owl and barred owl responses and timing of harvest. Because it is unlikely that the Project will be implemented during 2016 or possibily 2017, response data from the out-year surveys will be available to inform occupancy and project planning as appropriate. If resident spotted owls are detected during the surveys, the District will modify the project to avoid incidental take and/or reinitiate consultation as appropriate. If the District does not locate resident spotted owls, the project may be implemented as provided for in this consultation.

The Service has relied upon the results of multiple studies (for example, see *Spotted Owl Resource Use* section above and Appendix B) and site specific circumstances to inform our evaluation of anticipated effects of the proposed Project on the spotted owl. In summary, the best available information indicates spotted owls generally need a certain amount of habitat within the various spatial scales comprising individual home ranges so as to provide the resources necessary to meet essential life functions (e.g., Thomas et al. 1990, Courtney et al. 2004 and studies cited in the *Spotted Owl Resource Use* section above). In general, as the amount of habitat in a spotted owl's home range decreases, so does site occupancy, reproduction and survival. To assess the potential effects of habitat removal on spotted owls, the Service uses the home range and core-use area scales because of the spatial patterns exhibited by spotted owls and use of these concepts in the best available information (Thomas et al. 1990 p. 193-199, Bart 1995 p. 943-945, Swindle et al. 1997 p. 36-37, Rosenberg and McKelvey 1999, Meyer et al. 1998, Perkins 2000, Franklin et al. 2000, Zabel et al. 2003, Forsman et al. 2005, Dugger et al. 2005, and USDI FWS 2009). Generally, habitat amounts above 30 to 40 percent at the home range and 50 percent at the core-use area confer relatively better habitat-fitness (or individually: reproduction and/or survival) for spotted owls. Herein, habitat-fitness potential follows the use of Franklin et al. 2000 (p.542) in that it's a measure of an individual's interaction with habitat and an individual's probability of survival and reproduction. However, as with any evaluation, local site specific conditions, such as elevation, topography, spatial relationships, and survey

information should factor into such an analysis. For example, at many sites on the Medford District BLM in southern Oregon (USDA FS/USDI BLM 2013, Graph 1, page 9), including sites in the action area, sites generally have less habitat for fitness than provided in the best available information cited herein, yet continue to support spotted owl occupancy and reproduction.

The following analysis relies on best available science and site-specific circumstances such as the condition of R/F pre and post-treatment, spotted owl site occupancy in the action area, abiotic factors such as slope position of proposed harvest units, and the proximity of these units to spotted owl nest sites in the action area. For these reasons, while general threshold values of amount of habitat are provided below for spotted owl core-use areas and home ranges, another consideration of our evaluation are the effects to the structure and function of habitat based on a range of variables (and not single threshold values). For this consultation, the Service relies on the following general factors to evaluate if the proposed Federal action is likely to adversely affect spotted owls:

- Alteration of NRF habitat in the nest patch.
- Removal or downgrade of NRF habitat in core-use areas and home ranges with generally less than 50 and 40 percent NRF habitat.
- The scale and amount of NRF and/or dispersal-only habitat removal or treat and maintain activities within spotted owl core-use areas and home ranges that may result in a reduction of foraging opportunities that could likely lead to significant impairment of spotted owl survival and reproduction. This determination will be informed by a combination of factors, such as the amount, location, spatial arrangement and habitat quality of pre and post-harvest habitat conditions.

It should be noted that removal of NRF or R/F habitat may have an adverse effect to the species but may not result incidental take depending on site specific circumstances.

Spotted owls are central place foraging animals in that areas closer to the nest site receive disproportionally greater use (Rosenberg and McKelvey 1999). Schilling et al. (2013) found similar results for spotted owls in southwest Oregon in that the probability of stand use decreased with increasing distances from the nest area. Irwin et al. (2015) results showed that spotted owls would use thinned or partially harvested young stands equally or more often than before harvest and that the probability of use increased with decreasing distance from the nest site. Irwin et al. (2012) indicated that spotted owls used certain topographic locations, such as upper slopes and ridgetops, less than expected. Collectively, the information suggests that spotted owls use parts of their home range more intensively than others. As such, when projects are located outside of nest patches and core-use areas, and toward the outer portions of the home range, the actual use of stands will likely vary (i.e., less selection) albeit depending on relative habitat quality and abiotic factors.

A proposed action that avoids the above outcomes ***May Affect and are not likely to adversely affect*** spotted owls. These circumstances are further described below.

<u>Spotted Owls Likely Adversely Affected</u>

Overall, the Nedsbar action area includes 13 affected spotted owl sites and a total of 121 acres acres of R/F proposed for removal/downgrade. Among the 13 home ranges however, only three of the sites (1836O/A, 2232O and FS1993) have R/F habitat removal/downgrade (Table 5: 3 to

112 acres). As a result of R/F habitat removal/downgrade, which leads to a decrease in habitat quantity or quality, and has the potential to cause site abandonment or reduced survival of resident spotted owls (see Resource Selection section above), the Service anticipates ***adverse effects*** to spotted owls at these three sites.

One of the three sites, FS1993, is likely not viable/occupied given its limited habitat (per discussion above). Three acres of R/F is proposed for removal due to road/landing construction (Table 5). The three acres however are located outside of the core-use area and toward the outer portion of the home range and in an area of relatively low habitat suitability (RHS) (Analytical Approach section above) (Assessment), which is not reasonably likely to support breeding spotted owls. For these reasons, we do not anticipate the proposed action to further reduce the viability of the site.

For site 1836, the focus of the analysis is on the Original site (1836O) because of the relatively more recent occupancy (R. Snider pers. comm. 7-1-16). Up to nine acres of R/F removal due to road construction are planned outside the core-use area and toward the outer portion of the home range of the original site. These nine acres are distributed in six small, less than 2.5 acre segments (Table 5). Post-treatment, the core-use area for site 1836O is anticipated tohave 62 percent NRF habitat, which is above what best available information indicates for habitat-fitness potential. At the home range scale,post-treatment the site is anticipated to have 32 percent NRF habitat, which is less than what best available suggests for habitat-fitness but well within the range of NRF habitat for sites across the District and what Bart (1995) calculated for population stability. Because of the removal of R/F habiat and for reasons provided above, the Service anticipates adverse effects to spotted owls. The site (including the alternate site) is currently considered unoccupied.

For site third site, 2232O, no treatments are proposed within the core-use area but 111 acres of R/F habitat downgrade is proposed beyond the core area but within the home range of this site. The District's proposed treatments are intended to have two outcomes regarding future spotted owl habitat in this area. First, some of the proposed treatments are located in areas of high habitat suitability but the treated stands are homogeneous and the silvicultural actions are an effort to promote future structural diversity and development of NRF habitat conditions (Assessment, Table 10, p. 36). Over time, patches of habitat are anticipated to "in-fill" with already established NRF habitat and further block up habitat. Another intended outcome of the treatments are to promote forest health, ecological enhancement and to increase stand resiliency from fires, insects, and drought (Assessment, Table 14). Some of these R/F silvicultural treatments are in areas of low habitat suitability (not providing suitable conditions for breeding spotted owls) and mostly on the ridges, which are areas not preferred for spotted owl activities. Post-treatment, R/F habitat will not be reduce below "threshold" levels (e.g., post-treatment home range = 46 percent and core-use area = 67 percent NRF habitat) (Table 5 and see Resource Selection section). As analyzed above, the site is currently considered unoccupied.

To determine if habitat removal/downgrade caused by a proposed Federal action is likely to significantly disrupt the breeding, feeding, or sheltering behavior of the spotted owl to the extent that it actually injures or kills affected spotted owls, there must be a reasonable certainty that the spotted owl occupies the affected habitat area.

For the Nedsbar proposed action, each of the three adversely effected sites: 1836O/A, FS1993 and 2232O, are not anticipated to be occupied for reasons described above. As a result, impairment of spotted owl life history functions is not anticipated due to the proposed action.

Table 5. Summary of Habitat Effects to Spotted Owls/Sites within the Nedsbar Action Area, Medford District BLM (copied from the Assessment Table 10, with minor modifications) (FWS Ref. # 01EOFW00-2016-F-0283).

Site	Pre-treatment NRF Habitat[1] (acres)/%		NRF Habitat Reduced[2] (acres)			Dispersal Removed (acres)			T&M in Core (acres)/%		T&M in Home Range (acres)		Post-Treatment NRF Habitat (acres)/%		Effects Summary
	HR	Core	HR	Core	NP	HR	Core	NP	NRF	Disp	NRF	Disp	HR	Core	
0097O[3]	756 (22%)	135 (27%)	0	0	0	3	0	0	2 (1%)	1	57	131	756 (22%)	135 (27%)	**High Priority Site** based on high pair occupancy and reproductive success. Adverse effects not anticipated because no NRF removal/downgrade. Only 1 % of the existing NRF in the core area would be treated.
0875O[3]	1,303 (38%)	274 (55%)	0	0	0	1	0	0	0	5	105	76	1,303 (38%)	274 (55%)	**High Priority Site** based on high pair occupancy and reproductive success. Adverse effects not anticipated because no NRF removal/downgrade.
0957O	629 (19%)	1 (0.2%)	0	0	0	2	0	0	0	0	15	52	629 (19%)	1 (0.2%)	**Low Priority Site** based on the low pair occupancy and reproductive success. Site burned at high severity during the 2001 Quartz Fire and NRF habitat only comprises 18% of the home range and 0.2% of the core area. Unlikely there's sufficient NRF habitat, particular at the core-use area, to support spotted owl occupancy. Adverse effects not anticipated because of no NRF removal/downgrade.
0973O[3]	787 (23%)	35 (7%)	0	0	0	1	0	0	0	0	11	52	787 (23%)	35 (7%)	**Low Priority Site** based on the low pair occupancy and low reproductive success. Female owl not detected enough times to qualify as a resident single. Adverse effects not anticipated because no NRF removal/downgrade.
1836A[3]	1,152 (34%)	53 (11%)	7	2	0	11	1	0	6	48	63	289	1,145 (34%)	51 (10%)	**High Priority Site:** high pair occupancy and reproductive success. Vegetation treatments avoid NRF removal/downgrade. Adverse effects anticipated due to 9 acres R/F removal from road construction. These 9 acres are distributed in 6 small (less than 2.5 acres) road segments. 6 of these acres in high habitat suitability.
1836O[3]	1,099 (32%)	307 (62%)	9	0	0	12	4	0	0	92	58	228	1,099 (32%)	307 (62%)	

Site	Pre-treatment NRF Habitat[1] (acres)/%		NRF Habitat Reduced[2] (acres)			Dispersal Removed (acres)			T&M in Core (acres)/%		T&M in Home Range (acres)		Post-Treatment NRF Habitat (acres)/%		Effects Summary
	HR	Core	HR	Core	NP	HR	Core	NP	NRF	Disp	NRF	Disp	HR	Core	
2232O[3]	1,666 (49%)	335 (67%)	**112**	0	0	4	0	0	5 (1%)	1	93	197	**1,554 (46%)**	**335 (67%)**	**High priority** site based on high pair occupancy and reproductive success. Adverse effects anticipated due to R/F downgrade (111 acres) in high habitat suitability to promote future structural diversity and promote the development of NRF (McKelvey 1). Downgrade also proposed in areas of low habitat suitability and on the ridges for forest health, ecological enhancement, and to increase stand resiliency from fires, insects, and drought. 1 acre of R/F removal from road construction.
2401O[3]	1,052 (31%)	155 (31%)	0	0	0	3	0	0	0	15	59	172	1,052 (31%)	155 (31%)	**High Priority Site** based on high pair occupancy and reproductive success. Adverse effects not anticipated because no NRF removal/downgrade.
3648O[3]	1,716 (50%)	203 (41%)	0	0	0	1	0	0	0	27	69	125	1,716 (50%)	203 (41%)	**Low Priority Site** based on the low pair occupancy and reproductive success. Adverse effects not anticipated because no NRF removal/downgrade. Male owl not heard or seen enough times to meet resident single status during recent surveys.
3941O	755 (22%)	25 (5%)	0	0	0	1	0	0	0	0	11	53	755 (22%)	25 (5%)	**Low Priority Site** based on the low pair occupancy and reproductive success. Adverse effects not anticipated because no NRF removal/downgrade. Site center and nest patch, and the majority of the core is on private lands. Amount of core-use area NRF may be insufficient for occupancy.
4066A[3]	576 (17%)	123 (25%)	0	0	0	1	0	0	0	0	69	71	576 (17%)	123 (25%)	**High Priority Site:** high pair occupancy and reproductive success. Adverse effects not anticipated because no NRF removal/downgrade. Alternate nest is on private and 100 acres on private in the core were recently logged.

Site	Pre-treatment NRF Habitat[1] (acres)/%		NRF Habitat Reduced[2] (acres)			Dispersal Removed (acres)			T&M in Core (acres)/%		T&M in Home Range (acres)		Post-Treatment NRF Habitat (acres)/%		Effects Summary
	HR	Core	HR	Core	NP	HR	Core	NP	NRF	Disp	NRF	Disp	HR	Core	
4066O	713 (21%)	72 (14%)	0	0	0	1	0	0	0	0	29	0	713 (21%)	72 (14%)	
FS1993	553 (16%)	74 (15%)	3	0	0	3	1	0	6 (8%)	1	47	85	550 (16%)	74 (15%)	**Low Priority Site** based on the low pair occupancy and reproductive success. Treatments avoid NRF removal/downgrade. Adverse effects anticipated due to 3 acres of R/F removal from road construction although in low habitat suitability and on a ridge.
FS2001[3]	1,829 (54%)	460 (93%)	0	0	0	0	0	0	0	0	0	11	1,829 (54%)	460 (93%)	**Low Priority Site** based on the low pair occupancy and reproductive success. Adverse effects not anticipated because no NRF removal/downgrade.
FS2002[3]	1,944 (57%)	336 (68%)	0	0	0	0	0	0	0	0	0	63	1,944 (57%)	336 (68%)	**Low Priority Site** based on the low pair occupancy and reproductive success. Adverse effects not anticipated because no NRF removal/downgrade.

1 – NRF on Federal lands/percent of habitat within the total home range. 2 – NRF reduced = NRF removed or downgraded due to the proposed action. 3 – Site centers are within Critical Habitat.

Effects of Thinning (Treat and Maintain Prescriptions) on Resident Spotted Owls

As discussed above in the thinning effects, Treat and Maintain section, the proposed Nedsbar Project's effects to spotted owl R/F habitat is anticipated to be variable. Adverse effects are already anticipated to spotted owls at three (1836O/A, 2232O and FS1993) due to habitat removal. As such, those spotted owls are considered to be adversely affected by the overall project. Considering both the treatment prescriptions and model outputs, the post-thinning structural conditions of spotted owl habitat are within the ranges that commonly characterized as foraging or dispersal-only habitat. As such, spotted owl life history functions are not anticipated to be impaired due to the treat and maintain prescriptions.

Spotted Owls Not Likely to be Adversely Effected

The Nedsbar proposed action includes a mix of thinning prescriptions that are intended to treat and maintain R/F and dispersal-only habitat. Because the R/F treatment units are primarily outside the core-use areas (Assessment: Table 10, pages 34-38 and Appendix C, Table C-2 and Table 5 above) and per the spatial relationships described above, we do not anticipate adverse effects to spotted owls at these 10 sites. Site 0097O has two acres of proposed R/F thinning within the core-use area; however, the amout of acres is very minor and adverse effects are not anticipated.

The amount of acres proposed for dispersal-only habitat thinning treatments are also primarily located outside the core-use areas but up to 48 acres (Assessment, Appendix C, Table C-2 and Table 5 above) are proposed for treatment among four core-use areas (excluding sites already adversely effected). However, the amount of NRF habitat currently extant in these four cores (0097O, 0875O, 2401O and 3648O) is not at a level where we consider the core-use area as severely deficit. As such, the Service does not anticipated the dispersal-only habitat thinning within these core areas to exacerbate the discountable effects (see below regarding habitat fitness).

Up to 14 acres of dispersal-only habitat removal is proposed within the home ranges of eight sites (excluding sites already adversely effected). The maximum amount of dispersal-only habitat removal is 3 acres at these eight sites (Assessment, Appendix C, Table C-2). The landscape connectivity function of the action area (including the surrounding watersheds) is not expected to dimish post-treatment (see dispersal analysis above). Further, Dugger et al. (2005) suggest that there is little evidence for any relationship between intermediate-aged forests types and spotted owl demographics in their study. The amount of these younger-forest types does not appear to affect spotted owl fitness directly; instead, the contribution of older forest best explains the relationship (Dugger et al. 2005) (also seeThomas et al. 1990 p. 193-199, Bart 1995 p. 943-945, Meyer et al. 1998, Franklin et al. 2000, Zabel et al. 2003, and USDI FWS 2009 for older forest contribution) .

Even if spotted owl occupancy is presumed at two of the (NLAA) sites (i.e., FS2001 and FS2002), because of the minimal impacts (no R/F removal and sufficient home range habitat) of the proposed activities (Table 5), impairment of spotted owl life history behaviors is not anticipated.

Proposed Treatments Outside of Known Spotted Owl Home Ranges

Approximately 6,148 acres of NRF habitat occurs outside of known spotted owl home ranges on Federal lands within the Nedsbar action area. Of these acres, the proposed action's primary impact includes the removal (101 acres) and downgrade (172 acres) of up to 273 acres of R/F habitat (Assessment, p. 39, Table 11). For reasons similar to those discussed in the Effects to Habitat section above, this habitat modification will result in adverse effects to the species. The District initiated spotted owl protocol surveys in 2014 through 2016 in these areas (no responses) and are continuing protocol surveys in the outyears as appropriate. If resident spotted owls are located during these surveys, the District will modify or drop units to avoid incidental take of spotted owls and/or reinitiation consultation as appropriate (Assessment, p. 40 and see PDC). The District's avoidance of impairment of life history functions of spotted owls associated with the proposed action is therefore not likely to contribute to diminishment of the demographic condition of the species at the local level and/or recovery unit.

Effects of the Action on Spotted Owl Prey Species

Spotted owl prey species in this portion of the spotted owl's range, including the Nedsbar action area, consist primarily of northern flying squirrels, woodrats and a variety of other small mammals (Forsman et al. 2004 Table 2, p. 218). The Nedsbar proposed action will result in the removal, downgrade and thinning of spotted owl habitats. In general, spotted owl primary prey species, such as northern flying squirrels, will likely avoid harvested and/or thinned NRF (or R/F) habitat (Carey 2000, Forsman et al. 2004) and harvested and/or thinned dispersal-only habitat (Wilson 2010, Manning et al. 2012, Wilson and Forsman 2013). Flying squirrel avoidance is anticipated due to the reduction in tree densities, canopy cover (or closure), and mid-story canopy, as well as impacts to existing snags and down coarse wood in harvested areas. All of these attributes are key habitat features that influence the carrying capacity of the affected stands for the flying squirrels. These harvested areas will become much more inhospitable to flying squirrels, whose abundance is tied to complex mid-story canopies (Carey 2000 and Wilson 2010, Wilson and Forsman 2013).

However, Sollmann et al. (2016, p. 105) found that although specific treatment units experiencing canopy reductions did have fewer flying squirrels post-treatment, the surrounding stands were able to absorb displaced individuals to the extent that the overall landscape-scale density of flying squirrels remained similar to pre-treatment levels in their study area. The Sollmann et al. study was conducted in central California mixed-conifer forests which are somewhat similar in structure and processes to the District's dry-forest, mixed conifer conditions. Results by Stephens et al. (2014) suggest that flying squirrels were similar in abundance pre and post-treatment in their mixed-conifer forest study area (see below).

Dusky-footed woodrats occur in a variety of conditions, including both old, structurally complex forests and younger seral stages, and are often associated with streams (Carey et al. 1992, 1999, Sakai and Noon 1993, Hamm and Diller 2009). Results of Forsman et al. (2004, p. 218) indicate that woodrats are an important spotted owl prey item in southern Oregon. Ward (1990, p. 62) found in the California Klamath Province 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. These ecotones are primary habitat and transition areas for woodrats. Research has suggested that some types of harvest activities such

as regeneration harvest and thinning or associated practices (e.g., burning slash piles) could be detrimental to dusky-footed woodrats if it reduces hardwoods, shrubs or downed wood. These practices, some similar to proposed action, would remove food resources and nesting structure for the species. Conversely, the harvests could ultimately benefit woodrats if they result in the growth of shrubs or hardwoods (Innes et al. 2007) and the creation of new ecological edges (Sakai and Noon 1993). As mentioned above, Nedsbar prescriptions include the retention of hardwoods (to the extent practicable) and will most likely introduce more spatial heterogeneity within the stands that results in ecological edges. In the Sierra Nevada forests of northern California, Stephens et al. (2014) and Kelt et al. (2013) reported small mammal (i.e., woodrats, northern flying squirrels, mice, voles, ground squirrels) response to treated and mixed conifer forests. Whereas canopy thinning caused significant changes in forest structure, small mammal assemblages were similar before and after thinning and group selection, (Kelt et al. 2013), which suggest a minimal response in the short-term to these treatments (Stephens et al. 2014). The Nedsbar proposed action for a period of time, will enhance shrub and early seral species, benefitting woodrats, which are likely the more dominant prey item in the action area.

Considering all of the available information, the Service anticipates both short and long-term reductions in the distribution and possibly the abundance of primary prey species of the spotted owl in the action area, in particular the northern flying squirrel, caused by the habitat modification treatments (i.e., removal, downgrade and treat and maintain). These negative impacts to the prey base (i.e., flying squirrels) may be offset in the long-term by the on-site retention of snags and coarse wood (USDI BLM 1995 p. 39) as described in the Conservation Measures above. At the larger action area scale, the relatively small scale of R/F habitat removal is likely to ameliorate impacts to spotted owl prey species distribution and abundance. Additionally, the retention of Recovery Action 32 stands along with survey and manage species habitat protection areas across the action area is anticipated to serve as refugia areas and provide some connectivity for dispersing small mammals. Further, spotted owl habitat post-thinning is anticipated to continue its pre-thinning function which also has some beneficial effects to secondary prey species of the spotted owl (e.g., mice, voles, etc.). This includes likely beneficial outcomes for woodrats, either through thinning or downgraded habitat. There is speculation that secondary prey items are believed to benefit spotted owls. For example, Rosenberg et al. (2003) found a positive correlation between spotted owl reproductive success and deer mice abundance. This is somewhat surprising in that deer mice generally make up only a very small percentage of the biomass in spotted owl diets.

Potential Influence of Barred Owls

The District did not conduct surveys specifically for barred owls in the Nedsbar action area. However, during spotted owl surveys, biologists detected barred owls at four of the 13 spotted owl sites (Assessment, Appendix D, Table D-1 page 68). A study in the Oregon Coast Range suggests that over the course of a season, spotted owl surveys allow approximately 85 percent of the barred owls present in the area to be detected (Wiens et al. 2011, Table 1 p. 534; p. 535). While surveys are ongoing for spotted owls across the action area, the ratio of barred owls detected to known spotted owl sites is lower relative to what is reported for the Oregon demographic study areas (Dugger et al. 2016, Appendix C). As such, the “barred owl effect” may be relatively less in the local area compared to farther north in the spotted owl’s range; however, this is caveated in that targeted surveys for barred owls are not local conducted.

Available evidence suggests that the presence and distribution of barred owls may affect habitat quality for spotted owls (Wiens 2012 and Yackulic et al. 2012). Additionally, many studies suggest that the two species compete for resources and maintaining older, high quality forest habitat may help spotted owls persist, at least in the short-term (see Threats in Appendix B). While not common, Wiens (2012 and 2014) did find spotted owls and barred owls occupying the same territories concurrently.

To date, there are no known forest conditions where spotted owls have a competitive advantage over barred owls. It is also not known if forest habitat removal directly results in a range expansion of barred owls (USDI FWS 2013). The Service specifically considered and rejected an alternative to use forest management to favor spotted owls and hinder barred owls. It was reasoned that there are no known forest conditions where spotted owls have a competitive advantage over barred owls (USDI FWS 2013). For example, barred owls successfully colonized Olympic National Park in areas that never had timber harvest. It has been suggested that barred owls are habitat generalist and may benefit from timber harvest activities such as clearcutting and thinning (see for example Hamer 1988). However, much of the evidence to date shows that barred owls prefer older forest habitat, similar to the spotted owl (Wiens et al. 2014). An alternative hypothesis is that barred owls have a wider range of habitat use in the northern part of the spotted owl's range, and the spotted owl has a narrower one. But in the more southerly part of the spotted owl's range, the spotted owl seems to have a broader range of habitat use than the does the barred owl (Courtney et al. 2004). As considered above in the Thinning Effects section, spotted owls in the Klamath Province have broad range of habitat use patterns.

Because barred owls can prey on a wider range of species than spotted owls (USDI FWS 2013 and Wiens et al. 2014), it has been speculated that thinning may increase prey for barred owls. The results of studies evaluating commercial thinning of mid-seral stands have found an increase abundance of deer mice and chipmunks (see summary in Courtney et al. 2004). Wiens (2012) found that these two species comprised about five percent of the prey biomass for spotted owls compared to three percent for barred owls in western Oregon. Thus, the small mammal species that been found to increase most after thinning are not the prey that are selectively favored by barred owls more than spotted owls.

Our evaluation herein focused on whether the proposed action could potentially exacerbate competitive interactions between the two species by reducing the availability of high quality NRF habitat (see Recovery Plan section above), if the two species co-occur in the action area. The proposed action, which includes the removal and downgrade of spotted owl R/F habitat, is planned for non-high quality (non-Recovery Action 32) spotted owl habitat. As noted above, barred owls do select for older, more structural complex forest stands, similar to spotted owls (Hamer et al. 2007 and Wiens et al. 2014). The likelihood that inter-species competition will be exacerbated is likely minimal because the effects of the proposed action will not occur in forest stands that meet the criteria of high quality habitat. However, because there is relatively less overall habitat on the landscape, post-project, and barred owls are generally the dominant species, it is anticipated that competitive interactions between the two species may occur due to the a reduction in habitat caused by the proposed action.

Effects of the Proposed Action on Spotted Owls due to Disturbance

The effects of noise on spotted owls are largely unknown (Appendix B). However, noise-related disturbance, including altered foraging behavior and decreases in nest attendance and reproductive success, have been reported for other raptors (White and Thurow 1985, Andersen et al. 1989, McGarigal et al. 1991). For the Nedsbar proposed action, the District plans to implement PDC that restrict activities to outside of the breeding season (March 1– June 30) and/or beyond recommended disturbance distances (Assessment, Appendix A). Application of the PDC is expected to avoid noise or activity which would adversely affect nesting spotted owls and their young. Nesting owls are confined to an area close to the nest, but once the young fledge, they can move away from noise and activities that might cause adverse effects. For this reason, no adverse effects to spotted owls are anticipated due to disturbance with implementation of the Nedsbar proposed action.

Effects of the Action from the Perspective of the Northwest Forest Plan (NWFP)

The Nedsbar proposed action is located within the Matrix, Applegate AMA and riparian reserve land use allocations (USDA FS/USDI BLM 1994, complete). Under the NWFP, the Matrix LUA represents the area "in which most timber harvest and other silvicultural activities will be conducted" (USDA FS/USDI BLM 1994, p.7). The AMA represents an area that was "designed to develop and test new management approaches to integrate and achieve ecological, economic and other social and community objectives" (USDA FS/USDI BLM 1994, p.6). Riparian reserves are intended to protect the health of the aquatic system and its dependent species and to provide incidental benefits to upland species (USDA FS/USDI BLM 1994, p.7). Although some proportion of the spotted owls in the Matrix and on private lands within and adjacent to the action area are likely to be nesting and rearing young, the NWFP conservation strategy for the spotted owl does not rely on these nesting pairs and this nesting habitat to maintain the spotted owl population on Federal lands. However, as noted above, in recognition of the declining status of the spotted owl, Recovery Action 10 of the *Revised Recovery Plan for the Spotted Owl* recommends conserving spotted owl sites and high value spotted owl habitat to provide additional demographic support (i.e., survival and fecundity) to the spotted owl population (see below). As discussed below, the District integrated Recovery Action 10 principles into the proposed action.

The NWFP assumed that about 2.5 percent of the Matrix/AMA LUA would be subject to timber harvest per decade (Appendix B). During the decades of NWFP implementation (Davis et al. 2011 and 2015), consultation records show timber harvest in the Matrix/AMA LUA was consistent with (and lower than) that assumption (Appendix B). Further, the effectiveness of the NWFP generally shows it to be functioning in terms of a) arresting the decline of habitat, b) recruitment of habitat, and c) successful spotted owl dispersal (Davis et al. 2015), with some exceptions related to dispersal primarily on private lands that connect the Oregon Coast Range Province from the Oregon West Cascades Province. The Nedsbar proposed action is not anticipated to appreciably reduce the landscape dispersal function.

PROJECT CONSISTENCY WITH THE NORTHERN SPOTTED OWL RECOVERY PLAN

The Recovery Plan (USDI FWS 2011) is the most comprehensive reference for the ecology and management of the northern spotted owl. It also represents best management practices to facilitate recovery of the subspecies. The Plan identifies the primary range-wide threats to the spotted owl as competition with the barred owl and habitat loss or degradation, primarily from stand-replacing wildfire and other disturbances. The Plan describes a Recovery Strategy which includes habitat conservation and active forest management as necessary steps to address these threats; including: conserving more occupied habitat and unoccupied high-value habitat; and encouraging and initiating active management actions that restore, enhance and promote development of high value habitat, consistent with broader ecological restoration goals (USDI FWS 2011, III-4-5). Strategies and recovery actions (e.g., 10 and 32 are discussed below) in the Plan help the Service to evaluate projects, such as Nedsbar, in terms of their ability to contribute to the overall recovery of the spotted owl.

Specific text in the Plan addresses the disparate issues which face the spotted owl across its range. In the disturbance-prone drier forests of the Oregon Klamath Physiographic Province where the Project is located, the Plan recommends active management "in a way that reconciles overlapping goals of spotted owl conservation, responding to climate change and restoring dry forest ecological structure, composition and processes, including wildfire and other disturbances (USDI FWS 2011, III 20-21). The Province is threatened by ongoing habitat loss as a result of wildfire and effects of fire exclusion on vegetation change (USDI FWS 2011, I-8).

As a general rule, forest management activities that are likely to diminish a home range's capability to support spotted owl occupancy and reproduction in the long-term should be discouraged. However, the Service recognizes that land managers have a variety of forest management obligations. Including that it may be necessary to maintain or improve ecological conditions where the intent is to provide long-term benefits to forest resiliency and restore natural forest dynamic processes, when implemented in a landscape context and carefully applied prescriptions (USDI FWS 2011, III-45). Such actions may include silvicultural treatments that promote ecological restoration and are expected to reduce future losses of spotted owl habitat and improve overall forest ecosystem resilience to climate change, which should result in more habitat retained on the landscape for longer periods of time (USDI FWS 2011, II-11). Land managers should not be so conservative that, to avoid risk, they forego actions that are necessary to converse 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 an appropriate balance to this dichotomy will be an ongoing challenge for all engaged in spotted owl conservation and Federal actions will be subject to section 7 consultation allowing for site specific analysis of effects on spotted owls (USDI FWS 2011, II-11-12).

Increasingly, objectives for forests with moderate- or mixed-severity fire regimes, such as in the Oregon Klamath Province, are to restore successfully diverse landscapes that are resistant and resilient to current and future stressors (Hessberg et al. 2016). Best available information indicates that large portions of the forested landscape in the Province have missed frequent, low-intensity fires, and current conditions of stands are severely departed from historic conditions (Hessberg et al. 2016 and Haugo et al. 2015). This leads to the prospect of more high severity

and extent of large-scale fires, as suggested by Davis et al. (2015). There is scientific debate regarding past and future fire frequency in the dry forest systems and whether to actively manage at risk stands (Hessberg et al. 2016 and Odion et al. 2014). The Recovery Plan and Critical Habitat rule acknowledged differences of opinion in the literature but concluded that active forest management is needed in dry-forests. However, the treatments should be conducted in a strategic manner and with specific design features (USDI FWS 2011, e.g., section III).

Results of the District's IVM process indicated that the watersheds containing the Nedsbar Project rated medium in terms of having integrated project opportunities. As mentioned above the District has already treated high priority areas in this area of the District and is now assigning resources to the medium priority areas. Objectives for Nedsbar broadly include the harvest of stands for economic return and to accomplish restoration objectives (Assessment, e.g., Tables 13 and 15). Many of these treatments include promoting future multi-layered structure stands from stands that are currently very simple-homogeneous, so as to benefit the growth of spotted owl habitat or treat stands for ecological benefits (Assessment, Appendix B) and as described in the Recovery Plan and Critical Habitat rule. Overall, it is anticipated that some of these treatments will have short-term impacts to the spotted owl (and habitat) but over the longer-term, is anticipated to result in improved functioning of spotted owl habitat and/or more resilient forest stands (and habitat), better able to withstand large-scale wildfire events and therefore keeping habitat on the landscape.

The Nedsbar action area is within the larger Oregon Klamath Province where research clearly shows it is departed from historic forest conditions and susceptible to large-scale fire (Haugo et al. 2015 and Hessberg et al. 2016). Roloff et al. (2012) modeled active and no-management effects on spotted owls in fire-prone landscapes of southwest Oregon, near the Nedsbar area. Roloff et al. (2012) found that active management was "more favorable to spotted owl conservation…than no management." For example, they contend that small-scale heterogeneity caused by patchy distribution of fire intensity (or in this case, active management), is favorable to spotted owls in disturbance prone landscapes. Further, active management in older forests was effective at reducing crown fire potential, but caution that logging debris and surface fuels must be managed as well (Roloff et al. 2012, p. 7). Fuels management is proposed as part of the Nedsbar proposed action. Other efforts elsewhere in the range of the spotted owl have pointed out the potential cross purposes of treating spotted owl habitat (Odion et al. 2014 and Hessberg et al. 2016). However, it is likely that large-scale landscape fire risk reduction, when spatially optimized, can aid in maintaining spotted owl habitat in greater measure (Ager et al. 2007 and Finney et al. 2007).

For the proposed action, for R/F habitat with treat and maintain prescriptions, this habitat in the near term is expected to continue with a with similar function post-treatment (as described in the Thinning Effects section above) and overtime these stands are anticipated to be on a better trajectory for developing NRF habitat conditions (Assessment, Appendix B). In addition to the District's modeling data (Assessment, Appendix B), it provided to the Service empirical information from several stands near the action area, showing how these stands have responded to treatments that would have been considered as treat and maintain conditions, not unlike the prescriptions discussed here. From the information provided by the District (note: we do not know how the District selected these stands or how representative they are), the overall conclusion is that canopy cover, layering and basal area were meeting the post-harvest expectations or on a trajectory to meet the expectations (USDI BLM 2016d).

For current R/F homogeneous stands with proposed downgrade, it is evident that immediately post-harvest, canopy will be reduced by as much as 20 percent as well as a reduction by several hundred trees/acre (e.g.,769 to 64) (Appendix B). Clearly these overstocked stands are beyond the range of historic variability. However, the basal area and canopy of these stands immediately post-harvest is within the range of relatively lower quality spotted owl foraging habitat (see Thinning section above) and in 30 years, the basal area will have increased based on having larger tree and canopy cover will have incrementally increased (Assessment, Appendix B). Other structural features such as diameter distribution of trees and layering are anticipated to be present at that time as well (Appendix B, Figure 1-a), but likely not in a quality of more developed NRF habitat.

It appears based on recent surveys that there are very few resident spotted owls in the action area. Most of the stands proposed for treatment are homogeneous, lack layering and are of simple structure. A large proportion of the downgraded habitat is outside known home ranges. The lack of quality habitat could be a one of several factors making the area unfavorable to spotted owls. Best available information strongly suggests that the local and regional circumstances (e.g., departure from historic conditions) mark the area as highly vulnerable to large scale wildfire. One of the intents of the Project is to reduce fuel continuity within and among stands within the action area which should lead to an area less susceptible to large scale wildfire. Through the District' planning, PDC and implementation of Recovery Plan recommended Recovery Actions (per below), impacts to spotted owls were minimized to the extent practicable, in keeping with the Project's intent. Collectively for these reasons (and per below), the long-term benefits of the Project likely outweigh the short-term risk to spotted owls.

The Plan recommends continued application of the NWFP reserve network (as described above), and the maintenance and restoration of more occupied and high-value spotted owl habitat (Recovery Actions 10 and 32), including increased conservation of habitat on some Federal "Matrix" lands (USDI FWS 2011, p. III-41).

Recovery Action 10 recommends: "*Conserve spotted owl sites and high value spotted owl habitat to provide additional demographic support to the spotted owl population*."

Of the 13 sites analyzed, six rated as high value due to long-term and/or recent occupancy and reproduction (0097O, 0875O, 1836O/A, 2232O, 2401O and 4066A/O). The District's objectives at these six sites were to avoid adverse effects to the extent practicable, which was the case for four of the six sites (exceptions being sites 1836O/A and 2232O). While adverse effects to spotted owls are anticipated to these two sites, site 2232O will have post-treatment habitat levels above what best available information suggests for habitat-fitness potential. Further, treatments at site 2232O are intended to improve forest health and create more stand structure and species diversity (Assessment, Table 15). The adverse effects to spotted owls at site 1836O/A are due to habitat reduction (up to 9 acres) because of road construction and not vegetation treatments.

The remaining sites (0957O, 0973O, 3648O, 3941O, FS1993, FS2001 and FS2002) rated as low in the Recovery Action 10 process. Generally, the District's objectives at these sites is to promote the development of spotted owl habitat (Assessment, e.g., Tables 13 and 15).

Overall, only three of the 13 known spotted owl sites have adverse effects. None of the three adversely affected sites have current occupancy, and therefore no impairment of spotted owl life history functions is anticipated.

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

Field evaluations by District staff identified 20 acres of forest stands that meet the characteristics of Recovery Action 32 (USDI FWS 2011 and USDA FS/USDI BLM 2010). None of the District's proposed actions will include any harvest or associated activites in Recovery Action 32 stands.

Effects of Interrelated and Interdependent Activities

Interrelated actions are part of a larger action and depend on the larger action for their justification. Interdependent actions are those that have no independent utility apart from the action under consideration. The District provided the following Nedsbar Project interrelated and interdependent effects, such as noise, road construction or timber hauling on existing system roads, and post-harvest brush disposal. Brush disposal activities can include chipping, biomass removal, slashing, and burning, and slashing, but vary according to post-treatment conditions, fuels management objectives, requirements for coarse woody debris retention, and other resource management goals. All of these activities are covered in the Project Description above.

Summary of Adverse and Beneficial Effects

In summary, the scope of the habitat impacts likely to be caused by the proposed action have the potential to adversely affect spotted owls associated with sites 1836A/O, 2232O and FS1993 due to downgrade of R/F habitat. However, site specific circumstances, as analyzed above, has lead the Service to conclude that the proposed Federal action is not anticipated to significantly disrupt the breeding, feeding, or sheltering behavior of the spotted owl to the extent that it actually injures or kills affected spotted owls.

For the aforementioned reasons, we conclude that it is not reasonably certain that the adverse impacts due to implementation of the proposed action rise to the level of harm at any of these three sites. The mere potential of take is not a legitimate basis for exempting take. Therefore take is not exempted for any spotted owls associated with the proposed action (see Incidental Take section below). The impact, in particular whether it will jeopardize the continued existence of the species, is further analyzed and discussed below in the CONCLUSIONS section.

Multiple beneficial effects from the proposed action are anticipated. For example, the District is working in a prioritized area both locally and regionally and having a proposed action that is anticipated to help reduce the risk of large scale wildfire in the area. As a result, spotted owl habitat is anticipated to be developed over the long term and current habitat buffered from

potential low and moderate fire effects. Treated stands are likely to be more ecologically sustainable because residual stands would be less susceptible to suppression mortality, as well as mortality from insects and disease. Treatments would result in more vigorous trees that are less susceptible to insects and disease. Spotted owl demographic support and conservation of habitat is further provided for by the District's implementation of Recovery Actions 10 and 32.

EFFECTS OF THE ACTION ON SPOTTED OWL CRITICAL HABITAT

This section evaluates how the proposed action is likely to affect the capability of affected critical habitat PCEs/PBFs to support spotted owl NRF and dispersal habitat by considering how project impacts affect the landscape scale of spotted owl life history requirements regardless of the species' presence or absence in the affected critical habitat (77 FR 233:71876-72068).

The Nedsbar action area overlaps a total of 18,934 acres (Table 6) within the KLE 6 critical habitat subunit. The proposed action will affect approximately 1,326 acres of critical habitat PCEs, consisting of approximately 488 acres in PCE 2 and 3 (NR and F habitat) and 838 acres in PCE 4 (dispersal-only habitat) (Table 6) (Assessment, Table 13, pages 41-42 for treatment rationale). The consultation process evaluates how a proposed action is likely to affect the capability of critical habitat to support spotted owl nesting, roosting, foraging, or dispersal PCEs by considering the scales at which the life-history requirements of the northern spotted owl are based regardless of the species' presence or absence (USDI FWS 2012a).

Table 6. Summary of effects to spotted owl habitats in Critical Habitat Subunit KLE 6 within the Medford District's Nedsbar action area (Assessment, Table 12) (FWS Ref. # 01EOFW00-2016-F-0283).

	NRF[1] Habitat Removed (acres)	NRF Habitat Downgrade (acres)	NRF Habitat Treated &Maintained (acres)	Dispersal-Only Habitat[3] Removed (acres)	Dispersal-Only Habitat Treated &Maintained (acres)	Total Habitat Acres Treated
	RF[2]	RF[2]	RF[2]			
KLE-6 (baseline acres from Table 2)	10,464			2,931		
Nedsbar Project	7	234	246	20	818	**1,324**
% Change to KLE-6 Baseline Habitat	**<- 0.08%**	**-2.2%**	**No Change**	**- 0.7%**	**No Change**	

[1] NRF Habitat: consists of habitat used by owls for nesting, roosting, and foraging and R/F is a subset of NRF. Generally, this habitat is multistoried, 80 years old or older (depending on stand type and structural condition), has high canopy cover, and has sufficient snags and down wood to provide opportunities for nesting, roosting, and foraging. [2] Roosting/Foraging Habitat: differs from nesting habitat as these stands often consist of single storied canopies, lack decadent features, and usually has a lower basal area (at least 150 ft^2/acre basal area). [3] Dispersal-only Habitat: generally defined as forest stands with canopy cover of 40 percent or greater and an average diameter at breast height (DBH) of 11 inches or greater. It provides temporary shelter for owls moving through the area between NRF habitats and some opportunity for owls to find prey.

Effects from NRF (PCE 2 and 3) Removal and Downgrade within Critical Habitat

According to the final rule (77 *Federal Register* 233:71876-72068), Section 7 consultations need to consider the temporal and spatial scale of impacts a proposed action may have on the PCEs, using a scale that is relevant to the needs and biology of the spotted owl. The habitat primarily being impacted under the proposed action is foraging habitat (PCE 3). However, there are features of roosting habitat in some of the stands. To be conservative for this analysis, we are analyzing the effects to PCE 2 which includes nesting, roosting, foraging habitat features.

For this analysis we support the District's use of a 500 acre scale circle configuration because this metric approximates a spotted owl core-use area (USDI FWS 2009, USDI FWS 2012a and 77 Federal Register 233:71876-72068) which has been used in previous consultation analyses conducted by the Rogue Basin Level 1 Team, as appropriate for this Province. Therefore, a 500 acre (0.5 mile radius) circle was delineated and geographically centered on the most impactful proposed treatment unit in subunit KLE 6, and which represent potential localized effects (Assessment, Table 12, p. 40 and Table 7 herein). The purpose of the localized analysis is to determine, as a first step, whether adverse effects to critical habitat are likely due to the proposed action. Therefore, the most impactful type of project, such as either habitat removal or downgrade, along with the most acres of these types of projects, are identified for initial analysis and likely represent a worse case scenario. Once this step is completed, then pre-and post-treatment NRF habitat amounts within the 500 acre analysis areas are compared to determine effects to PCEs and PBFs of spotted owl critical habitat (Table 7).

Table 7. 500 acre analysis of spotted owl critical habitat associated with the Nedsbar Project, Medford District BLM (Assessment, Table 14) (FWS Ref. # 01EOFW00-2016-F-0283).

Project	Critical Habitat Subunit	R/F Habitat Reduced (acres)	R/F Habitat Pre-Treatment (acres)	R/F Habitat Post-Treatment (acres)	Percent Change	Effects Determination
Nedsbar	KLE-6	78[1]	351	273	-22%	Likely to Adversely Effect

1 = Includes NRF Habitat Downgrade from unit 27-34A and portions of other NRF downgrade units within the 500-acre circle (total of 78 acres).

Based on the 500-acre analyses, the proposed downgrade of NRF habitat (PCE 2) (to PCE 4 dispersal-only habitat) would result in a measureable effect to the PCEs at the 500-acre scale due to a 22 percent change. This is because the selective thinning would likely remove large diameter trees, reduce canopy layering, and canopy cover. As a result, there will be less favorable within stand conditions for spotted owls to forage along with a reduction in some prey species such as flying squirrels (see Wilson 2010 and Manning et al. 2012). Conversely, dusky-footed woodrats are likely to benefit because of increased shrub and pole stands (Sakai and Noon 1993). Spotted owl are known to forage in more open conditions (see Effects section above) and this is likely due to abundance of large prey, such as woodrats.

As previously mentioned, the R/F downgrade is associated with selective thinning and density management of the stands. The prescriptions are designed to promote structural and species diversity in mostly simple structure and homogenous stands that are part of the two percent reduction of habitat (i.e., R/F to dispersal). The intent of the selective thinning is to place the stands of simple structure on a longer-term trajectory. The result of this trajectory is having stands with increased layering, more vertical and horizontal diversity and with a species composition more resilient to withstand high severity fire. More immediately post-harvest, the canopy cover is anticipated to facilitate successful dispersal of spotted owls and provide relatively lower quality foraging habitat. Overall, the proposed action is not anticipated to appreciably diminish the ability of this sub-unit to provide intended connectivity and demographic support functions (see below).

Effects from Dispersal Habitat Removal in Critical Habitat

Implementation of the Nedsbar project is expected to result in the removal of up to 27 acres of dispersal quality habitat (Assessment, Appendix C, Table C-1) (7 acres R/F and 20 acres of dispersal-only removal), in critical habitat subunit KLE-6, primarily as a result of landing and temporary route construction. These areas are small in size, generally no more than an acre and broadly distributed throughout the action area. The 51,440 acre action area currently consists of approximately 54 percent dispersal quality habitat (NRF plus dispersal-only). Post-project, the proposed removal represents less than one percent of dispersal quality habitat in the surrounding fifth-field watersheds (Little Applegate River, Upper Applegate River and Bear Creek), all with dispersal habitat above 40 percent for each watershed (see Effects analysis above) and all within critical habitat. Because of these factors, we do not anticipate that the removal of 27 acres of PCE 2, 3 and 4 will appreciably diminish the dispersal support function of the area or critical habitat, sub-unit KL 6.

Effects of Treating and Maintaining NRF and Dispersal-only Habitat within Critical Habitat

Prescriptions are intended to treat and maintain 246 acres of spotted owl NRF (R/F) habitat (PCE 2 and 3) and 817 acres of dispersal-only habitat (PCE 4). This is because proposed harvest units consisting of treat and maintain prescriptions are anticipated to have post-treatment basal area, canopy cover of 60 (RF) and 40 (dispersal-only) percent (USDI FWS 2012a) and other key within stand-structural features retained that are important to spotted owls, such as decadent woody material, large snags, and a multi-layered canopy. However, for reasons provided above in the Habitat Treat and Maintain section, we anticipate variable effects to habitat.

Intended Function of Critical Habitat Unit

As described above, the Nedsbar proposed action is likely to have adverse effects to critical habitat at the project-level scale, due to the removal of seven acres and downgrade of 234 acres of NRF (i.e., R/F habitat). However, at the larger subunit scale, the proposed removal and downgrade of spotted owl R/F habitat is not anticipated to diminish the intended demographic support function of critical habitat subunit KLE 6, due to project planning conservation measures that limit NRF habitat removal within known spotted owl home ranges.

Ten of the 13 affected spotted owl sites (0097O, 0875O, 0973O, 1836A/O, 2232O, 2401O, 3648O, 4066A, FS2001and FS2002) associated with this proposed action occur in spotted owl critical habitat. The District, through Recovery Action 10, attempted to avoid adverse effects to known-occupied sites by planning treatments that avoid the removal or downgrade of NRF habitat. This was challenging given the high overlap/distribution of home ranges across the action area/District. However, some negative effects are anticipated but they are limited to two sites,1836A/O (potentially nine acres due to road construction and not vegetation treatments) and 2232O. As described above in the Effect section, we do not anticipate impacts that significantly impair essential spotted owl behaviors and the sites are not occupied. Therefore, the intended demographic support function of the subunit will be intact post-project.

In addition, because one of the primary objectives of the Nedsbar proposed action is to improve functioning late seral habitat in the action area, treatment units within known spotted owl home ranges consist of prescriptions designed to improve future ecologic conditions.

Proposed activities that would result in the removal of 27 acres of dispersal quality (R/F plus dispersal-only habitat) habitat in critical habitat subunit KLE 6 would have negative effects at the project level scale. However, this level of removal is not expected to materially affect spotted owl movement across the landscape because at several scales (action area, individual watersheds and critical habitat subunit KLE 6), dispersal habitat occurs in amounts sufficient to support spotted owl dispersal. Forest landscapes traversed by dispersing spotted owls typically include fragmented mosaics of roads, clear-cuts, and non-forested areas, and a variety of forest age classes ranging from fragmented forests on cutover areas to old-growth forests (Forsman et al. 2002).

The following beneficial effects are anticipated as a result of implementation of the Nedsbar proposed action:

- Thinning in RF and dispersal-only habitat would promote growth, improve future foraging conditions for spotted owls, and promote the development of structurally complex forest conditions (Assessment, Appendix B, Table B-1).
- The quality of spotted owl foraging habitat in treated stands may improve in response to the relatively more open structure of the treated stands.
- Thinning in young stands that do not currently provide dispersal or NRF habitat would accelerate the development of spotted owl habitat.
- Very dense stands would be opened by thinning, thereby improving the ability for spotted owls to disperse within these stands. Thinning stands that currently provide poor quality dispersal habitat would improve the dispersal function for spotted owls by providing more “flying space,” and encouraging residual trees to develop more size and structural diversity.
- Treated stands are likely to be more ecologically sustainable because residual stands would be less susceptible to suppression mortality, as well as mortality from insects and disease. Treatments would result in more vigorous trees that are less susceptible to insects and disease.
- Treatments would increase survivability and vigor of more drought- or fire-tolerant species (pines, cedars, hardwoods) on ridge tops and in areas where site conditions do not favor Douglas-fir, or Douglas-fir is suppressing the occurrence of pines.

Summary of Effects to Spotted Owl Critical Habitat

Implementation of the Nedsbar proposed action is anticipated to have adverse efects to spotted owl critical habitat due to the modification of PCEs 3 and 4. Overall though, the Service concludes that the sub-unit will continue to provide its intended functions of connectivity and demographic support. This is because as the analysis above has demonstrated, connectivity of the action area is anticipated to facilitate successful spotted owl dispersal due to having sufficient habitat post-project and impacts that significantly impair essential spotted owl behaviors are not expected. As a result of these findings, the Service concludes that the proposed action is not anticipated to adversely modify spotted owl critical habitat.

CUMULATIVE EFFECTS ON THE SPOTTED OWL

Cumulative effects include the effects of future State, tribal, local or private activities that are reasonably certain in the action area considered in this biological 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.

The action area for the proposed action consists of a checkerboard pattern of ownership of private land interspersed with BLM administered lands. Management practices occurring on private lands primarily consist of industrial timber management. There are approximately 15,492 acres (30 percent) of non-Federal land within the 51,440 acre Nedsbar action area, a significant proportion of which may be subject timber harvest. The BLM does not track pre-harvest habitat on non- BLM managed lands. Given private lands forest practices and relatively short harvest rotations, it is likely that much of the forest habitat on private land provided a dispersal function for spotted owls. Non-Federal lands are not expected to provide demographic support for spotted owls across and between physiographic provinces (Thomas et al. 1990; USDA FS/USDI BLM 1994 entire).

To date, Oregon Forest Practice Rules have not adopted any regulations that specifically provide protection to spotted owls, other than a 70-acre nest site protection. Implementation of timber harvest activities that may occur on non-Federal lands in and adjacent to the action area have the potential to adversely affect individual spotted owl home ranges. However, the Service finds that no significant cumulative effects to the spotted owl are likely to occur on non-Federal lands in the action area for this consultation due to the current degraded condition of forest habitats on these lands relative to the life history requirements of the spotted owl.

CONCLUSION

After reviewing the current status of the spotted owl, spotted owl critical habitat, the environmental baseline for the action area, the effects of the proposed action and cumulative effects, it is the Service's Biological Opinion that the District's Nedsbar proposed action is not likely to jeopardize the continued existence of the spotted owl and not likely to destroy or adversely modify spotted owl critical habitat. The Service reached these findings for the spotted owl and spotted owl critical habitat based on the following reasons.

The Nedsbar proposed action is consistent with the NWFP in that it's located primarily within the Matrix and AMA LUAs, which, under the NWFP, are areas within which timber harvest activities are expected. Proposed treatments were designed to avoid adverse effects to spotted owls to the extent practicable and/or to promote the development of late-seral forest conditions (see below) benefical to spotted owls. Late-successional reserves are not impacted by the project and therefore large tracts for reserved areas are anticipated to continue current function for breeding pairs.

Pursuant to Service policy, when an action impairs or precludes the capacity of a recovery unit from providing both the survival and recovery function assigned to it, that action may represent/inform jeopardy to the species as determined at the range-wide scale. The Nedsbar action area occurs within the Oregon Klamath Mountains Physiographic Province, which serves as a recovery unit for the spotted owl. The Service does not anticipate the proposed action will impair or preclude the capacity of the recovery unit's conservation contribution to the species as a whole for the following reasons.

For the Province, approximately 864,953 acres of spotted owl NRF habitat exists (Appendix B herein) and the proposed action will remove/downgrade this by 394 acres. The District's reduction of NRF(i.e., lesser quality habitat –R/F) is not anticipated to reduce the Recovery Unit's capacity for spotted owl recovery because the action will modify less than one percent of NRF habitat within the recovery unit and most of these acres (via downgrade) will still provide canopy cover and other within stand structural features that support spotted owl dispersal and foraging, post-treatment.

While the overall loss of spotted owl habitat under the NWFP is generally within anticipated rates, habitat loss due to fire is heaviest in southwest Oregon. However, the size and redundancy of the LSR system are important features to accommodate, for a period of time, habitat losses due to large scale disturbance events (Davis et al. 2015). For example, LSRs and other large reserves account for over 50 percent of the Oregon Klamath Province (Lint et al. 2005). As stated above, the Recovery Plan continues to rely on the NWFP reserve system plus additional habitat conservation efforts per Recovery Actions 10 and 32. High quality, Recovery Action 32 type habitat is not being removed under the proposed action nor is NRF habitat (McKelvey 1). High quality spotted owl habitat retained on the landscape is intended to ameliorate barred owl impacts/competition with spotted owls for space and prey. Further, the District identified high priority sites (per Recovery Action 10) for conservation and restoration, so as to lessen impacts to relatively more reproductive spotted owls and provide demographic support to the broader population. Therefore, we conclude the habitat condition of the Province post-project is not anticipated to materially affect spotted owl recovery. As provided above in the Environmental Baseline section, the action area and Provincial habitat baseline are represented by best available information due to recent habitat updated provided by the District. While habitat is still important to spotted owl conservation, barred owl competition is likely the most pressing threat to spotted owls (see Conservation Recommendations below).

Given the climate trends (IPCC 2007, p.5) toward warmer, drier conditions and recent increases in the frequency of large wildfire events in the region (Davis et al. 2011, p. 63 and Westerling et al. 2006, p. 3), the reduction of within-stand fuel loadings inherent to the type of prescriptions for the majority of acres under the proposed action could benefit spotted owls by decreasing the likelihood and extent of large-scale wildfire within the action area. Wildfire has become the primary cause of spotted owl nesting/roosting habitat loss (Davis et al. 2015, p. 2).

Spotted owl survival and recovery are not only informed by habitat condition (per above) but also demographics. Habitat modification associated with the Nedsbar proposed action is likely to affect spotted owls at only three of 13 known spotted owl sites within the action area. In other words, 80 percent of the sites are not adversely effected. Overall, the District developed the Project, as much as possible in keeping with the Project Objectives and to have discountable effects.

Collectively, the Service anticipates that the Oregon Klamath Mountains recovery unit will continue to function post-project implementation because; 1) the action is compliant with the NWFP; 2) the analysis herein accounts for the effects of barred owls on spotted owl occupancy (completed surveys) and therefore effects to spotted owls are likely not underestimated to any meaningful degree in the action area; 3) besides the habitat provisions of the NWFP, the proposed action includes additional habitat conservation through Recovery Plan recommendations 10 and 32 that further conserve high quality spotted owl habitat and high

priority spotted owl sites to provide demographic support to the local population and ameliorate barred owl effects, and 4) no harm to spotted owls is anticipated due to the proposed action. While there are adverse effects due to the proposed action, the Provincial population is likely resilient enough to absorb negative impacts to habitat (see Shumaker et al. 2014) and results of Forsman et al. (2011) and Dugger et al. (2016) show that the spotted owl population in the KLA study area, the closest demography study area to the Nedsbar action area, may be stationary because the upper confidence interval overlaps 1.0 (Dugger et al. 2016 Figure 4, page 70). For these reasons, the Service does not anticipate reduction in spotted owl survival and recovery at the provincial scale. Therefore the Nedsbar proposed action is ***not likely to jeopardize the spotted owl***.

The Nedsbar proposed action includes the removal of seven acres of R/F habitat and 20 acres of dispersal-only habitat and the downgrade of 234 acres of R/F habitat in designated critical habitat. This represent less that two percent of the dispersal quality habitat in this portion of the KLE 6 critical habitat subunit that overlaps the action area. Based on the analysis provided in the Effects to Critical Habitat section above, the Service anticipates the proposed action is ***not likely to adversely modify*** critical habitat because the intended functions, connectivity and demographic support, of the sub-unit are anticipated to remain post-project.

INCIDENTAL TAKE STATEMENT

Section 9 of the Act and federal regulation pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Harass is defined by the Service as intentional or negligent actions that create the likelihood of injury to listed species 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 Act, provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

Spotted Owl

Based on the findings presented above in the "Effects of the Action" section, incidental take of listed species is not reasonably certain to occur, therefore, no incidental take statement is provided herein. We reached this conclusion because the proposed action has been planned in a manner that reduces and minimizes adverse effects to known spotted owl sites. Since no incidental take is anticipated, no take exemption has been provided. If incidental take is detected during implementation of the proposed action, re-initiation of formal consultation should be requested, and any operations causing such take must cease pending the outcome of the reinitiated consultation.

Reasonable and Prudent Measures

No reasonable and prudent measures are set forth below, because the Project Design Criteria and Conservation Measures along with the Project's Strategies, were developed as part of the proposed action and include adequate measures to minimize the impacts of the proposed action, eliminating any anticipated take of spotted owls. However, the District has agreed to monitor impacts to spotted owl habitat (see below) during the course of the proposed action to ensure that the anticipated amount or extent of take (zero) is not exceeded.

Terms and Conditions

No Terms and Conditions are provided in this Opinion because no incidental taking is anticipated.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the ESA directs 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. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

The Service believes the following conservation action may facilitate further conservation of spotted owls within the action area:

The Service recommends that the District monitor the extent of spotted owl habitat affected by the proposed Project to ensure that those effects are consistent with description of the Proposed Action; the findings in the Effects of the Action analysis, and the incidental take limits presented herein. The District shall conduct that monitoring and report the results to the Service using the Project Implementation and Monitoring Form most recently updated in March 2004 (Appendix C) that was developed by the Service for that purpose. The District shall submit the form by November 30 of the year the project was considered implemented.

The Service recommends that annual spotted owl surveys continue in the action area at the sites affected, and other un-surveyed habitat as described above. Survey findings should be reported annually to the Level 1 Team and used to inform and refine project placement so as to avoid incidental take of the spotted owl.

In order for the Service to be kept informed of actions that minimize or avoid adverse effects or benefit listed species or their habitats, the Service requests notification regarding the implementation of any conservation recommendation.

Support and implement to the extent practicable Recovery Actions in the revised recovery plan, particularly Recovery Action 29, the experimental removal of barred owls to evaluate subsequent response by spotted owls and inform future management decisions.
Because existing conditions show departure from historic norms, such as increased stand densities and decreased landscape heterogeneity that futher exacerbates the vulnerability of the system to disturbance. The Service recommends that the District conduct more fuels treatments and other silvicultural actions to reduce the risk of large scale wildland fire.

Recovery implementation for spotted owls should, whenever feasible, look for opportunities where managing their habitat also meets other societal priorities concerning climate change.

PROJECT MONITORING

According to the District, timber sales are administered by an Authorized Officer and Contract Administrator. All other contracts are administered at the local level by Contracting Officer Representatives (CORs) and Project Inspectors (PI) throughout implementation until the project work is completed, or implemented by District staff. Timber sales also have a contract clause (E-4) that authorizes stop work when threatened or endangered species or sites are found within the timber sale or to comply with court orders. When (and if) a spotted owl or other listed species is found in the project area, the District is authorized to stop the work until the issue is evaluated further. If a spotted owl or other listed species site is found, biologists will review PDCs and the appropriate consultation document to confirm the ESA analysis remains valid.

If the spotted owl (or other listed species) was not analyzed in the Biological Assessment, if the project area changes from what was originally analyzed in the Biological Assessment, if a site has moved, or other information is inconsistent with what is authorized, the District coordinates with project proponents, contractors, managers, local biologists and the Level 1 Team to ensure the project impacts remain consistent with the Biological Assessment and the responding consultation document (biological opinion or letter of concurrence). If not, the project will remain stopped until the District implements one or more of the following:

- Modify the proposed action to ensure that impacts remain as described in the consultation documents:
- Impose seasonal protection (if necessary);
- Re-initiate consultation.

The Service understands the District plans to monitor forest management activities per their Guide for Planning and Implementing Vegetation Management Projects (USDI BLM 2015b). The District will periodically provide results of monitoring activites from these efforts to the Service. Further, the District and Service will meet as needed (but at least annually within Level 1/2 meetings) to review the results and discuss changes as appropriate.

REINITIATION NOTICE

This concludes formal consultation on the proposed Project described in your Assessment. As provided in 50 CFR § 402.16, re-initiation of consultation is required where 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 exempted incidental take is exceeded; (2) new information reveals effects of the agencies' action that may affect listed species or critical habitat in a manner or to an extent not considered in this consultation; (3) the agency action is subsequently modified in a manner that causes an effect to listed species or critical habitat that was not considered in this consultation; or (4) a new species is listed or critical habitat designated that may be affected by the action. When consultation is reinitiated, the provisions of section 7(d) of the ESA apply.

This concludes formal consultation on the District's proposed action. If you have any questions regarding this Opinion, please contact Cindy Donegan of the Service's Roseburg Field Office at 541-618-2374.

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APPENDIX A: PROJECT DESIGN CRITERIA (PDC) (COPIED FROM THE ASSESSMENT; USDI BLM 2016A).

Project design criteria (PDC) are measures applied to project activities designed to minimize potential detrimental effects to proposed or listed species. PDC usually include seasonal restrictions and may also include clumping of retention trees around nest trees, establishment of buffers, dropping the unit(s)/portions, or dropping the entire project. Use of project design criteria may result in a determination of no effect for a project that would have otherwise been not likely to adversely affect. In other cases, project design criteria have resulted in a determination of not likely to adversely affect for a project that might have otherwise been determined to be likely to adversely affect. The goal of project design criteria is to reduce adverse effects to listed or proposed threatened or endangered species.

Physical impacts to habitat and disturbances to spotted owls will be reduced or avoided with PDC. Listed are project design criteria designed for the programmatic impacts discussed in the *Effects of the Action* section.

Medford BLM retains discretion to halt and modify all projects, anywhere in the process, should new information regarding proposed and listed threatened or endangered species arise. Minimization of impacts will then, at the least, include an appropriate seasonal restriction; and could include clumping of retention trees around the nest trees, establishment of buffers, dropping the unit, modifying units, or dropping the entire project.

The seasonal or daily restrictions listed below may be waived at the discretion of the decision maker if necessary to protect public safety (as in the case of emergency road repairs or hazard tree removal). Emergency consultation with the Service will then be initiated in such cases, where appropriate.

PDC for disturbance are intended to reduce disturbance to nesting spotted owls. For this consultation, potential disturbance could occur near either documented owl sites or projected owl sites. To estimate likely occupied habitat outside of known home ranges, nearest-neighbor distances and known spotted owl density estimates were utilized to “place” potential spotted owl occupied sites in suitable habitat

Any of the following Mandatory PDC may be waived in a particular year if nesting or reproductive success surveys conducted according to the Service endorsed survey guidelines reveal that spotted owls are non-nesting or that no young are present that year. Waivers are only valid until March 1 of the following year. Previously known sites/ activity centers are assumed occupied until protocol surveys indicate otherwise.

Mandatory Project Design Criteria

A. Activities (such as tree felling, yarding, road/route construction, hauling on roads not generally used by the public, prescribed fire, muffled blasting) that produce loud noises above ambient levels will not occur within specified distances (Appendix A-1) of any owl site between March 1 and June 30 (or until two weeks after the fledging period) – unless protocol surveys have determined the activity center is non-nesting or failed in their nesting attempt. The distances may be shortened if significant topographical breaks or blast blankets (or other devices) muffle sound traveling between the work location and nest sites.

B. The action agency has the option to extend the restricted season until September 30 during the year of harvest, based on site-specific knowledge (such as a late or recycle nesting attempt) if project would cause a nesting spotted owl to flush. (see disturbance distance).

C. Burning will not take place within 0.25 miles of spotted owl sites (documented or projected) between March 1 and June 30 (or until two weeks after the fledging period) unless substantial smoke will not drift into the nest stand.

D. To minimize the number of potential spotted owl nest trees used for instream structures, only the following sources will be used:

(I) Trees already on the ground in areas where large woody material is adequate;
(II) Trees that lack structural conditions (snags, cavities) suitable for spotted owls.

Table A-1. Mandatory Restriction Distances to Avoid Disturbance to Spotted Owl Sites

Activity	**Buffer Distance Around Owl Site**
Heavy Equipment (including non-blasting quarry operations)	105 feet
Chain saws	195 feet
Impact pile driver, jackhammer, rock drill	195 feet
Small helicopter or plane	360 feet*
Type 1 or Type 2 helicopter	0.25 mile*
Blasting; 2 lbs. of explosive or less	360 feet
Blasting; more than 2 lbs. of explosives	1 mile

***** If below 1,500 feet above ground level

Above-ambient noises further than these Table B-1 distances from spotted owls are expected to have either negligible effects or no effect to spotted owls. The types of reactions that spotted owls could have to noise that the Service considers to have a negligible impact, include flapping of wings, the turning of a head toward the noise, hiding, assuming a defensive stance, etc. (USDI FWS 2003).

Recommended PDC

Recommended PDC will be incorporated during project implementation when practical. If recommended PDC cannot be incorporated, the project will still be in compliance with this BA.

No NRF habitat removal will occur within 0.25 miles of any spotted owl site from March 1 through September 30, or until two (2) weeks after the fledging period, unless protocol surveys have determined owls are not present, are non-nesting, or nesting has failed.

Gray Wolf

The Level 1 team is currently developing PDFs they plan to finalize by the 2016 breeding season. These PDFs would be followed if a den or rendezvous site is identified in the within the Big Butte Creek Project area. At a minimum, these PDFs would include the restriction of activities within 1 mile of a denning or rendezvous sites from March 1 to June 30 to avoid disturbance to wolves during the breeding season.

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APPENDIX B. STATUS OF THE SPECIES AND STATUS OF CRITICAL HABITAT FOR THE SPOTTED OWL.

Northern Spotted Owl--Status of the Species

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). The "C" reflects conflict with development, construction, or other economic activity (USDI FWS 1983, p. 43104). This number reflects a high degree of threat, a low potential for recovery, and the owl's taxonomic status as a subspecies (USDI FWS 1983, p. 51895). 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 2011).

Life History

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., unpubl. 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 introregression 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).

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 2011, 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).

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 A-1) based on recognized landscape subdivisions exhibiting different physical and environmental features (USDI FWS 2011, p. III-1; Thomas et al. 1993). 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 (USDI FWS 2011, pp. B-1 to B-4; Thomas and Raphael 1993).

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).

Figure B-1. Physiographic provinces, northern spotted owl demographic study areas, and demographic trends (Anthony et al. 2006).

Demographic Study Area	Land Ownership	# Owls Banded	Fecundity	Apparent Survival	λ_{RJS}	Population Trend Based on $\Delta\lambda$
Washington						
Wenatchee (WEN)	Private	1,200	Stable	Declining	0.917	Declining
Rainer (RAI)	USFS	217	Stable	Declining	0.896	Declining
Olympic (OLY)	NPS & USFS	985	Stable	Declining	0.956	Declining
Cle Elum (CLE)	USFS	724	Declining[1]	Declining?[2]	0.938	Declining
Oregon						
Oregon Coast Range (COA)	USFS & BLM	1,025	Declining?[1]	Stable	0.968	Declining
Tyee (TYE)	BLM & Private	1,032	Increasing	Stable	1.005	Stationary
South Oregon Cascades (CAS)	USFS & BLM	881	Declining	Stable	0.974	Stationary
H.J. Andrews (HJA)	USFS	1,095	Stable?[3]	Stable	0.978	Declining
Klamath (KLA)	BLM & Private	1,147	Stable	Stable	0.997	Stationary
Warm Springs (WSR)	Tribal	381	Stable	Stable	0.908	Declining
California						
Marin (MAR)	NPS	96	Stable	Stable	NA	NA
Simpson (SIM)	Private	1,344	Declining[1]	Stable	0.970	Declining
Hoopa (HUP)	Tribal	279	Increasing	Stable	0.980	Stationary
NW California (NWC)	USFS	1,026	Declining	Declining	0.985	Declining?[4]

[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).

Habitat Relationships

Home Range and Core Areas

Spotted owls are territorial raptors that range widely in search of prey but are 'anchored' during the breeding season to a nest site (central-place forager). Evaluations of spotted owl habitat are usually conducted at two spatial scales; the home range and core areas. The home range is the "area traversed by the individual in its normal activities of food gathering, mating, and caring for young" (Burt 1943:351, cited in USDI FWS 2009). Within home ranges, areas receiving concentrated use, typically surrounding the nest site and favored foraging areas, are called core areas. Because the size and pattern of spotted owl's space use are typically unknown, estimates of use areas are derived from radio-telemetry studies. Results from Bingham and Noon (1997) showed that spotted owls typically used 20-21 percent of their home range as core use area habitat, which generally included 60-70 percent of the sites within their home range used during the breeding season. As central place foragers, nesting spotted owls are likely very sensitive to activities that occur within their core use areas and especially their nest patch (Swindle et al. 1997, Miller et al. 1989, and Meyer et al. 1998).

The habitat composition within cores and annual home ranges has been found to be directly correlated with demographic response such as occupancy, reproductive success, survival, and fitness. Meyer et al. (1998) examined landscape indices associated with spotted owl sites versus random plots on BLM lands throughout Oregon. Across provinces, landscape indices highly correlated with the probability of spotted owl occupancy included the percent older forest (30 percent) within the 500 acres (analogous to a core-use area) surrounding the site. Zabel et al. (2003) found for their northwest California study that the highest probability of owl occupancy occurred when the core use area comprised 69 percent nesting/roosting habitat. Bart (1995) found that core areas should contain 30-50 percent mature and old growth forest. Results from Thomas et al. (1990), Bart and Forsman (1992) Bart (1995) and Dugger et al (2005) suggest that when spotted owl home ranges have less than 40 to 60 percent NRF, they were more likely to have lower occupancy and fitness. Olson et al. (2005) found similar results on their Oregon Coast Ranges study area.

As further described in the 2009 FWS Guidelines (USDI FWS 2009, "Guidelines"), the probability of occupancy is increased when core areas contain a range of habitat conditions suitable for use by spotted owls, and the survival and fitness of spotted owls is positively correlated with larger patch sizes or proportion of older forests (Franklin et al. 2000, Dugger et al. 2005). The Guidelines express "the strongest type of information relevant to the evaluation of take relates to the fitness of spotted owls to characteristics of their habitat." Depending on the availability of habitat, fitness may be compromised when additional habitat degradation or losses occur. The final evaluation of incidental take is both a quantitative and qualitative analysis of the actual amount and distribution of habitat available to the spotted owl when compared to the effects of the proposed action

Recently developed habitat-fitness and landscape models have demonstrated the importance of having sufficient amounts of NRF habitat within core use areas to adequately provide for spotted owl survival and reproduction along with access to prey. For example, Franklin et al. (2000) found that the proportion of good habitat was around 60 percent to lesser quality habitat for owl core use areas in northwest California. In a recently published study of spotted owls in the Oregon Klamath Province, survival was negatively correlated with forest fragmentation (Schilling et al. 2013).

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 1994, 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. 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). Some studies have found that 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). In Southern Oregon, one study found that home range and core areas remained essentially the same between

seasons, concluding that perhaps this was due to the quality of available habitat (Shilling et al. 2013).

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).

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 condition (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 condition 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 available to them (Folliard 1993, p. 40; Buchanan et al. 1995, p. 1402; Hershey et al. 1998, p. 1404).

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 condition 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 2011, 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 (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 condition to provide protection from avian predators and at least minimal foraging opportunities (USDI FWS 2011, 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 2011, p. G-1). Forsman et al. (2002, p. 22) found that spotted owls could disperse through highly fragmented forest landscapes. However, 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 conditon 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 condtion) 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 for 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.

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).

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 2012a, 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 2012a, 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 2012a, p. 14086).

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, California 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*) (r2 = 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).

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).

Annual variation in population parameters for spotted owls has been linked to environmental influences at various life history stages (Franklin et al. 2000, p. 581). 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 regulate 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).

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). However, there was enough temporal and spatial variability in detection rates to indicate that more visits would be needed in some years and in some areas, especially if establishing pair occupancy was the primary goal.

Threats

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.

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 member 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 2011, Appendix B).

Barred Owls (*Strix varia*)
With its recent 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 may be competing with spotted owls for prey (Hamer et al. 2001, p.226) 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 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). Evidence that barred owls are causing negative effects on spotted owls is largely indirect, based primarily 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). Recent research has shown that the two species of owls share similar habitats and are likely competing for food resources (Hamer et al. 2001, p. 226). Research on barred owls and their interactions with northern spotted owls is lacking, but necessary to determine the specific effects barred owls may have on northern spotted owls and their habitat. Forsman et al. (2011, pp. 69-70) found that the presence of barred owls led to a decrease in fecundity, apparent survival, and caused a decline in populations in most of the demography study areas included in their large scale modeling effort. However, given that the presence of barred owls has been identified as a negative effect while using methods designed to detect a different species (spotted owls), it seems safe to presume that the effects are stronger than estimated. Because there has been no research to evaluate quantitatively the strength of different types of competitive interactions, such as resource partitioning and competitive interference, the particular mechanism by which the two owl species may be competing is unknown.

Barred owls, though they are generalists, likely compete with northern spotted owls for prey resources (Hamer et al. 2001, p. 226; Gutiérrez et al. 2007, p. 187; Livezey and Fleming 2007, p. 319). The only study comparing northern spotted owl and barred owl food habits in the Pacific Northwest indicated that barred owl diets overlap strongly (76 percent) with northern spotted owl diets (Hamer et al. 2001, 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). Even though barred owls may be taking northern spotted owls' primary prey only as a generalist, northern spotted owls may be affected by a sufficient reduction in the density of these prey items due to barred owls, 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).

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 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 presence of barred owls has been reported to reduce spotted owl detectability, site occupancy, reproduction, and survival. 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. The occupancy of historical territories by spotted owls in Washington and Oregon was 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. Most recently, 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 et al. 2010, p. 4).

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 2011, p. B-11). 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. Extinction rates of northern spotted owl territories nearly tripled when barred owls were detected (Dugger et al. 2011, p. 2464).

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). Evidence that northern spotted owls were responding less frequently during surveys led the Service and its many research partners to update the northern spotted owl survey protocol (USDI FWS 2012b). The recent changes to the northern spotted owl survey protocol were based on the probability of detecting northern spotted owls when barred owls are present (See USDI FWS Memorandum, revised January 9, 2012, "Northern Spotted Owl Survey Protocol" and attached "Protocol for Surveying Proposed Management Activities That May Impact Northern Spotted Owls" for guidance and methodology).

In a recent 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).

Evidence suggests that barred owls are exacerbating the spotted owl population decline, particularly in Washington, portions of Oregon, and the northern coast of California (Gutiérrez et al. 2004, pp. 739-740; Olson et al. 2005, pp. 930-931). 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). In Oregon, Dugger et al. (2011, p. 2466) reported that 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 that the effects of reduced old growth forest in the core habitat areas were compounded when barred owls were present.

Wildfire

Studies indicate that the effects of wildfire on spotted owls and their habitat are variable, depending on fire intensity, severity, and size. Within the fire-adapted forests of the spotted owl's range, spotted owls likely have adapted to withstand fires of variable sizes and severities. However, 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). Bond et al. (2002, p. 1025) examined the demography of the three spotted owl subspecies after wildfires, in which wildfire burned through spotted owl nest and roost sites in varying degrees of severity. Post-fire demography parameters for the three subspecies were similar or better than long-term demographic parameters for each of the three subspecies in those same areas (Bond et al. 2002, p. 1026). In a preliminary study conducted by Anthony and Andrews (2004, p. 8) in the Oregon Klamath Province, their sample of spotted owls appeared to be using a variety of habitats within the area of the Timbered Rock fire, including areas where burning had been moderate.

In 1994, the Hatchery Complex fire burned 17,603 hectares in the Wenatchee National Forest in Washington's eastern Cascades, affecting six spotted owl activity centers (Gaines et al. 1997, p. 125). Spotted owl habitat within a 2.9-kilometer (1.8-mile) radius of the activity centers was reduced by 8 to 45 percent (mean = 31 percent) as a result of the direct effects of the fire and by 10 to 85 percent (mean = 55 percent) as a result of delayed mortality of fire-damaged trees and

insects. Direct mortality of spotted owls was assumed to have occurred at one site, and spotted owls were present at only one of the six sites 1 year after the fire (Gaines et al. 1997, p. 126). In 1994, two wildfires burned in the Yakama Indian Reservation in Washington's eastern Cascades, affecting the home ranges of two radio-tagged spotted owls (King et al. 1998, pp. 2-3). Although the amount of home ranges burned was not quantified, spotted owls were observed using areas that burned at low and medium intensities. No direct mortality of spotted owls was observed, even though thick smoke covered several spotted owl site-centers for a week. It appears that, at least in the short term, spotted owls may be resilient to the effects of wildfire—a process with which they have evolved. 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 2011, p. III-31).

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). New information suggests fire may be more of a threat than previously thought. In particular, the rate of habitat loss in the relatively dry East Cascades and Klamath provinces has been greater than expected (see "Habitat Trends" below). Moeur et al. (2005, p. 110) suggested that 12 percent of late-successional forest rangewide would likely be negatively impacted by wildfire during the first 5 decades of the Northwest Forest Plan. Currently, the overall total amount of habitat affected by wildfires has been relatively small (Lint 2005, p. v). It may be possible to influence through silvicultural management how fire prone forests will burn and the extent of the fire when it occurs. Silvicultural management of forest fuels are currently being implemented 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 (Courtney et al. 2004, pp. 12-11). The 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 may help mitigate the risks associated with large-scale fire (Lint 2005, p. 77).

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).

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, *Phytopthora 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).

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 2012a, 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 2012a, 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).

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 (USDI FWS 2011, pp. III-5 - III-11). In the Pacific Northwest, mean annual temperatures rose 0.8^{o} C (1.5^{o} F) in the 20th century and are expected to continue to warm from 0.1^{o} to 0.6^{o} C (0.2^{o} 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. 2015 Draft, table 6).

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).

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.

Various types of changes in climate can have direct or indirect effects on species. These effects may be positive, neutral, or negative and they may change over time, depending on the species and other relevant considerations, such as the effects of interactions of climate with other variables (e.g., habitat fragmentation) (IPCC 2007, pp. 8–14, 18–19). For the more central portion of the northern spotted owl's range such as the location of the action area, climate models have provided a series of projections. For example, annual temperatures are likely to increase up to 3 degrees in the next couple of decades. Total precipitation may remain roughly similar to historic levels but likely increasing in the fall and winter months. Rising temperatures will cause snow to turn to rain in the lower elevations. As a result, the area is likely to experience more severe storm events, variable weather, higher and flashier winter and spring runoff events and increased flooding. Reduced snowpack and soil moisture along with hotter temperatures and longer fire seasons likely will increase significantly (Doppelt et al. 2008).

While a change in forest composition or extent is likely as a result of climate change, the rate of that change is uncertain. In forests with long-lived dominant tree species, mature individuals can survive these stresses, so direct effects of climate on forest composition and structure would most likely occur over a longer time scale (100 to 500 years) in some areas than disturbances such as wildfire or insect outbreaks (25 to 100 years) (McKenzie et al. 2009). The presence of high-quality habitat may buffer the negative effects of cold, wet, springs and winters on survival of spotted owls as well as ameliorate the effects of heat. This habitat might help maintain a stable prey base, thereby reducing the cost of foraging during the breeding season when energetic needs are high (Franklin et al. 2000).

Although the scientific literature has explored the link between climate change and the invasion by barred owls, changing climate alone is unlikely to have caused the invasion (Livezey 2009). In general, climate change can increase the success of introduced or invasive species in colonizing new territory. Invasive animal species are more likely to be generalists, such as the barred owl, than specialist, such as the spotted owl and adapt more successfully to a new climate than natives.

Recovery implementation for spotted owls should, whenever feasible, look for opportunities where managing their habitat also meets other societal priorities concerning climate change. At this point though, it is unclear, what role, if any, Federal and State forest lands will ultimately play in mitigating climate change.

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 1988, 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.

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:

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.

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.

Conservation Strategy

Since 1990, various efforts have addressed the conservation needs of the spotted owl and attempted to formulate conservation 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 1992b), the Draft Recovery Plan (USDI FWS 1992a), and the Scientific Analysis Team report (Thomas et al. 1993), report of the Forest Ecosystem Management Assessment Team (Thomas and Raphael 1993); and they culminated with the NWFP (USDA FS/USDI BLM 1994a). Each conservation strategy 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.
- 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.

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/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, as well as to produce a predictable and sustainable level of timber sales. The NWFP included land use allocations which would provide for population clusters of northern spotted owls (i.e., demographic support) and maintain connectivity between population clusters. 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. Matrix areas were to support timber production while also retaining biological legacy components important to old-growth obligate species (in 100-acre owl cores, 15 percent late-successional provision, etc. (USDA FS/USDI BLM 1994a, USDI FWS 1994) which would persist into future managed timber stands.

The NWFP with its rangewide system of LSRs was based on work completed by three previous studies (Thomas et. al. 2006): the 1990 Interagency Scientific Committee (ISC) Report (Thomas

et. al. 1990), the 1991 report for the Conservation of Late-successional Forests and Aquatic Ecosystems (Johnson et. al. 1991), and the 1993 report of the Scientific Assessment Team (Thomas et. al. 1993). In addition, the 1992 Draft Recovery Plan for the Northern Spotted Owl (USDI FWS 1992a) was based on the ISC report.

The Forest Ecosystem Management Assessment Team predicted, based on expert opinion, the spotted owl population would decline in the Matrix land use allocation over time, 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/USDI BLM 1994a, 1994b, p. 3&4-229). Based on the results of the first decade of monitoring, Lint (2005, p. 18) could not determine whether implementation of the NWFP would reverse the spotted owl's declining population trend because not enough time had passed to provide the necessary measure of certainty. However, the results from the first decade of monitoring do not provide any reason to depart from the objective of habitat maintenance and restoration as described in the NWFP (Lint 2005, p. 18; Noon and Blakesley 2006, p. 288). Bigley and Franklin (2004, pp. 6-34) suggested that more fuels treatments are needed in east-side forests to preclude large-scale losses of habitat to stand-replacing wildfires. Other stressors that occur in suitable habitat, such as the range expansion of the barred owl (already in action) and infection with WNV (which may or may not occur) may complicate the conservation of the spotted owl. Recent reports about the status of the spotted owl offer few management recommendations to deal with these emerging threats. The arrangement, distribution, and resilience of the NWFP land use allocation system may prove to be the most appropriate strategy in responding to these unexpected challenges (Bigley and Franklin 2004, p. 6-34). The Revised Recovery Plan builds on the NWFP and recommends continued implementation of the NWFP and its standards and guides (USDI FWS 2011, p. I-1).

Under the NWFP, the agencies anticipated a decline of spotted owl populations during the first decade of implementation. Recent reports (Courtney et al. 2004; Anthony et al. 2006, pp. 33-34) identified greater than expected spotted owl declines in Washington and northern portions of Oregon, and more stationary populations in southern Oregon and northern California. The reports did not find a direct correlation between habitat conditions and changes in vital rates of spotted owls at the meta-population scale. However, at the territory scale, there is evidence of negative effects to spotted owl fitness due to reduced habitat quantity and quality. Also, there is no evidence to suggest that dispersal habitat is currently limiting (Courtney et al. 2004, p. 9-12; Lint 2005, p. 87). Even with the population decline, Courtney et al (2004, p. 9-15) noted that there is little reason to doubt the effectiveness of the core principles underpinning the NWFP conservation strategy.

The current scientific information, including information showing northern spotted owl population declines, indicates that the spotted owl continues to meet the definition of a threatened species (USDI FWS 2004, p. 54). That is, populations are still relatively numerous over most of its historic range, which suggests that the threat of extinction is not imminent, and that the subspecies is not endangered; even though, in the northern part of its range population trend estimates are showing a decline.

On June 28, 2011 the Service published the Revised Recovery Plan for the Northern Spotted Owl (USDI FWS 2011). 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 2011, p. II-2 and Appendix B). 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 2011, 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 (USDI FWS 2008). 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 2011, Appendix C).

The final recovery plan (USDI FWS 2011) 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 2011, 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 2011, p. II-12). The Revised Recovery Plan estimates that recovery of the spotted owl could be achieved in approximately 30 years (USDI FWS 2011, p. II-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 2011, p. III 1-2). Recovery criteria, as described in the 2011 Final Revised Recovery Plan (p. 11-3), are measurable and achievable goals that are believed to result through implementation of the recovery actions described in the recovery plan. Achievement of the recovery criteria will take time and are 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 criterion 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 2011, p III-3).

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 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 in Washington, three in Oregon, and six in California (USDI FWS 2011, 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 2011, 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 2011, 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 2011, 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 2011, p. A-16).

California. The California State Forest Practice Rules, which govern timber harvest on private lands, require landowners to conduct spotted owl surveys for actions proposed in suitable habitat and to require specified habitat retention requirements around nest sites, core areas, and home ranges (California Department of Forestry and Fire Protection [CAL FIRE] 2007, pp. 85-87). Under the Forest Practice Rules, timber harvest plans cannot be approved if they are determined to likely result in incidental take of federally listed species, unless the take is authorized by a Federal incidental take permit (CAL FIRE 2007, pp. 85-87). Currently CAL FIRE is responsible for those determinations unless Service technical assistance is specifically requested. Three industrial timberland owners or managers operate under spotted owl management plans that have been reviewed by the U.S. Fish and Wildlife Service or CAL FIRE that outline basic measures for spotted owl protection specific to their ownership, in accordance with state forest practice rules, and other state and Federal laws. One Habitat Conservation Plan (HCP) was recently approved for approximately 152,200 acres in the California Klamath and Southern Cascades ecological provinces of Northern California (Fruit Growers Supply Company). Elsewhere in the range, four HCPs and two Safe Harbor Agreements authorizing take of spotted owls have been approved; these agreements 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 2011, p. A-16).

Range-wide Environmental Baseline

The environmental baseline 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, including all previously consulted on effects (USDI FWS/USDC NMFS 1998, pp. 4-19).

Habitat and Population Trends

Habitat Trends

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 FS/USDI BLM 1994b, USDI FWS 2001, Lint 2005, Davis et al. 2011). The estimate of 7.4 million acres used for the NWFP in 1994 (USDA FS/USDI BLM 1994b) was believed to be representative of the general amount of northern spotted owl habitat on NWFP lands at that time. The most recent mapping effort (Davis et al. 2011, Appendix D, Table D) indicates approximately 8.85 million acres of spotted owl nesting/roosting habitat existed on Federal lands and 4.19 million acres existed on non-federal lands at the beginning of the NWFP in 1994/1996. Davis et al. (2011, pp. 28-30) further evaluated changes in spotted owl nesting/roosting habitat using data from California that covered 14 years from 1994 to 2007, and data from Oregon and Washington that covered 10 years from 1996 to 2006. Although the spatial resolution of this new habitat map currently makes it unsuitable for tracking habitat effects at the scale of individual projects, the Service has evaluated the map for use in 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.

Periodic range-wide evaluations of habitat, as compared to the Final Supplemental Environmental Impact Statement (FSEIS; USDA FS/USDI BLM 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 FS/USDI BLM 1994a, p. 46). In particular, the Service considers habitat effects that are documented through the section 7 consultation process since 1994. In general, the analytical framework of these consultations focuses on the reserve and connectivity goals established by the NWFP land-use allocations (USDA FS/USDI BLM 1994a), with effects expressed in terms of changes in suitable northern spotted owl habitat within those land-use allocations.

In 2001, the Service conducted the first assessment of habitat baseline conditions since implementation of the NWFP (USDI FWS 2001). The Service determined that actions and effects were consistent with the expectations for implementation of the NWFP from 1994 to June 2001 (USDI FWS 2001). 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 2006/07 satellite imagery data on spotted owl habitat as the new 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.

Service's Consultation Database

To update information considered in 2001 (USDI FWS 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.

Range-wide Consultation Effects: 1994 to May 12, 2016

Between 1994 and May 12, 2016, the Service has consulted on the proposed removal/downgrade of approximately 732,710 acres or 8.3 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 B-1). 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/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 on these efforts since 1992 have documented the eventual loss

of over 522,431 acres of habitat on non-NWFP lands (calculated using data in Table B-1 below). Most of these losses have yet to be realized because they are part of long-term HCPs. However, the NWFP 15 year monitoring report documented habitat losses on non-federal lands associated with timber harvest continues to occur at a rate of approximately 2 percent per year in Oregon and Washington, and at a lesser rate in California (Davis et al. 2011, pp. 123-124).

Table B-1. Range-wide Aggregate of Changes to NRF[1] Habitat Acres from Activities Subject to Section 7 Consultations and Other Causes (1994 to May 12, 2016).

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Land Ownership	Consulted On Habitat Changes[2]		Other Habitat Changes[3]	
	Removed/ Downgraded	Maintained/ Improved	Removed/ Downgraded	Maintained/ Improved
NWFP (FS,BLM,NPS)	210,279	558,629	272,063	97,136
Bureau of Indian Affairs / Tribes	113,926	28,372	2,398	0
Habitat Conservation Plans/Safe Harbor Agreements	339,692	14,539	N/A	N/A
Other Federal, State, County, Private Lands	68,813	28,447	2,392	0
Total Changes	**732,710**	**629,987**	**276,853**	**97,136**

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.

Range-wide Consultation Effects: 2006/2007 to May 12, 2016

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). This mapping effort accounted for habitat loss due to wildfire, harvest, insects and disease, and indicates approximately 8.555 million acres of spotted owl nesting/roosting habitat existed on Federal lands in 2006/2007. 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 current owl habitat trends at provincial and range-wide scales.

Table B-2 summarizes the habitat impacts on Federal lands that have occurred since 2006/2007. Habitat loss from Federal lands since 2006/2007 due to land management activities and natural events has varied among the individual provinces with most of the impacts concentrated within the ‘Non-Reserves’ land-use allocations relative to the ‘Reserve’ land-use allocations. When

habitat loss is evaluated as a proportion of the affected acres range-wide, the most pronounced losses have occurred within Oregon (over 50 percent; especially within its Cascades West and Cascades East provinces, followed by California with the majority within the Klamath Province. In contrast, much smaller habitat losses have occurred in Washington. When habitat loss is evaluated as a proportion of provincial baselines, the Oregon Cascades East and the California Klamath provinces have proportional losses greater than the loss of habitat across all provinces.

Table B-2. Summary of northern spotted owl suitable habitat (NRF) 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.

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State	Physiographic Province[2]	Evaluation Baseline (2006/2007)[3]			Habitat Removed/Downgraded[4]							% Provincial Baseline Affected	% Range-wide Effects
					Land Management Effects			Habitat Loss from Natural Events			Total NRF removed/ downgraded		
		Nesting/ Roosting Acres in Reserves	Nesting/ Roosting Acres in Non-Reserves	Total Nesting Roosting Acres	Reserves[5]	Non-Reserves	Total	Reserves	Non-Reserves	Total			
WA	**Eastern Cascades**	462,400	181,100	643,500	2,700	2,238	4,938	1,559	132	1,691	6,629	1.03	5.13
	Olympic Peninsula	729,000	33,400	762,400	6	0	6	0	1	1	7	0	0.01
	Western Cascades	1,031,600	246,600	1,278,200	779	877	1,656	3	0	3	1,659	0.13	1.29
	Western Lowlands	24,300	0	24,300	0	0	0	0	0	0	0	0	0
OR	**Cascades East**	248,500	128,400	376,900	2,994	7,499	10,493	7,639	2,434	10,073	20,566	5.46	15.93
	Cascades West	1,275,200	939,600	2,214,800	1,587	26,202	27,789	761	1,775	2,536	30,325	1.37	23.49
	Coast Range	494,400	113,400	607,800	750	1,891	2,641	0	0	0	2,641	0.43	2.05
	Klamath Mountains	549,400	334,900	884,300	2,999	6,772	9,771	5,736	3,840	9,576	19,347	2.19	14.99
	Willamette Valley	700	2,600	3,300	0	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	0.26
	Coast	132,900	10,100	143,000	274	1	275	0	175	175	450	0.31	0.35
	Klamath	910,900	501,200	1,412,100	75	1,064	1,139	24,301	21,700	46,001	47,140	3.34	36.51
Total		**5,961,000**	**2,594,200**	**8,555,200**	**12,174**	**46,545**	**58,719**	**40,324**	**30,057**	**70,381**	**129,100**	**1.51**	**100**

Notes:

1. Nesting, roosting, foraging (NRF) 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.
2. Defined in the Revised Recovery Plan for the Northern Spotted Owl (USFWS 2011) as Recovery Units as depicted on page A-3.
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.
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.

Of the total Federal acres consulted on for 'Habitat Removed/Downgraded', approximately 129,100 acres or 1.45 percent of 8.55 million acres of northern spotted owl habitat were removed/downgraded (Table B-2). Of these, about 58,719 acres (Table B-3) were a result of timber harvest. Northern spotted owl habitat lost due to 'Natural Events' (e.g., wildfires, wind throw, disease) is one of the primary threats to the species. Range-wide, approximately 70,381 acres range-wide have been lost, with the California Klamath province contributing the majority (46,001 acres or 37 percent) of habitat lost, followed by the Oregon Cascades East province (10,073 acres or 8.1 percent).

Table B-3: Summary of northern spotted owl suitable habitat (NRF)[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.

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Suitable Habitat (NRF) Effects	Reserves (LSR, MLSA, CRA)[3]	Non-reserves (AWA, AMA, Matrix)[3]	Totals
Evaluation Baseline (2006/2007)[2]	5,961,000	2,594,200	8,555,200
Removed/Downgraded (timber harvest only)[4]	8,514	43,945	52,459
Removed/Downgraded (other management activities)[5]	3,660	2,600	6,260
Subtotal	12,174	46,545	58,719
Removed/Downgraded (natural disturbance)[6]	40,324	30,057	70,381
Total Net Change	52,498	76,602	129,100
Baseline Balance	**5,908,502**	**2,517,598**	**8,426,100**
Habitat Maintained[7]	53,638	72,939	126,577

Notes:

1. Nesting, roosting, foraging (NRF) 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. Effects to spotted owl habitat in California reported here include effects to Nesting/Roosting habitat only. Foraging habitat removed or downgraded in California is not summarized in this table.
2. 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) imagery.
3. 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.
4. NRF habitat removed or downgraded from timber harvest on Federal lands.
5. NRF habitat removed or downgraded from recreation, roads, minerals, or other non-timber programs.
6. NRF habitat losses resulting from wildfires, insect and disease, windthrow or other natural causes.
7. Habitat maintained means that stands have been modified by management, but the habitat function remains the same.

Other Habitat Trend Assessments

In 2005, the Washington Department of Wildlife released the report, "An Assessment of Spotted Owl Habitat on Non-Federal Lands in Washington between 1996 and 2004" (Pierce et al. 2005). This study estimates the amount of spotted owl habitat in 2004 on lands affected by state and private forest practices. The study area is a subset of the total Washington forest practice lands, and statistically-based estimates of existing habitat and habitat loss due to fire and timber harvest are provided. In the 3.2-million acre study area, Pierce et al. (2005) estimated there was 816,000 acres of suitable spotted owl habitat in 2004, or about 25 percent of their study area. Based on their results, Pierce et al. (2005) estimated there were less than 2.8 million acres of spotted owl habitat in Washington on all ownerships in 2004. Most of the suitable owl habitat in 2004 (56%) occurred on Federal lands, and lesser amounts were present on state-local lands (21%), private lands (22%) and tribal lands (1%). Most of the harvested spotted owl habitat was on private (77%) and state-local (15%) lands. A total of 172,000 acres of timber harvest occurred in the 3.2 million-acre study area, including harvest of 56,400 acres of suitable spotted owl habitat. This represented a loss of about 6 percent of the owl habitat in the study area distributed across all ownerships (Pierce et al. 2005). Approximately 77 percent of the harvested habitat occurred on private lands and about 15 percent occurred on State lands. Pierce and others (2005) also evaluated suitable habitat levels in 450 spotted owl management circles (based on the provincial annual median spotted owl home range). Across their study area, they found that owl circles averaged about 26 percent suitable habitat in the circle across all landscapes. Values in the study ranged from an average of 7 percent in southwest Washington to an average of 31 percent in the east Cascades, suggesting that many owl territories in Washington are significantly below the 40 percent suitable habitat threshold used by the State as a viability indicator for spotted owl territories (Pierce et al. 2005).

Moeur et al. 2005 estimated an increase of approximately 1.25 to 1.5 million acres of medium and large older forest (greater than 20 inches dbh, single and multi-storied canopies) on Federal lands in the NWFP area between 1994 and 2003. The increase occurred primarily in the lower end of the diameter range for older forest. In the greater than 30 inch dbh size class, the net area increased by only an estimated 102,000 to 127,000 acres (Moeur et al. 2005). The estimates were based on change-detection layers for losses due to harvest and fire and re-measured inventory plot data for increases due to ingrowth. Transition into and out of medium and large older forest over the 10-year period was extrapolated from inventory plot data on a subpopulation of Forest Service land types and applied to all Federal lands. Because size class and general canopy layer descriptions do not necessarily account for the complex forest structure often associated with northern spotted owl habitat, the significance of these acres to northern spotted owl conservation remains unknown.

In 2011, Davis et al. produced the second in a series of monitoring reports on northern spotted owl population and habitat trends on Northwest Forest Plan administered lands. They summarized demographic analyses from Forsman et al. (2011) discussed below under trends in numbers, distribution and reproduction, and reported on a new effort using remotely sensed data from 1994 to 2007 to develop "habitat suitability" models, and ultimately suitable habitat maps for the entire range of the northern spotted owl for each of these time periods. They also created change-detection maps and reported on the cause of habitat change during this time period. The authors suggest that because of improvements in remotely sensed vegetation, and change-

detection mapping, their habitat maps represent the best available information and should replace the baseline versions used for the first monitoring report. Davis et al. (2011) estimated 8.9 million acres of suitable habitat for the 1994 baseline map, as compared to 7.4 million acres estimated by FEMAT in 1994, and 10.3 million acres estimated by Davis and Lint (2005) for the 10-year report.

Davis et al. (2011) were not able to report on gains in nesting/roosting habitat suitability due to issues with current technology, and the need for additional time to capture the slow process of forest succession. However, they were able to report on gains in recruitment of younger forests or dispersal habitat. They estimated a gain of about 1.26 million ac of dispersal habitat, with the greatest increases in non-reserves than reserves. The largest increase in dispersal habitat was in the Oregon Coast Range province.

Davis et al. (2011) estimated that nesting/roosting habitat declined by 3.4 percent (298,600 ac) rangewide on federal lands since 1994, which is less than the anticipated rate of habitat loss under the NWFP of 5 percent per decade. Most of the loss (79 percent) occurred within reserves and was the result of wildfires. Wildfires also were responsible for about half of the loss in non-reserves. Timber harvest accounted for about 45 percent (37,400 ac) in non-reserves, and 7 percent (16,000 ac) in reserves. The Oregon Klamath province lost the most nesting/roosting habitat (93,730 ac) due to the Biscuit Fire in 2002. They estimated a rangewide loss of about 417,000 ac of dispersal habitat, but like nesting/roosting habitat, most of the loss of dispersal habitat was due to wildfire.

Davis et al. (2011) created a wildfire suitability (likelihood) map for large fires throughout the range of the northern spotted owl. Their goal was to identify landscape-scale areas where large wildfires are more probable. They report that the California Klamath province has the most owl habitat in fire-prone landscapes, followed by the Oregon Western Cascades and Oregon Klamath provinces.

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 (USDI FWS 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.

As of July 1, 1994, there were 5,431 known site-centers of spotted owl pairs or resident singles: 851 sites (16 percent) in Washington, 2,893 sites (53 percent) in Oregon, and 1,687 sites (31 percent) in California (USDI FWS 1995, p. 9495). The actual number of currently occupied

spotted owl locations across the range is unknown because many areas remain unsurveyed (USDI FWS 2011, p. A-2). In addition, many historical sites are no longer occupied because spotted owls have been displaced by barred owls, timber harvest, or severe fires, and it is possible that some new sites have been established due to reduced timber harvest on Federal lands since 1994. The totals above represent the cumulative number of locations recorded in the three states, not population estimates.

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 (λ), which provides information on the direction and magnitude of population change. A λ of 1.0 indicates a stationary population, meaning the population is neither increasing nor decreasing. A λ of less than 1.0 indicates a decreasing population, and a λ of greater than 1.0 indicates a growing population. Demographic data, derived from studies initiated as early as 1985, have been analyzed periodically (Anderson and Burnham 1992; Anthony et al. 2006; Burnham et al. 1994; Forsman et al. 2011; Forsman et al. 1996 and Dugger et al. 2015 unpublished/video presentation) to estimate trends in the populations of the spotted owl.

In January 2009, two meta-analyses modeled rates of population change for up to 24 years using the re-parameterized Jolly-Seber method (λ_{RJS}). One meta-analysis modeled the 11 long-term study areas (Table B-4), while the other modeled the eight study areas that are part of the effectiveness monitoring program of the NWFP (Forsman et al. 2011, pp. 65-67).

Table B-4. Summary of spotted owl population trends from in demographic study areas (Forsman et al. 2011, p. 65).

Study Area	Fecundity	Apparent Survival[1]	λ_{RJS}	Population change[2]
Cle Elum	Declining	Declining	0.937	Declining
Rainier	Increasing	Declining	0.929	Declining
Olympic	Stable	Declining	0.957	Declining
Coast Ranges	Increasing	Declining since 1998	0.966	Declining
HJ Andrews	Increasing	Declining since 1997	0.977	Declining
Tyee	Stable	Declining since 2000	0.996	Stationary
Klamath	Declining	Stable	0.990	Stationary
Southern Cascades	Declining	Declining since 2000	0.982	Stationary
NW California	Declining	Declining	0.983	Declining
Hoopa	Stable	Declining since 2004	0.989	Stationary
Green Diamond	Declining	Declining	0.972	Declining

[1]Apparent survival calculations are based on model average.
[2]Population trends are based on estimates of realized population change.

Point estimates of λRJS were all below 1.0 and ranged from 0.929 to 0.996 for the 11 long-term study areas. There was strong evidence that populations declined on 7 of the 11 areas (Forsman

et al. 2011, p. 65), these areas included Rainier, Olympic, Cle Elum, Coast Range, HJ Andrews, Northwest California and Green Diamond. On other four areas (Tyee, Klamath, Southern Cascades, and Hoopa), populations were either stable, or the precision of the estimates was not sufficient to detect declines.

The weighted mean λRJS for all of the 11 study areas was 0.971 (standard error [SE] = 0.007, 95 percent confidence interval [CI] = 0.960 to 0.983), which indicated an average population decline of 2.9 percent per year from 1985 to 2006. This is a lower rate of decline than the 3.7 percent reported by Anthony et al. (2006, p. 23), but the rates are not directly comparable because Anthony et al. (2006) examined a different series of years and because two of the study areas in their analysis were discontinued and not included in Forsman et al. (2011, p. 65). Forsman et al. (2011, p. 65) explains that the indication populations were declining was based on the fact that the 95 percent confidence intervals around the estimate of mean lambda did not overlap 1.0 (stable) or barely included 1.0.

The mean λRJS for the eight demographic monitoring areas (Cle Elum, Olympic, Coast Range, HJ Andrews, Tyee, Klamath, Southern Cascades and Northwest California) that are part of the effectiveness monitoring program of the NWFP was 0.972 (SE = 0.006, 95 percent CI = 0.958 to 0.985), which indicated an estimated decline of 2.8 percent per year on Federal lands with the range of the spotted owl (Forsman et al. 2011, p. 67). The weighted mean estimate λRJS for the other three study areas (Rainier, Hoopa and Green Diamond) was 0.969 (SE = 0.016, 95 percent CI = 0.938 to 1.000), yielding an estimated average decline of 3.1 percent per year. These data suggest that demographic rates for spotted owl populations on Federal lands were somewhat better than elsewhere; however, this comparison is confounded by the interspersion of non-Federal land in study areas and the likelihood that spotted owls use habitat on multiple ownerships in some demography study areas.

The number of populations that declined and the rate at which they have declined are noteworthy, particularly the precipitous declines in the Olympic, Cle Elum, and Rainier study areas in Washington and the Coast Range study area in Oregon. Estimates of population declines in these areas ranged from 40 to 60 percent during the study period through 2006 (Forsman et al. 2011, p. 66). Spotted owl populations on the HJ Andrews, Northwest California, and Green Diamond study areas declined by 20-30 percent whereas the Tyee, Klamath, Southern Cascades, and Hoopa study areas showed declines of 5 to 15 percent (Forsman et al. 2011, p. 66).

Decreases in adult apparent survival rates were an important factor contributing to decreasing population trends. Forsman et al. (2011, pp. 65-66) found apparent survival rates were declining on 10 of the study area with the Klamath study area in Oregon being the exception. Estimated declines in adult survival were most precipitous in Washington where apparent survival rates were less than 80 percent in recent years, a rate that may not allow for sustainable populations (Forsman et al. 2011, p. 66). In addition, declines in adult survival for study areas in Oregon have occurred predominately within the last five years and were not observed in the previous analysis by Anthony et al. (2006). Forsman et al. (2011, p. 64) express concern for the decline in adult survival rates across the subspecies range because spotted owl populations are most sensitive to changes in adult survival.

More recently in January of 2014, another spotted owl meta-analysis (workshop) was conducted that incorporated the long history of the aforementioned data plus the immediate past five years of spotted owl data. The results of the 2014 workshop are provided in Dugger et al. 2016.

The 2014 workshop included the following objectives: 1) estimate northern spotted owl vital rates (e.g., survival, fecundity, population change [lambda], etc), 2) evaluate the range-wide status and trends of spotted owls and 3) determine factors associated with the trends. Eleven individual study areas were included in the analysis (either analyzed individually and/or combined in the meta-analysis). Individual study areas provided survey and banding data that ranged from 22 to 29 years. Acronyms are used below in noting the study areas and are defined as: for Washington: Cle Elum (CLE), Rainer (RIA) and Olympics (OLY), for Oregon: Coastal Oregon (COA), H.J. Andrews (HJA), Tyee (TYE), Klamath (KLA), and South Cascades (CAS), and for California: Northwest California (NWC), Hoopa Tribe (HUP) and Green Diamond (GRD).

Across the 11 individual study areas, rate of population change point estimates were below 1.0 for each area. For the three areas in Washington (CLE, RAI and OLY), the upper 95 percent confidence intervals were also below 1.0, indicating declining populations in Washington. Of the five study areas in Oregon (COA, HJA, TYE, KLA, and CAS), two of the areas (COA and HJA) had declining populations as represented with upper confidence intervals below 1.0. The other three areas, located in southern Oregon (TYE, KLA and CAS) had stationary population trends due to the upper confidence intervals overlapping 1.0. In the northern California, two study areas (NWC and HUP) had declining populations whereas GRD had a stationary population. Overall, spotted owl populations were declining on 7 of the 11 (more northerly) individual study areas. For the more southern portion of the species range (i.e., southern Oregon and northern California), spotted owl populations were either stable or the precision of the demographic estimates were not sufficient to detect declines.

For the meta-analysis, that is all 11 areas combined, the lambda estimate for the past 20 plus years of monitoring was 0.962. This value represents as 3.8 percent average annual decline during the 20 plus year time period, and an increased rate of decline (3.8% vs. 2.9%) since the last meta-analysis was conducted in 2009.

Another way to evaluate population trends is through realized population change estimates. This analysis compares the spotted owl population remaining at each study area in 2011 relative to the starting population (i.e., year of initial survey). For the individual study areas combined per state (results of individual areas was not provided), Washington's realized population change showed a decline of 55 to 77 percent. For Oregon, the decline was 31 to 64 percent and for California the decline was 32 to 55 percent.

Analyses of female fecundity provided strong evidence of declining trends in fecundity at 3 areas (TYE,NWC,GRD) weak evidence of declines at 4 areas(COA, CLE, HJA, HUP), and no evidence of declines at 4 areas (OLY, RAI, KLA, CAS). Barred owl presence and habitat did not explain much of the variation in fecundity, although there was an effect with amount of core habitat in the meta-analysis of fecundity.

Apparent annual survival was declining on 8 (CLE, RAI, HJA, TYE, CAS, NWC, HUP, GRD) of the 11 study areas. Negative effects of barred owls on survival were detected in the best model at 6 study areas and in a competitive model at 4 study areas. The amount of change in suitable habitat (HC) occurred in top or competitive models on 4 of 10 study areas (TYE, CAS, NWC, GDR), and in all cases more habitat change was associated with lower survival. Weather and climate also influenced annual survival at 10 of the 11 study areas, although climate effects varied widely across study areas.

For this 2014 workshop, it was the first time that an occupancy analysis had been conducted compared to previous workshops. This is because the occupancy estimators recently became available for use. Modeled occupancy estimates showed 44 to 74 percent, 22 to 47 percent and 32 to 37 percent declines in spotted owl occupancy in Washington, Oregon and California, respectively, from 1995 to 2013. As demonstrated in the individual study area annual reports, the empirical occupancy rates across individual territories have been in decline for the past several years on most of the areas throughout the range of the northern spotted owl. Factors likely influencing occupancy included competition with barred owls and/or the interactive effects of barred owls and habitat loss on a spotted owl territory.

In summary, the key findings from the Digger et al. 2016 include the following:

- Spotted owl populations range-wide are declining at an average annual rate of 3.8 percent.
- Barred owls have a strong negative effect on spotted owl survival, on some but not all of the individual study areas.
- Occupancy is declining on all individual study areas but at differing rates among the areas. Barred owls have a strong positive effect on spotted owl site extinction rates on all areas. Barred owls also have a strong negative effect on spotted owl colonization on some but not all study areas.
- Effects of climate/weather are variable on spotted owl vital rates. The effects are more evident range-wide in this analysis relative to the results of Forsman et al. 2011.
- Habitat loss is still concerning, with effects on spotted owl survival, extinction and colonization rates on some individual study areas.

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 (USDI FWS 2011, 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.

Range-wide Status of Spotted Owl Critical Habitat

Legal Status

The final rule designating critical habitat for the northern spotted owl was published on December 4, 2012 (USDI FWS 2012a), and became effective on January 3, 2013. Critical

habitat for the northern spotted owl now includes approximately 9,577,969 acres in 11 units and 60 subunits in California, Oregon, and Washington.

Designation of critical habitat serves to identify those lands that are necessary for the conservation and recovery of the listed species. In this case, the Service's primary objective in designating critical habitat was to identify capable and existing essential northern spotted owl habitat and highlight specific areas where management of the northern spotted owl and its habitat should be given highest priority. 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 (USDI FWS 2012a, 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 2012a, p. 71938). The specific conservation roles of the subunits included in the action area are described below in the Environmental Baseline.

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 2012a, 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 2012a, 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 2012a, 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 2012a, 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 2012a, 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 2012a, p. 71904). Within areas essential for the conservation and recovery of the northern spotted owl, the Service has determined that the PCEs are:

i) Forest types that may be in early-, mid-, or late-seral stages and that support the northern spotted owl across its geographic range;
ii) Habitat that provides for nesting and roosting;
iii) Habitat that provides for foraging;

iv) 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 2012a, 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 2012a, 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 2012a, p. 72051).

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 cover (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 2012a, p. 72051).

PCE 3: Foraging Habitat

Klamath Province
Stands of nesting and roosting habitat; in addition, other forest types with mature and old-forest characteristics; Presence of the conifer species, incense-cedar, sugar pine, 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 in (52.5 cm); Increasing mean stand diameter and densities of trees greater than 26 in (66 cm) increases 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.

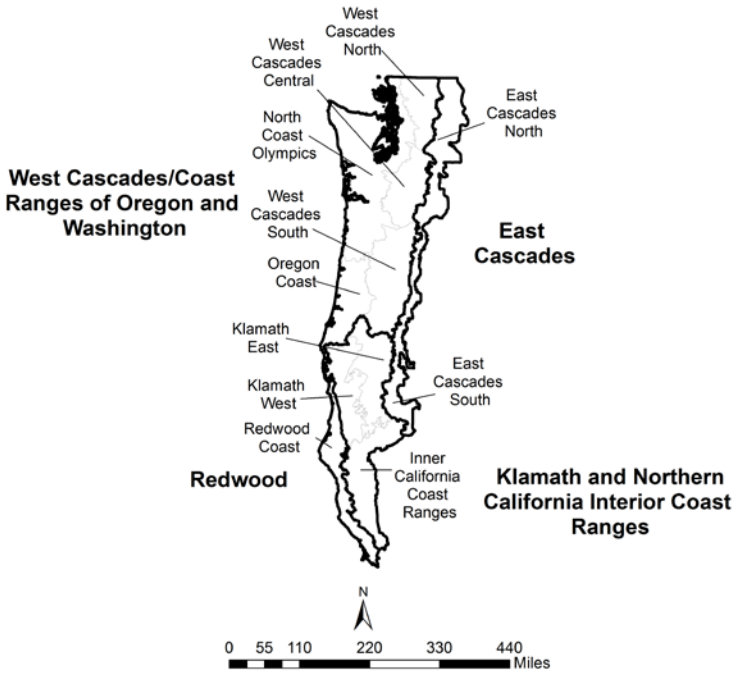
PCE 4: Dispersal Habitat

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 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 2012a, p. 72052).

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 B-2). 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 2012a). 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 B-2. Regions and zones of habitat associations used by northern spotted owls in Washington, Oregon, and California.



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 (USDI FWS 2011, p. C–13). This region in southwestern Oregon and northwestern California is 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. Summer temperatures are high, and northern spotted owls occur at elevations up to 5,800 feet. 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. The eastern portions of this zone have a Mediterranean climate with increased occurrence of the ponderosa pine. Douglas-fir/dwarf mistletoe is rarely 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 and the California Interior Coast Range portion of the 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 Zone

This zone is confined to the northern California coast, and is represented by the Redwood Coast region (USDI FWS 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.

Current Condition of Range-Wide 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 FWS/USDC NMFS 1998, pg. 4-19). With the revision of spotted owl critical habitat, the range-wide condition has been "reset" as of December 4, 2012.

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). This mapping effort indicates that approximately 9.577 million acres of spotted owl critical habitat existed in 2006/2007 (Table B-5). As of May 12, 2016, the database reports 29,758 acres have been removed or downgraded from critical habitat range-wide. The majority of these impacts originated in the Oregon Coast Range and Oregon West Cascades Physiographic Provinces, and less than half (3,381 acres) occurred in land use allocations under the NWFP that were intended to emphasize maintenance of spotted owl habitat values (i.e., late-successional reserves).

Table B-5. Summary of Northern Spotted Owl Critical Habitat NRF[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.

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Physiographic Province[2]		Evaluation Baseline		Habitat Removed/Downgraded					% Provincial Baseline Affected	% Range-wide Effects
				Land Use Allocations[5]			Habitat Loss to Natural Events	Total		
		Total Designated Critical Habitat Acres[3]	Nesting/Roosting Acres[4]	Reserves	Non-Reserves	Total				
WA	Eastern Cascades	1,022,960	416,069	265	2	267	0	267	0.06	0.90

Physiographic Province[2]		Evaluation Baseline		Habitat Removed/Downgraded					% Provincial Baseline Affected	% Range-wide Effects
				Land Use Allocations[5]			Habitat Loss to Natural Events	Total		
		Total Designated Critical Habitat Acres[3]	Nesting/Roosting Acres[4]	Reserves	Non-Reserves	Total				
	Olympic Peninsula	507,165	238,390	6	0	6	0	6	0.00	0.02
	Western Cascades	1,387,567	667,173	268	43	311	0	311	0.05	1.05
OR	**Cascades East**	529,652	181,065	887	1,277	2,164	0	2,164	1.20	7.27
	Cascades West	1,965,407	1,161,780	648	3,708	4,356	662	5,018	0.43	16.86
	Coast Range	1,151,874	535,602	1	1,136	1,137	0	1,137	0.21	3.82
	Klamath Mountains	911,681	481,577	1,306	1,215	2,521	3,011	5,532	1.15	18.59
CA	**Cascades**	243,205	98,243	0	0	0	0	0	0.00	0.00
	Coast	149,044	58,278	0	1	1	2,888	2,889	4.96	9.71
	Klamath	1,708,787	752,131	0	684	684	11,750	12,434	1.65	41.78
Total		**9,577,342**	**4,590,308**	**3,381**	**8,066**	**11,447**	**18,311**	**29,758**	**0.31%**	**100%**

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.
2. Defined in the Revised Recovery Plan for the Northern Spotted Owl (USFWS 2011) as Recovery Units as depicted on page A-3.
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).
4. Calculated from GIS data for spotted owl Nesting/Roosting habitat generated by Davis et al. 2011 for the Northwest Forest Plan 15-year Monitoring Report (PNW-GTR-850). NR habitat acres are approximate values based on 2006 (OR/WA) and 2007 (CA) satellite imagery.
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.

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APPENDIX C. MONITORING FORM

Consultation Effects Data Input Form for
Northern Spotted Owls & Marbled Murrelets
(for use in preparing BA, BO, and annual tracking reports)

Section I: Consultation Identifier Information (fill out for each form) Page ____ of ____ forms

Consultation Type:	Consultation #	Consultation Name			Sale Volume (MBF)
☐ Formal					
☐ Informal	Reinitiation Cross-Ref.#	Consultation Author (full name)			Fiscal Year Signed
☐ Tech Assistance					
☐ Tech Asst Nat Event	Suppl. ☐ or Replace ☐	Termination Date	/ /	Signature Date	/ /
Comments					

Section II: Ownership and Location Identifier Information[1]

Species	NWFP Province	Group	Land Use Allocation	CHU Identifier
		☐ NWFP Lands	☐ AMA ☐ AW	
Consulting Agency	California Ecozone	☐ Tribal	☐ CRA ☐ LSR	FY of Record
		☐ Other Fed Agency/Land	☐ MLSA ☐ MX	
Administrative Unit	MAMU Conservation Zone	☐ HCP	☐ NAT ☐ PVT	Decade
		☐ Other Private/State	☐ SEA[2]	
Administrative Subunit	NWFP Timber Sale Activity		[2]Murrelets only	Consult Status
	☐ YES ☐ NO			☐ Authorize
Project Report Name	**Report Contact Name**	**Report Contact Phone**	LUA Identifier	☐ Proj. Report

[1]Requires a new data entry form for each change in any field (fill out all fields for each form).

Section III: NSO Consultation Habitat Effects (requires separate form for each change in any data entry field in Section II)

Affected Suitable Habitat				Habitat Associated Take			Dispersal Habitat (non NRF)	
Effect	NRF	NR[3]	F[3]	Acres	AC (w/acres)	AC (wo/acres)	Acres	Assoc. Harm
Removed								
Downgraded								
Degraded								
Added								

[3] California only.

		Annual Effects (Number by Fiscal Year)					
	Disturbance Effects	FY'	FY'	FY'	FY'	FY'	FY'
☐ Harm	Acres (wo/ LOPs)						
☐ Harass	Activity Centers (w/acres)						
	Activity Centers (wo/acres)						

Section III: MAMU Consultation Habitat Effects (requires separate form for each change in any data entry field in Section II)

Affected Habitat				Habitat Associated Harm		
	Suitable Habitat		Critical Habitat			
Effect	Stands	Remnants	½ Site Potential w/in .5 mile	Unsurveyed Acres	Occupied Acres	Surveyed Not Occupied Acres
Removed						
Degraded						
Added						
# trees						

		Annual Effects (Number by Fiscal Year)					
	Non-Habitat Effects	FY'	FY'	FY'	FY'	FY'	FY'
☐ Harm	Unsurveyed Suitable Habitat (Acres)						
☐ Harass	Occupied Suitable Habitat (Acres)						
	# Individuals						

Section II & III: General Note and Comments

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