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November 24, 2014

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 Double Bowen Vegetation Management Project
(Reference Number 01EOFW00-2014-F-0209)

This document transmits the Fish and Wildlife Service's (Service) Biological Opinion (Opinion) addressing the Double Bowen Vegetation 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. Wolves (*Canis lupus*) are known to be located Jackson County, Oregon. The Service has determined that the location of the den and rendezvous sites for known wolves to be outside the Double Bowen Action Area and therefore no further analysis is needed. 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.).

The Opinion is based on information provided in the District's Biological Assessment (USDI BLM 2014; Assessment) dated July 9, 2014 and received in our office on July 14, 2014, 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. The Opinion includes a finding by the Service that the District's proposed action is not likely to jeopardize the spotted owl or adversely modify spotted owl critical habitat.

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It may take several years to fully complete the activities included in the proposed action. On that basis, the Opinion 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 one or both of these proposed actions 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 Opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in the Opinion; 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.

cc: Robin Snider, District Biologist, Medford District BLM, Medford, Oregon. (e)
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Biological Opinion
Addressing
The Double Bowen Vegetation Management Project
Proposed by
The Medford District of the Bureau of Land Management
(FWS Reference Number 01EOFW00-2014-F-0209)

U.S. Department of the Interior
U.S. Fish and Wildlife Service
Roseburg Field Office
November 24, 2014

Signature: Jim Thrailkill
Jim Thrailkill
Field Supervisor

Date Signed: 11/24/2014

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INTRODUCTION

This document transmits the Fish and Wildlife Service's (Service) Biological Opinion (Opinion) addressing the Double Bowen Vegetation 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 (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 (16U.S.C. 1531 et seq.).

This Opinion is based on information provided in the District's Biological Assessment (USDI BLM 2014; Assessment) dated July 9, 2014 and received in our office on July 14, 2014, 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.

Please note that 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 statutory provisions of the ESA to complete the following analysis with respect to critical habitat.

Please also note that the analysis and findings presented in this Opinion do not rely on the Spotted Owl Estimation Methodology (OEM) (USDI/USDA 2008) pursuant to the court order issued by the District Court for the District of Columbia in the *Swanson v Salazar* case on June 26, 2013. 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, along with the Service's professional judgment on the Project's potential effects to spotted owls, which includes site specific circumstances.

CONSULTATION HISTORY

The Double Bowen Project represents a new project and was presented to the Service during a field trip on January 23, 2014. The project was further presented to the Rogue Basin Level 1 Team (Team) on February 10, 2014. The Team, which is comprised of the Rogue River-Siskiyou National Forest Biologist, the Medford BLM District Biologist, and the Roseburg Fish and Wildlife Office Biologist, was established in accordance with the interagency consultation streamlining process (USDI BLM, USDI FWS, USDA FS, and USDC NMFS 1999).

The District submitted a draft Assessment to the Team for review on June 4, 2014 and the Service responded with comments on June 27, 2014. The Service received the final Assessment on July 14, 2014.

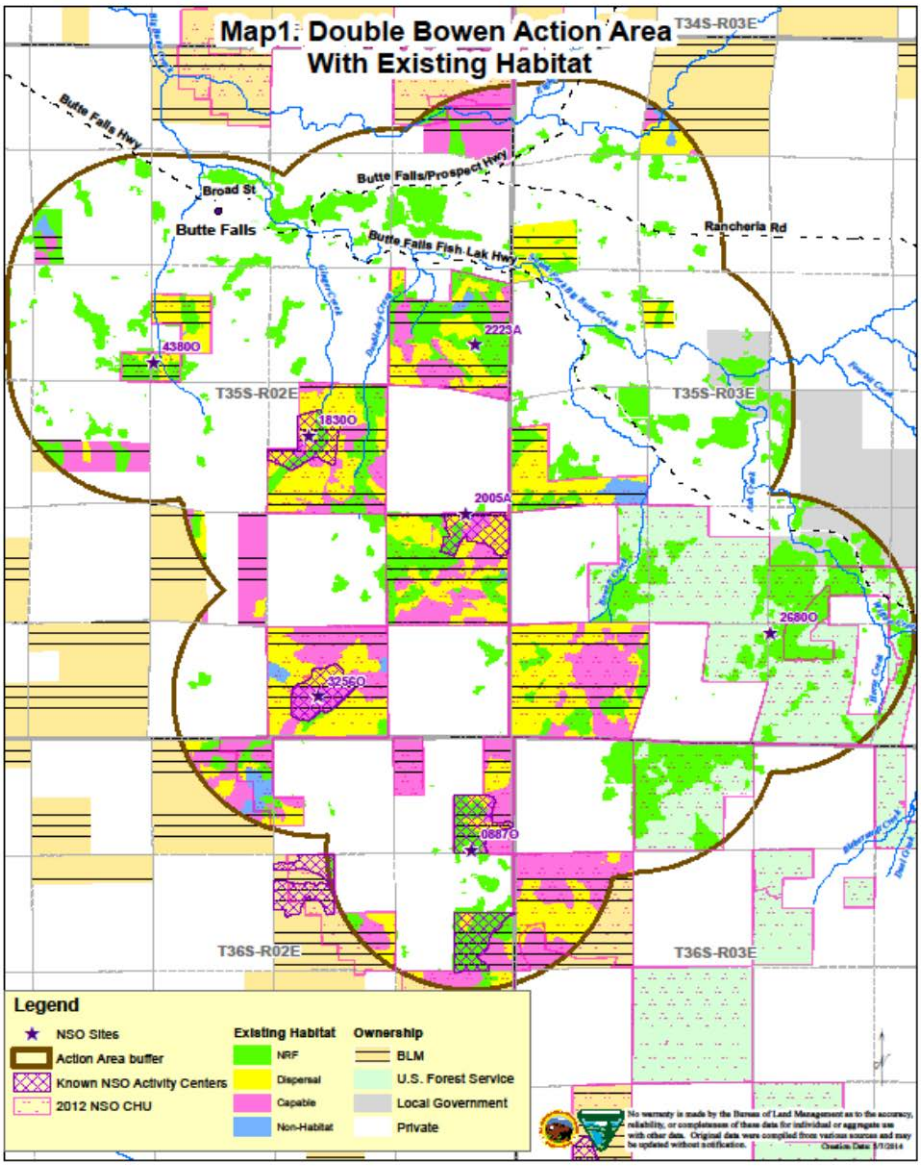
On July 29, 2014 the Service submitted a draft biological opinion to the Team for review, for which the Service received the District's comments on August 11, 2014. An amendment to the District's Assessment was received by the Service on August 29, 2014 and that information was incorporated into this Opinion

DESCRIPTION OF PROPOSED ACTION

Project Location

Projects associated with the Double Bowen proposed action are located east of Interstate 5 and southeast of the town of Butte Falls, Oregon, on the west slope of the Cascade Mountains (Figure 1), within the Oregon Western Cascades Physiographic Province. Proposed projects occur within the Matrix and Riparian Reserve land use allocations (LUAs) (Northwest Forest Plan – NWFP) (USDA FS/USDI BLM 1994), and Connectivity/Diversity Block, as defined in the District's Resource Management Plan (RMP) (USDI BLM 1995). Connectivity/Diversity Blocks represent a sub-set of the Matrix LUA, consisting of 640-acre blocks that the RMP directs be managed on a 150-year rotation. Each block is expected to consist of 25 to 30 percent late-successional forest at any point in time.

Figure 1. Vicinity map of the Double Bowen Project Action Area, Medford District BLM (copied from the Assessment).



Project Description

The Assessment (USDI BLM 2014) includes a detailed description of the activities associated with the proposed action and is herein incorporated by reference. The District planned the Double Bowen project to comply with the District's 1995 RMP (USDI BLM 1995) and the NWFP (USDA FS/USDI BLM1994a).

The District identified the following objectives for the proposed action:

1) Design and implement commercial timber sales on matrix lands in the Lower South Fork Big Butte Creek sixth field watershed.
    - The Medford District Resource Management Plan (p. 81) directs the BLM to design and implement forest management activities to produce a sustained yield of products to support local and regional economic activity.
    - The timber harvested from this project would produce revenue for the federal government which would contribute toward the Medford District's annual Allowable Sale Quantity during fiscal year 2015.
2) Improve Forest Health by increasing landscape resiliency to environmental disturbances and accelerate the development of structural complexity and spatial heterogeneity.
    - Reduce stand densities in stands greater than 100 years old in order to make site resources available for remaining trees.
    - Accelerate the development of a multiple canopy, multiple age stand.
    - Forest stands with densities that exceed historic conditions and natural carrying capacities would be harvested using restoration and small diameter thinning techniques. Restoration and small diameter thinning would be implemented to reduce stand densities and tree mortality, and restore stand vigor, resiliency, and stability.

To inform project planning, the District completed a landscape assessment early in the planning process to determine current forest-stand conditions, stand trajectories, as well as to identify threats, such as fires and insects to forest-habitat. For example (as discussed below), approximately 46 acres of spotted owl habitat have been identified for treatment due to root rot disease. Without treatment, is it estimated the root rot would likely continue to spread throughout Douglas fir and true fir tree species, thus weakening and/or killing them directly and could result in a more wide-spread loss of spotted owl habitat. Overall, results of the landscape analysis showed a simplification of forest structure and pattern in the project area which has reduced biological diversity, connectivity, and landscape function. This analysis informed where the District chose to conduct timber harvest and forest-habitat management activities within the action area. As discussed in the analysis herein, it is acknowledged that some short-term effects to spotted owl habitat will occur. However in return, the long-term enhancement of stand and landscape resiliency of spotted owl habitat is anticipated.

Under the proposed action, the District plans to harvest at varying intensities approximately 243 acres of spotted owl nesting, roosting, foraging habitat (NRF), 616 acres of dispersal-only habitat, 23 acres of capable habitat, and four acres of non-habitat within the Matrix and Riparian

Reserve LUA in the Lower South Fork Big Butte Creek sixth field watershed. A description of spotted owl habitat is provided below in the Environmental Baseline section.

Regeneration Harvest

To maximize volume growth and yield, regeneration harvest which is proposed occur in older forest stands (that generally function as spotted owl NRF habitat) with declining growth rates or experiencing deterioration from insects, disease, or other factors. Regeneration harvest using the District's RMP shelterwood prescription guidelines would retain 12 to 25 green trees per acre greater than 20 inches diameter at breast height (dbh) and the most vigorous trees would be selected based on tree crown ratio and form. Post-harvest the spatial distribution of trees would be more uniformly distributed and canopy cover would be reduced to 20 to 30 percent. Healthy understory ponderosa pine (*Pinus ponderosa*), sugar pine (*Pinus lambertiana*), incense cedar (*Calocedrus decurraens*), and Douglas-fir (*Pseudotsuga menziessi*) trees free of insects, disease, or damage would be retained. Wildlife snags and coarse woody debris would be designated for retention following the District's RMP standards. All other trees would be removed. Slash would be lopped and scattered or piled and burned. Conifer seedlings would be planted following harvest.

Retention of the shelterwood trees is anticipated to provide protection for newly planted and natural seedlings in areas with growing-season frost. Overstory trees in excess of 6 to 8 trees per acre may be removed after 15 to 30 years if the understory trees are no longer susceptible to damage caused by late growing-season frost.

Regeneration harvest is planned beyond any known spotted owl home ranges as well as outside of spotted owl designated critical habitat. In addition, if spotted owls are located during on-going annual protocol surveys, the District plans to modify prescriptions and/or drop units to avoid adverse effects or re-initiate consultation.

Selection Harvest

Selection harvest is planned in forest stands that meet the District RMP guidelines for timber harvest and forest health objectives for this project. This treatment, likely in either spotted owl NRF or dispersal only habitat, would remove poor vigor trees from *all* diameter classes. Stand densities would be reduced to the desired basal area and anticipated to result in treat and maintain or downgrade prescriptions in spotted owl habitat (see Effect section below). Tree crown ratio and form are the primary factors used to determine which trees would be left or removed. Post-treatment, stand structure would be multi-aged and multilayered and canopy cover would range from 40 to 60 percent. Site resources (water, sunlight, nutrients, and growing space) are likely to be more available post-treatment benefitting the remaining trees.

Riparian Thinning

The purpose of thinning overstocked Riparian Reserves is to improve individual tree and stand health, reduce risk for high severity wildfires, to restore ecosystem functions by accelerating the growth of healthier trees, and to provide an increase of large wood sooner to streams than through tree tipping. Treatment would reduce stand densities by thinning from below, where no trees 20 inches in dbh or larger would be removed. Post-treatment utilizing treat and maintain prescriptions as discussed below, a minimum of 50 percent and 60 percent canopy cover would remain in dispersal-only and NFR habitat.

Density Management

Density management treatments would thin trees from below to maintain or enhance forest health, stand structure, and no changes in spotted owl NRF and dispersal-only habitat function are anticipated. Prescriptions in these units will remove some trees, but post-treatment NRF habitat is expected to retain its function by continuing to provide at least 60 percent canopy cover, large trees, multistoried canopy, standing and down dead wood, diverse understory adequate to support prey, and may have some mistletoe or other decay. Treated dispersal-only habitat will retain its function by providing at least 40 percent canopy cover, flying space, and an average of trees 11 inches diameter at breast height (dbh) or greater.

Small Diameter Thinning (Plantation Thinning)

High stand densities in young ponderosa pine and mixed conifer stands have resulted in slow or stagnant growth rates. Pre-commercial and commercial thinning would be applied in young stands to reduce the number of trees per acre to levels that the site has resources to sustain. As a result, a promotion in stand health is anticipated; structural diversity should be created along with enhancing landscape resiliency of the stands to environmental disturbances. Riparian areas located adjacent to upland thinning units would be thinned using a similar prescription with an emphasis on retaining riparian species (e.g., maple [Acer sp.], willow [Salix sp.]). A minimum of 40 percent canopy cover would remain post-harvest which is anticipated to provide for spotted owl dispersal habitat.

Meadow Restoration

Upland meadows where tree and brush species are encroaching would be restored through the cutting, burning, or both, of small conifers and brush in an effort to rejuvenate vegetation species that would benefit wildlife as browse. At best, the treatment units currently provide little function for spotted owls. However, meadow habitat proposed for treatment occurs adjacent to stands of NRF habitat, and prescribed burns conducted on the meadows will be allowed to creep into these areas, the effects of which are considered below in the Effects to Spotted Owl Habitat section of this document. The overall objective of meadow restoration treatments is to obtain desired vegetation conditions in this special habitat type. Down wood, snags, and other unique legacy features would be retained. Burn pile scars would be planted with native grass or forb seed.

Hazardous Fuels Reduction

Post-harvest practices as previously described, the District will assess the fuel hazard and fire risk based on surface fuel loading, aspect, slope, access, and location of each unit. Most fuels treatments would begin within 90 days after completion of harvest activities and using the following methods:

Lop and Scatter

When the slash (live and dead material 9 inches or less) remaining in the units post-harvest is less than 11 tons per acre, all stems and branches would be cut from the tree trunk and scattered. Trunks 7 inches diameter and less would be cut to 3-foot lengths and left on the ground. The depth of the slash would not exceed 18 inches.

Hand Piling and Hand Pile Burning

Slash remaining in the units after harvest is less than 11 tons per acre, material between 1 and 7 inches in diameter and longer than 2 feet would be piled by hand. The piles would

be a minimum of 4 feet high and 6 feet in diameter. Piles would be burned in the fall, winter, or spring.

Mechanical Piling and Pile Burning
Slash remaining in the units after harvest is greater than 11 tons per acre and the slope is less than 35 percent would be machine piled. Material between 2 and 12 inches in diameter and 2 feet long would be machine piled. The piles would be a minimum of 8 feet high and 10 feet in diameter. Piles would be burned in the fall or winter.

Underburning
Underburning would remove at least 60 percent of slash less than 3 inches in diameter and a lesser amount of larger fuel size classes in timbered stands. This treatment would move the stands from a timber understory to a timber litter fuel type. Underburning would be implemented in the spring or fall.

Biomass Removal
Whole trees or tree tops would be yarded to log landings, the tree tops and limbs removed and piled at the landings and the resulting piles of slash hauled away from the landings. Whole tree yarding and tree top yarding would not be required but are options for treating activity slash.

The District plans to use ground based and cable-based extraction methods for removing cut material from treatment units. Details of these methods are described in the Assessment (pages 11 and 12). The proposed action includes temporary route construction and reconstruction of existing routes. The District analyzed effects to spotted owl habitat associated with the road/route construction that occurs outside of treatment units as a separate treatment area, and incorporated those effects into the total habitat effects for the proposed action (Table 1). All other roads and openings are within treatment units or existing road beds.

Table 1. Summary of project activities for the Medford District BLM's proposed Double Bowen project.

Project Activity	Number of Acres
Double Bowen Timber Sale (Regeneration, Selection, Density Management, Riparian Thinning)	769
Double Bowen Plantation Thinning	76
Double Bowen Temporary Roads/Landings	4
Double Bowen Underburn (Meadow Restoration)	10
TOTAL	**859**

The District plans to begin project implementation soon after they receive this Opinion, and National Environmental Policy Act (NEPA) compliance is completed. Timber sales associated with this project are scheduled to be implemented in Fiscal Year 2015. 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 (plantation thinning or

underburning). However, it's anticipated the projects could take multiple years to complete. Project completion includes harvest unit treatments for slash and reforestation post-harvest.

Project Design Criteria and Conservation Measures

Project Design Criteria (PDC)

Project Design Criteria (PDC) are conservation measures developed to reduce disturbance impacts to listed species (Assessment Appendix A). Disturbance of listed wildlife species may occur when noise, smoke, vibration, or visual stimuli cause impairment of normal behavior. Mandatory PDC are measures applied to project activities designed to avoid the potential adverse disturbance effects to nesting birds and their young, which in the case for Double Bowen is spotted owls. Mandatory PDC will be incorporated into all activities as integral to the Proposed Action. PDC involving seasonal restrictions will be implemented from March 1 through June 30, unless surveys, following approved protocols, indicate either non-occupancy or non-nesting of target species (see Appendix A herein). Recommended PDC will be incorporated during project implementation when practical.

Conservation measures for the Double Bowen Timber Harvest Project

The District developed the following conservation measures (in addition to specific conservations measures associated with the revised recovery plan described below) to reduce impacts to spotted owls. The analysis conducted herein and the resulting effects are based on the full implementation of these measures.

- No projects 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 AMA lands, and are managed as Late Successional Reserves (LSR). 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).
- No treatments would occur in spotted owl 70 acre nest patches outside of KSOACs. This patch size was selected because research indicates this area is important to the reproductive success of spotted owl sites, and in particular, that on average, the extent of forested area used by juvenile owls prior to dispersal averaged approximately 70 acres (Miller et al. 1989).
- Protection of mollusk, great gray owl sites, and sensitive plants resulted in no treatment buffers that provide untreated patches of spotted owl habitat throughout the project area.
- District biologists conducted field evaluations to identify approximately 30 acres of forest stands that meet the characteristics of Recovery Action 32 (USDI FWS 2011 and USDA FS/USDI BLM 2010) in the action area. No harvest activities, temporary road construction, yarding corridors, or skid roads are proposed within stands meeting the intent of Recovery Action 32.
- Large standing and down wood will be retained in all project areas to meet or exceed the District's RMP (USDI BLM 1995) standards and guidelines. Generally the marking guidelines allow the retention of large hardwoods and some trees with visible nest structures, wildlife cavities, wide-forks with flat nesting spots, or loose bark, which provide nesting opportunities for spotted owls. Some snags may be felled for safety reasons, but will be left on site to provide additional down woody material in stands not meeting RMP down wood requirements.
- Limited (less than five acres) removal and downgrading of NRF habitat would occur in spotted owl home ranges in this project area.

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 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. For example, if a spotted owl is found, District 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 will coordinate 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.

Consideration of the Revised Recovery Plan for the Northern Spotted Owl

Under the *Revised Recovery Plan for the Spotted Owl*, 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 following description of these specific recovery actions is excerpted from the recovery plan.

Recovery Action 10

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

The District used the concepts underpinning Recovery Action 10 (USDI FWS 2011 and USDA FS/USDI BLM 2013) to prioritize known spotted owl sites with relatively long-term continuous occupancy and high reproduction to inform project planning so as to avoid and minimize to the extent practicable, potential adverse effects to spotted owls from the proposed action.

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."

District staff completed field evaluations to identify forest stands that meet the characteristics of Recovery Action 32 habitat (USDI FWS 2011 and USDA FS/USDI BLM 2010). This resulted in the identification of approximately 30 acres (occurring in three different patches) meeting those characteristics within the action area and activities associated with the proposed action will not occur within these stands.

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."

For the purposes of this analysis, the action area is defined as the Project site (i.e., Double Bowen treatment units defined under the Project) and adjacent lands that will be affected by project-generated, above ambient noise levels and the visual presence and noise generated by human use of the Project site, as well as vehicular use of roads to and from the site. The boundaries of the action area cannot be precisely defined due to variation in the extent of noise and visual impacts beyond the Project site that are caused by the proposed action due to variation in topography, vegetation, and weather conditions. For the purposes of this analysis, spotted owl habitat composition and population distribution within 1.2 miles of treatment unit perimeter was used to characterize conditions in the action area (Figure 1). The 1.2-mile distance is based on the average home range size of spotted owls in the Oregon Western Cascades Province (see Appendix B herein and *Spotted Owl Resource Use and Selection* below) and is an acceptable scale to assess potential effects to known spotted owl activity centers from the proposed action. The District utilized multiple information sources and habitat data (Assessment, e.g., p. 15) to characterize spotted owl habitat within 1.2 miles of the Project site.

The action area is located within the Oregon West Cascades Physiographic Province. The southern portion of this region exhibits a gradient between Douglas-fir/western hemlock (*Tsuga heterophylla*) and increasing Klamath Province-like vegetation (mixed conifer/evergreen hardwoods). The southern boundary of this region is novel and reflects a transition to mixed-conifer forest (Franklin and Dyrness 1988, pp. 23–24, 137–143). District-managed lands occur in a checkerboard pattern of ownership, with alternating one square mile sections of private lands. Adjacent private lands are generally managed for wood fiber production on a relatively short rotation of approximately 40 years.

Historically, fire was the primary large-scale, natural disturbance event. Both stand-replacement fires and less intense under burns were common prior to fire suppression. High summer temperatures and moderate precipitation provide conditions favorable for fires. Intense stand-replacement wildfires burned every 80 to 200 years or more; less intense under burns occurred more frequently (Friese Camp EA #DOI-BLM-OR-M050-2011-0015-EA**)**. As described above and informed by the District's landscape analysis, an objective of the Double Bowen project is improve forest health in some stands by reducing stand densities that exceed historic and natural carrying capacities. The unhealthy trajectory of some of these stands is due to the stands experiencing less intense, frequent fire return intervals.

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 project area is located in the Oregon West Cascades Physiographic Province, which is recognized as a recovery unit in the revised recovery plan for the spotted owl. 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 jeopardy to the species. When using this type of analysis, 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. For the spotted owl, 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 inform the jeopardy analysis of the spotted owl at the range-wide scale.

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

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 statutory provisions of the ESA to complete the following analysis with respect to critical habitat.
The following analysis relies on four components to support the adverse modification determination: (1) the *Status of Critical Habitat*, which evaluates the range-wide and provincial condition of designated critical habitat for the spotted owl in terms of primary constituent elements (PCEs), the factors responsible for that condition, and the intended recovery function of

the critical habitat at the provincial and range-wide scales; (2) the *Environmental Baseline*, which evaluates the condition of the critical habitat in the action area, the factors responsible for that condition, and the recovery role of affected critical habitat units in the action area; (3) the *Effects of the Action*, which determines the direct and indirect impacts of the proposed Federal action and the effects of any interrelated or interdependent activities on the PCEs and how that will influence the recovery role of affected critical habitat units; and (4) *Cumulative Effects*, which evaluates the effects of future, non-Federal activities in the action area on the PCEs and how that will influence the recovery role of affected critical habitat units.

In accordance with Service policy and guidance, the adverse modification determination is made in the following manner: the effects of the proposed Federal action on spotted owl critical habitat are evaluated in the context of the aggregate effects of all factors that have contributed to the current status of the critical habitat at the provincial and range-wide scales and, for non-Federal activities in the action area, those actions likely to affect the critical habitat in the future, to determine if critical habitat at the range-wide scale would remain functional (or retain the current ability for the PCEs to be functionally established in areas of currently unsuitable but capable habitat) to serve its intended recovery role for the spotted owl with implementation of the proposed Federal action.

The following analysis places an emphasis on using the intended range-wide and provincial scale recovery functions of spotted owl critical habitat and the role of the action area relative to those intended functions as the context for evaluating the significance of the effects of the proposed Federal action, taken together with cumulative effects, for purposes of making the adverse modification determination.

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. Adverse effects to an individual tree within spotted owl critical habitat will not trigger the need to complete an adverse modification analysis under formal consultation if those effects are not measurable at the stand level.

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

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 11 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. Analysis of demographic data can provide an estimate of the finite rate of population change [lamda] (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.

The most recent, best available meta-analyses of spotted owl demographic data modeled rates of spotted owl population change for up to 24 years (Appendix B, Table B-4). One meta-analysis modeled demographic data for 11 long-term spotted owl study areas, while the other meta-analysis modeled eight study areas that are part of the effectiveness monitoring program of the NWFP (Forsman et al. 2011, pp. 65-67). Demographic data for seven of the eleven long-term study areas indicate strong evidence that spotted owl populations are declining; these seven study areas are the Rainier, Olympic, Cle Elum, Coast Range, HJ Andrews, Northwest California and Green Diamond (Forsman et al. 2011). Spotted owl populations were either stable or the precision of the demographic estimates was not sufficient to detect declines on the Tyee, Klamath, Southern Cascades, and Hoopa study areas.

In one of the meta-analyses, the weighted mean population change for all of the 11 spotted owl study areas indicates 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) explain that the indication that populations were declining was based on the fact that the 95 percent confidence intervals around the estimate of mean lambda for these 11 study area populations did not overlap 1.0 (stable) or barely included 1.0.

The result of the second meta-analysis, based on data reported for eight demographic monitoring areas (Cle Elum, Olympic, Coast Range, HJ Andrews, Tyee, Klamath, Southern Cascades and Northwest California), estimated a spotted owl population decline of 2.8 percent per year. Forsman et al. (2011) indicated that the number of declining spotted owl populations on study areas in Washington and northern Oregon, together with their rates of decline, are concerning for the long-term sustainability of northern spotted owl populations.

Range-wide habitat trends were reported by Davis et al. (2011), who estimated that spotted owl nesting and roosting habitat has declined by 3.4 percent (298,600 ac) range-wide on Federal lands since 1994. This rate is less than the anticipated rate of habitat loss under the NWFP of 5 percent per decade. Most of this habitat loss (79 percent) occurred within reserves and was the result of wildfires.

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 threat (USDI FWS 2013).

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, it is not yet possible to quantify how those environmental changes are likely to affect the spotted owl (USDI USFWS 2011).

Survival and Recovery Needs of the Spotted Owl

The conservation of the spotted owl continues to depend on increasing the distribution and abundance of high quality nesting, roosting, and foraging habitat throughout its range and eliminating or reducing the adverse effects of the barred owl on the spotted owl.

Spotted Owl Revised Recovery Plan

The *Revised Recovery Plan for the Spotted Owl* 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. The proposed Project is within the Oregon West Cascades Mountains Province. 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.

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 habitat on some Federal "Matrix" lands (USDI FWS 2011, p. III-41). As noted above, under the *Revised Recovery Plan for the Spotted Owl*, 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). These specific recovery actions were described above under the *Description of the Proposed Action* section.

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 Spotted Owl*.

ENVIRONMENTAL BASELINE FOR THE SPOTTED OWL

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* 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.

Environmental Baseline of the Spotted Owl and Spotted Owl Habitat within the Oregon West Cascades Province

The proposed Double Bowen Project is located within the Oregon West Cascades Mountains physiographic province. Generally, the current conditions of forested stands in the province reflect an area characterized by very high climatic and vegetative diversity resulting from steep gradients of elevation, dissected topography, and the influence of marine air (relatively high potential precipitation). These conditions support a highly diverse mix of mesic forest communities such as Pacific Douglas-fir, Douglas-fir- tanoak (*Lithocarpus densiflorus*), and mixed evergreen forest interspersed with more xeric forest types (Franklin and Dyrness 1988). The most common nesting structure used by spotted owls in the Oregon portion of this province include some type of cavity nest in Douglas-fir trees on federally managed lands (as summarized *in* Courtney et al. 2004:5-26). The prey base of spotted owls in the action area is diverse, but generally dominated by woodrats (*Neotoma sp.*) and northern flying squirrels (*Glaucomys sabrinus*) (Forsman et al. 2004).

<u>Spotted Owls</u>
For the purposes of this analysis, we are relying upon the results of demographic data analysis from the South Cascades Demographic Study Area (SCDSA) (Dugger et al. 2014) and Forsman et al. 2011(see Appendix B herein) along with other local sources of information provided herein to evaluate the current condition of the spotted owl for the local environmental baseline and throughout its range. The SCDSA is located within the Oregon West Cascades Province and adjacent to the District's Double Bowen action area. We assume demographic data from the SCDSA is likely representative of the spotted owl population condition in the associated action area (see Anthony et al. 2006). The meta-analysis indicated that spotted owl fecundity and

apparent survival were declining; however, the population trend was stationary with confidence intervals overlapping 1.0 on the SCDSA (Forsman et al. 2011). Recent site occupancy data for the SCDA (Dugger et al. 2014) indicates that 36 of the 171 sites surveyed during 2013 were occupied by resident pairs, 4 by single owls, and 20 occupied by spotted owls with unknown social status. This data represents one of the lowest occupancy rates recorded during the study. Data from the 2014 field season was not available at the time of the analysis contained in this Opinion.

Radio-marked spotted owls selected old-growth and mature forests for foraging and roosting and used young forests less than predicted based on availability (Forsman et al. 1984, pp. 24-25; Carey et al. 1990, pp. 14-15; Thomas et al. 1990; Forsman et al. 2005, pp. 372-373). Landscape-level analyses 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, Olson et al. 2004). Glenn et al. (2004, pp. 47-48) studied spotted owls in young forests in western Oregon and while findings were variable across their two study areas, the authors found overall, spotted owls were closely associated with mature and old growth forests and the ecotones of broadleaf forests and other cover types.

Most spotted owls that inhabit the action area nest in drainages and on northerly aspects where it is likely that prior to fire suppression, these areas acted as refugia from frequent fire and may have been in a condition similar to today. While elevation and watershed position are somewhat general variables, finer scale variables like slope position, curvature, and distance to streams seem to correspond well with known spotted owl nest sites. For example, spotted owls in northern California select the lower third of slopes more than expected in proportion to their availability, used the middle third of slopes in proportion to their availability, and used the upper third of slopes less than expected for roosting and nesting (Blakesley et al. 1992). The spotted owl nest locations within the action area exhibit a similar trend, and tend to occur lower on the slope. These are likely areas with more stable microclimates, and larger trees with more complex forest structure that spotted owls are selecting as nest sites. It may also be that these same areas historically acted as refugia from stand replacement fires, due to being near the bottom of the canyons and on north tending slopes that maintained spotted owl habitat over time.

Across its range, spotted owl habitat use is strongly 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. Within the Oregon Western Cascades Province in southwest Oregon, dusky-footed woodrats represent one of the primary prey species (28 percent by composition) for spotted owls (Forsman et al. 2004) and are typically found in high densities in early-seral or edge habitat (Sakai and Noon 1993, Bingham and Noon 1997), but are also abundant in old growth and complex forests (Carey et al. 1997). Northern flying squirrels represent another major source of owl prey (28 percent) in southwest Oregon (Forsman et al. 2004) and to some extent have bimodal distribution in both young and late-seral forests (Courtney et al. 2004). Other prey items include deer mice, red-backed voles, red tree voles, gophers, snowshoe hare, bushy-tailed wood rats, birds, and insects, although these species comprise a small portion of the spotted owl diet (Forsman et al. 2004).

Action Area - Known Spotted Owls

The action area overlaps the home range of seven known spotted owl sites on the District and adjacent Forest Service land. Known sites within the action area have been surveyed consistently in the past 10 years (Assessment Appendix B and Site Narratives below), and the District plans to continue surveying the sites beyond implementation of the proposed action. In addition, spotted owl protocol surveys (USDI FWS 2012b) were initiated in the spring of 2013 and/or 2014 in previously un-surveyed NRF habitat within 1.2 miles of the proposed treatment units to determine spotted owl occupancy of these areas. These protocol surveys will continue over the next two to five years, depending on the harvest schedule and occurrence of spotted owl detections.

Spotted Owl Habitat

The proposed action is planned to occur within the Oregon Western Cascades Physiographic Province, which, as of July 21, 2014 consists of approximately 1,031,600 acres of spotted owl NRF habitat (calculated using the data found in Table B-2). Management activities have resulted in the loss of approximately 529 acres in reserve areas, and an additional 861 acres of spotted owl NRF habitat in non-reserves in this province. An additional two acres of spotted owl NRF habitat were lost due to natural events (Table B-2) in this province.

Douglas-fir is the primary over-story tree and represents the most common species throughout the Double Bowen action area inclusive of proposed harvest units. Like the Oregon Western Cascades Province in general, the action area and adjacent lands are generally composed of a fragmented landscape of alternating sections of Federal and intensively managed private lands dominated by clear cuts and young, homogenous conifer plantations.

According to the District's estimates, approximately 15 percent (3,617 acres) of the 24,274 acre action area consists of spotted owl NRF habitat (Table 2). Total spotted owl habitat which includes both NRF and dispersal-only habitat accounts for approximately 25 percent (5,991 acres) of the action area (Table 2). Evaluating dispersal habitat conditions for spotted owls is most meaningful at landscape scales (e.g., watershed or larger scale) (Thomas et al. 1990, Lint et al. 2005 and Davis et al. 2011) and this is further analyzed in the Effects section below. The action area overlaps approximately 5,739 acres of spotted owl critical habitat of which 1,989 acres is considered NRF habitat, in subunits KLE 4 and KLE 5 combined (Table 2).

Approximately 552 acres of spotted owl NRF habitat occurs outside of known spotted owl home ranges on federal lands within the Double Bowen action area. These NRF habitat acres occur as relatively small and isolated patches across the heavily fragmented, checkerboard ownership pattern that characterizes the area. Due to the small size and lack of contiguous habitat, the District believes these areas are unlikely to support spotted owl occupancy (see Assessment, page 17; USDI BLM 2014) and are not planning to survey these areas as a result. The Service agrees with the District's assessment of the high potential for lack of spotted owl occupancy in this area. Because of these habitat and occupancy factors, the District has planned much of the Double Bowen timber harvest activities in this fragmented landscape. Outside of these areas, the District is surveying spotted owl NRF habitat, and if spotted owls are found within 1.2 miles of proposed units, the District plans to modify proposed prescriptions or drop the units to reduce potential effects to spotted owls in a manner that is consistent with this Opinion. Otherwise the District will reinitiate consultation. The effects of the proposed action to NRF habitat that occurs

outside any known spotted owl home ranges are discussed in the "Proposed Treatments Outside of Known Spotted Owl Home Ranges" portion of the effects section below.

Table 2. Spotted Owl Habitat Environmental Baseline for the Medford District BLM's Double Bowen Action Area (01EOFW00-2014-F-0209).

		ACRES	NSO NRF[6] HABITAT ACRES (% TOTAL)	CAPABLE[4, 8] NSO HABITAT ACRES (% TOTAL)	RESERVED ACRES[1] (% OF TOTAL)	NON-RESERVED[9] ACRES (% OF TOTAL)	DISPERSAL [2,4,7] ACRES (% OF TOTAL)
OWNERSHIP							
-All Ownerships		24,274	3,617 (15%)	2,166 (9)	519 (2%)	7,949 (33%)	5,991 (25%)
- Non-Federal (Private, State)		15,326	1,388 (9%)	N/A[4]	N/A[4]	N/A[4]	1,388 (9%)
-Federal (BLM, USFS)		8,468	2,230 (26%)	2,166 (26%)	519 (6%)	7,949 (94%)	4,603 (54%)
LAND ALLOCATION - FEDERAL (*hierarchal, no acres double-counted*)							
-Late-Successional Reserves (mapped)		0	0	0	519 (100%)	0	0
- 100-Acre Spotted Owl Core Areas in the Matrix		519[10]	214 (41%)	111 (21%)			407 (78%)
-Matrix [3]		7,949	2,016 (25%)	2,055 (26%)	0	7,949 (100%)	4,696 (59%)
Spotted Owl Critical Habitat							
Critical Habitat Unit	**Sub-unit**	**Acres[5]**	**NRF Habitat Acres**	**Capable NSO Habitat Acres**	**RESERVED**	**NON-RESERVED**	**DISPERSAL**
10	**KL E4**	849	849 (100%)	0	0	849 (100%)	849 (100%)
10	**KL E5**	4,890	1,140 (23%)	1,566 (32%)	519 (11%)	4,371 (89%)	3,212 (66%)

Notes: 1. Reserved = land allocation with no programmed timber harvest which includes Congressionally Reserved land, LSR's, Owl Cores and Wild and Scenic River Corridors. 2. Dispersal includes NRF habitat. 3. Matrix/AMA includes Riparian Reserves (no Riparian Reserve layer is available) 4. Capable and Dispersal-Only acres are primarily calculated on federal lands only in this BLM layer (BLM used the same layer to be consistent with the BA data). 5. Includes CH on State Lands. 6. NRF habitat is 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 (generally 60 percent and above), and has sufficient snags and down wood to provide opportunities for nesting, roosting, and foraging. 7. Dispersal habitat, at a minimum, consists of stands with adequate tree size and canopy cover (generally 40 percent and above) to provide protection from avian predators and at least minimal foraging opportunities. 8. Capable Habitat for the northern spotted owl is forestland that is currently not habitat but can become NRF or dispersal in the future, as trees mature and the canopy closes. 9. Non-reserved refer to those areas that do not fall in to the categories listed in footnote 1. 10. Not all KSAOCs intersect the action area and therefore this value would not reflect a whole number.

Barred Owls

According to the Assessment the District does not conduct surveys designed to detect barred owls; however, barred owls are detected opportunistically within the Medford District, usually during spotted owl surveys. These incidental observations have increased within the Medford District, which somewhat resembles the trend of increasing numbers of barred owls across the range of the northern spotted owl (Dugger et al. 2011). Observational data suggests barred owl presence may result in direct and/or interference competition with spotted owls from nesting habitat (USDI FWS 2013).

While the District did not conduct surveys specifically for barred owls within the Double Bowen Action Area barred owls were occasionally detected during spotted owl surveys, with at least one barred owl detected within three of the seven spotted owl home ranges associated with the Double Bowen project (see Assessment Appendix B and summarized below in the Effects section). As discussed elsewhere in this Opinion, the longevity and consistency of the District's surveys along with several years of recently implemented spotted owl protocol surveys likely represents best available information as to the occupancy status of spotted owls within the action area.

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

As noted above, the action area is located within the Oregon Western Cascades Province, which serves as a Recovery Unit as identified in the final *Revised Recovery Plan for the Spotted Owl* (USDI FWS 2011, p. III-1). The Oregon Western Cascades Province provides a north-south across the extent of the Cascade Range, providing connectivity to the Washington Cascades to the north and to the California Cascades Province to the south.

Northwest Forest Plan

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 (and further supported in the Revised Northern Spotted Owl Recovery Plan; USDI FWS 2011), the Federal forest lands containing the action area are intended to provide: (1) habitat blocks in 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 proposed action are planned to occur within the Matrix and Riparian Reserve LUA. The action area does not overlap any Late Successional Reserve units.

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 Spotted Owl* recommends conserving all spotted owl sites and high value spotted owl habitat to provide additional demographic support to the spotted owl population.

LSRs near the action area are intended to provide habitat blocks for a breeding population of spotted owls. In addition, spotted owl NRF habitat is developing within the LSR system because, 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 a subsequent 15-year monitoring report (Davis et al. 2011) on NWFP implementation, consultation records show timber harvest in the Matrix/AMA LUA was consistent with (and lower than) that assumption. Additionally, habitat for spotted owls to disperse between LSRs does not appear to be limiting (Davis et al. 2011). Though, spotted owl occupancy data from local demographic study areas suggest reduced spotted owl demographic performance across most of the NWFP area most likely due to the

presence of barred owls and possibly additive effects of high quality NRF habitat removal (see Appendix B barred owl section herein and Forsman et al. 2011).

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, 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 closure; 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). Generally, guidance for management activities addressing territorial organisms is 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 a central-place forager. 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 1998). 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 1992a). 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). 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 2009a 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 (See Appendix B Status of the Species, Habitat Use and Selection).

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, the use of circles may not correspond exactly with the areas used by spotted owls and 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. 2006, and see summary in Courtney et al. 2004) by providing a uniform method for quantifying (comparing/contrasting) spotted owl habitat. The use of circles also seems appropriate for species, like the spotted owl, characterized as a “central place species.” The use of circles, as described herein that correspond to MCP estimates should be large enough to include 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 will 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 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 will inform the spotted owl core-use area analysis for each of the aforementioned provinces (Thomas et al. 1990, USDI FWS 1992a, Carey et al. 1992, Anthony and Wagner 1998, Irwin et al. 2000, Courtney et al. 2004, Glenn et al. 2004 and USDI FWS 2011a). 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 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 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 (USFWS Service 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. 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 1992a) that at least 40 percent of the estimated home range be retained as suitable 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 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 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 area) surrounding the site (and this predictive value decreased with increasing distance) and that territory occupancy decreased following the harvest of NRF habitat in the vicinity of the affected core area. Zabel et al. (2003) found for their northwest California study area that the highest probability of spotted owl occupancy occurred when the core area is comprised of 69 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 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

Dispersal Habitat for spotted owls, 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). Dispersal habitat generally consists of forest stands with canopy cover of at least 40 percent and an average dbh of 11 inches or greater. Dispersal habitat provides temporary shelter for spotted owls moving through an area between NRF habitats as well as some opportunity for owls to find prey; but it does not provide all of the requirements to support all spotted owl biological needs. NRF habitat can also function as dispersal habitat. However, the term dispersal (or 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 NRF 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. (2011). 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.

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).

For the purposes of this effects analysis, the area within 1.2 miles of project sites will be used for the action area, as it occurs in the Oregon Western Cascades Province. This distance is based on the median home range size of spotted owls (see the *Spotted Owl Resource Use and Selection* section above). The District utilized habitat data based on the NWFP 15-year Monitoring Reports (Davis et al. 2011 and Raphael. et al. 2011); GIS data; aerial photos; stand exams; and field verification to assist in their characterization of spotted owl habitat within 1.2 miles of the project site.

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, along with the Service's professional judgment. As noted above, the analysis below does not rely on the Owl Estimation Methodology (USDI/USDA 2008).

Effects of the Proposed Action on Spotted Owl NRF and Dispersal Habitats

Analytical Approach

Specific terms are used herein to categorize the estimated degree of change (potential effect) to spotted owl habitat elements that may or are likely to be caused by the proposed action. For example, the term treat and maintain indicates that changes in affected spotted owl habitat may be neutral or beneficial to habitat function even though the habitat element may be modified because the manner of the change retains habitat structure that supports spotted owl life history requirements. The term remove or downgrade signifies that the proposed treatments may have a negative influence on the quality of affected spotted owl habitat by removing or reducing habitat elements that support spotted owl life history requirements. 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).

Under the proposed action, up to 243 acres of NRF habitat is likely to be affected by timber harvest, thinning, temporary road construction and meadow restoration activities. Up to 616 acres of dispersal-only habitat is likely to be affected and this includes one acre to be removed due to construction of a temporary road/landing. Overall, this level of impact represents 3.5 percent of the total acres in the action area (Table 3).

Table 3. Summary of spotted owl habitat acres affected due to the Medford District BLM's proposed Double Bowen project (01EOFW00-2014-F-0209).

	NRF Removed (acres)	NRF Downgrade (acres)	NRF Treat & Maintain (acres)	Dispersal-Only Removed (acres)	Dispersal-Only Treat & Maintain (acres)	Total Acres Treated
Double Bowen Action Area Baseline Habitat	**3,617**			**5,991** (NRF+Dispersal Only)		**24,274** (total Action Area)
Timber Harvest	41	44	153	0	531	769
Small Diameter Thinning	0	0	0	0	76	**76**
Temporary Roads/Landings	3	0	0	1	0	**4**
Underburn/Meadow Restoration	0	2	0	0	8	**10**
TOTAL	**44**	**46**	**153**	**1**	**615**	**859**
% Change to Action Area Baseline Habitat	**- 1.2%**	**-1.3%**	**No Change**	**-0.02%**	**No Change**	**3.5 % treated**

NRF Habitat Removal or Downgrade

The collective removal and downgrade of 90 acres of NRF habitat represents 2.5 percent of the 3,617 total acres of NRF habitat within the 24,274-acre action area (Table 3) and four percent of the 2,230 acres of federally-managed land. The District planned the majority (84 of the 90 acres) of this NRF removal or downgrade outside of known spotted owl home ranges; this is further discussed below in the Effects to Spotted Owl section.

As discussed above, NRF habitat proposed for removal/downgrade under this proposed action is not of the quality characterized as Recovery Action 32 type habitat. Nonetheless, adverse effects to spotted owl NRF habitat are likely because of the removal of key habitat elements such as large diameter trees (generally greater than 16 inches dbh) that may have potential nesting structure and the associated reduction in canopy cover (to less than 60 percent; Appendix B herein) and the loss of multiple canopy layers that provide concealment cover, foraging perches, and suitable microclimate conditions for spotted owls (Appendix B herein). Spotted owl foraging opportunities are likely to be reduced as well due to the habitat loss which may diminish spotted owl habitat-fitness because of reductions in spotted owl prey (see below) along with spotted owls having to travel greater distances for prey. As a result spotted owl reproduction could be affected, the physical health likely impacted, then likely site abandonment or reduced survival.

Similarly, the proposed two acres of NRF downgrading resulting from the underburn/meadow restoration treatment, is expected to adversely affect habitat function, although in this case the

post-treatment overstory canopy cover is expected to be above 60 percent and roosting/foraging functions are anticipated to remain. The adverse impacts primarily result from simplifying the stand's lower understory that may reduce spotted owl roosting and hunting perches and by removing food and cover resources to spotted owl prey species.

NRF Habitat Treat and Maintain

Up to 153 acres of spotted owl NRF (non-Recovery Action 32) habitat is proposed for treatment with prescriptions that treat and will maintain the current function of NRF habitat. The majority of these treatment acres, 128 acres, occur beyond known spotted owl home ranges. For the District's activities that maintain 128 acres of spotted owl NRF habitat, individual or small group tree removal is expected to retain the appropriate amount of canopy cover (at least 60 percent) and other attributes of spotted owl habitat such as multiple canopy layers, basal area, down wood, snags, and hardwoods post-harvest. While there are no experimental studies currently available relating spotted owl response to thinning in NRF habitat, observational accounts indicate both positive and negative impacts to spotted owls (USDI FWS 2011). The best available information provides support to the relationship of spotted owl use of lightly-thinned NRF habitat (Solis 1983, Forsman et al. 1984, King 1993, Anthony and Wagner 1998, Hicks et al. 1999, and Irwin et al. 2010). Therefore, it is anticipated that affected Double Bowen stands are not measurably changed in a manner that would affect spotted owl breeding, feeding or sheltering activities, and the affected stands are likely to continue to function as NRF habitat post-treatment. For these reasons, the Service has determined timber harvest activities that maintain up to 153 acres of spotted owl NRF habitat, as these prescriptions are intended, are not anticipated to have adverse effects.

Dispersal-only Habitat Treat and Maintain

Timber harvest, small diameter thinning and meadow restoration activities are expected to treat but maintain habitat function on up to 615 acres of dispersal-only habitat (Table 3). Of these acres, 460 acres are proposed beyond known spotted owl home ranges. For these activities, individual or small group tree removal is expected to provide for the appropriate amount of canopy cover (at least 40 percent) and other attributes of spotted owl dispersal habitat such as basal area, down wood, and snags, post-harvest. It's anticipated that affected stands are not measurably changed in a manner that would affect spotted owl dispersal activities, and the affected stands are likely to continue to function as dispersal habitat post-treatment. Therefore, for reasons similar to the NRF habitat treat and maintain section immediately above, the Service has determined that treating and maintaining 460 acres of dispersal habitat are not anticipated to have adverse effects.

The remaining 155 acres of dispersal-only habitat are expected to be treated but maintain habitat function within the home range and/or core-use area of three individual spotted owl sites (2005A, 2223A and 4380O). However, the effects of these specific treatment areas are considered in the Effects to Spotted Owl section below.

Dispersal Habitat Removal (includes NRF and Dispersal-only habitat)

Facilitation of spotted owl movements, in particular natal movements, have long been assessed at the landscape scale, and as being a function of the percent land cover in forest habitat in a minimum structural condition (for example, the "50-11-40" recommendation described by

Thomas et al. 1990). Thomas et al. (1990) concluded that landscapes consisting of at least 50 percent spotted owl dispersal habitat across a quarter-township should successfully accommodate dispersing spotted owls. More recently, Lint et al. (2005) and, Davis et al. (2011) found that dispersal habitat function and connectivity do not appear to be limiting in the Oregon Cascades West Province or the NWFP area. In assessing the ability of the action area to provide for spotted owl dispersal, including the removal of 42 acres of dispersal quality habitat (41 acres of NRF and 1 acre of dispersal-only habitat; Table 3herein), we conducted an analysis similar to Davis et al. (2011; page 40). In particular, we buffered the known spotted owl home ranges by a 15 mile distance and calculated the amount of dispersal habitat remaining within the resulting polygon and if 40 percent or more dispersal quality habitat remained post-treatment, the area was considered adequate for spotted owl dispersal. Our analysis estimated that up to 69 percent of the polygon consisted of dispersal quality habitat. Therefore, we conclude that the proposed Double Bowen project is not anticipated to represent a barrier or preclude the ability of spotted owls to disperse or move through this landscape.

The District has identified beneficial effects of the proposed action to spotted owl habitat and this reasoning is provided in the Summary and Conclusion sections below.

Effects of the Proposed Action on Spotted Owls

The Service has relied upon the results of multiple studies (for example see *Spotted Owl Resource Use* section above and Appendix B) to inform our evaluation of anticipated effects of the proposed Project on the spotted owl and to develop the conditions provided below. 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 [Thomas et al. 1990, Courtney et al. 2004, Seattle Audubon Society et al. v. Sutherland et al. Civ. No. C06-1608MJP (D.W. Wa August 1, 2007)]. In general, as the amount of habitat in a spotted owl's home range decreases, so does site occupancy, reproduction and survival (summarized in Courtney et al. 2004). To assess the potential effects of habitat removal on spotted owls, the Service uses the home range, core-use area, and nest patch scales because of the spatial patterns exhibited by spotted owls (Thomas et al. 1990, Bart and Forsman 1992, Bart 1995, Forsman et al. 2005, Rosenberg and McKelvey 1999, Meyer et al. 1998, Zabel et al. 2003, Franklin et al. 2000, Dugger et al. 2005, Swindle et al. 1997, USDI FWS 2009,and Perkins 2000). Generally, habitat amounts above 40 percent at the home range and 50 percent at the core-use area confer relatively better habitat-fitness for spotted owls (see the literature above). However, as with any evaluation, local site specific conditions, such as elevation, topography, and survey information should factor into such an analysis. For example, many sites on the Medford District have demonstrated high site occupancy and reproduction with around 30 to 40 percent habitat at both the core-use area and home range scales (see USDA FS/USDI BLM 2013, Figure 1 and Assessment – NLAA Effects section).

This analysis relies on best available science, professional judgment and site-specific circumstances such as the condition of NRF 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. Additionally, in some situations, activities that treat and maintain relatively large portions of core-use areas that are also lacking in NRF habitat have the potential to result in adverse impacts. For this consultation,

the Service relies on the following general factors to evaluate if the proposed Federal action is ***likely to adversely affect*** (LAA) the spotted owl:

- Alteration of NRF habitat in the nest patch.
- Removal or downgrade of NRF habitat in core-use areas and home ranges generally with less than 50 and 40 percent NRF habitat, respectively. As provided elsewhere herein, site specific factors will help inform this determination.
- 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.

Proposed actions that avoid the above outcomes will generally be considered as ***May Affect and Not Likely to Adversely Affect*** (NLAA) the spotted owl. These circumstances are further described in the site narratives below.

The Double Bowen action area overlaps the home range of seven individual known spotted owl sites and the proposed action generally avoids adverse effects to spotted owls in that 84 of the 90 acres of NRF habitat removal and downgrade are located outside known spotted owl home ranges. As indicated above and also below in the site narratives, the District is surveying these acres prior to and during project implementation and if spotted owls are located, the District will modify the project to reduce effects to the species consistent with this Opinion or reinitiate consultation.

Of the approximately six acres remaining of NRF removal and downgrade in proximity to spotted owl sites, five acres are within the core-use area/home range of site 2223A (Table 4) and one acre is within the home range of spotted owl site 2680O. Overall, the Service anticipates the proposed action will likely adversely affect spotted owls at two sites (2005A and 2223A) and not adversely affect spotted owls at five sites. For the purposes of this consultation, a known spotted owl site is determined to be unoccupied when the most recent two years of surveys have demonstrated that resident spotted owls are not occupying the site (see site descriptions below).

Table 4. Acres of spotted owl habitat pre and post-treatment for individual spotted owl sites affected by the Double Bowen Proposed Action, Medford District BLM (01EOFW00-2014-F-0209).

Site	Pre-Treatment NRF Habitat (acres/%)		NRF Habitat Reduced			Treat and Maintain in Core		Treat and Maintain in HR		Post-Treatment NRF Habitat (acres/%)		Effects Determination
	HR	Core	HR	Core	NP	NRF	Disp	NRF	Disp	HR	Core	
0877O[4]	211 (7.3%)	67 (12%)	0	0	0	0	0	0	9.9	211 (7.3%)	67 (12%)	NLAA
1830O[4]	194 (6.7)	59 (12%)	0	0	0	0	3	6	62	194 (6.7)	59 (12%)	NLAA
2005A[4]	351 (12.1)	64 (13%)	0	0	0	11	52	93.8	202.9	351 (12.1)	64 (13%)	LAA

Site	Pre-Treatment NRF Habitat (acres/%)		NRF Habitat Reduced			Treat and Maintain in Core		Treat and Maintain in HR		Post-Treatment NRF Habitat (acres/%)		Effects Determination
	HR	Core	HR	Core	NP	NRF	Disp	NRF	Disp	HR	Core	
2223A[4]	371 (12.8)	183 (37%)	2.75	2	0	14	47	48.3	174.8	369 (12.7)	181 (36.2%)	LAA
2680O[4]	570 (19.7)	217 (44%)	0.85	0	0	0	0	5.4	0	569.9 (19.6%)	217 (44%)	NLAA
3256O[4]	106 (3.7)	10 (2%)	0	0	0	0	0	18.8	0	106 (3.7)	10 (2%)	NLAA
4380O[4]	125 (4.3)	67 (14%)	0	0	0	0	50	2.2	87.2	125 (4.3)	67 (14%)	NLAA

Descriptions of Effects to Individual Spotted Owl Sites (summarized from the August 29, 2014 Amendment to the Assessment; USDI BLM 2014).

<u>Site # 0877O</u>

- The site has been monitored from 1990-2014 with a spotted owl pair first confirmed in 1991; resident single owls were detected in 1994, 1995, 1999, 2010, and 2012. Protocol surveys (USDI FWS 2012b) were completed in 2013 and 2014 with no spotted owls detected and these surveys will continue in 2015 and 2016 with spot checks as appropriate. For the purposes of this analysis, the site is considered currently unoccupied by spotted owls because of the results protocol surveys.
- No NRF habitat is proposed for removal or downgrading within the home range, core-use area or nest patch of this site. Up to 10 acres of dispersal-only habitat is proposed for treatment, and at the outer portion of the site's home range. The outer edges of home ranges are areas generally less traversed by spotted owls and projects at a greater distance from the site center (Rosenberg and McKelvey 1999 and Schilling et al. 2013) may be less impactful to a central-place animal like the spotted owl.
- The Service anticipates the proposed action ***may affect and is not likely to adversely affect*** spotted owls because the action it is not adversely impacting NRF habitat and the treatment of approximately 10 acres of dispersal-only habitat, at the outer edge of the home range, is anticipated to retain stand function post-treatment. As a result, spotted owl life history functions of reproduction and survival are not anticipated to be impacted by the proposed action for the aforementioned reasons.

<u>Site # 1830O</u>

- Pair status was confirmed at this site from 1990-2007 and no spotted owls have been detected within spotted owl habitat associated with this site since 2008, most recently informed by using protocol surveys (USDI FWS 2012b). Surveys will continue in 2015 and beyond as appropriate. For the purposes of this analysis, based on the longevity and

annual consistency of surveys at this site since 2008, including recent protocol surveys, the Service anticipates the site is not currently occupied by spotted owls.

- In January, 2008 a winter wind storm blew down 90 acres of large trees in dispersal and NRF habitat within the site's core-use area. Then later in the summer of 2008, a wildfire burned 390 acres of NRF and dispersal-only habitat within the same area as the blow-down. The combination of the wind storm and the subsequent wildfire resulted in the loss of much of the NRF habitat within the core of this site (Table 4).
- Under the proposed action, NRF habitat would not be removed or downgraded within the home range, core-use area or nest patch of this site. The proposed treatments within the home range of this site include six acres of NRF habitat treat and maintain and 62 acres of dispersal-only habitat treat and maintain within the home range, including up to three acres of dispersal-only habitat within the core-use area of this owl site. These three acres are part of a ten acre young stand plantation unit (small diameter thinning) that was established in 1983. This is comprised of even-aged rows of 30-year-old Douglas-fir trees and is providing marginal dispersal habitat at best because this stand lacks tree diversity, structure, and decadence components. The stand would be thinned to increase stand vigor and to remove root rot pockets. The stand is well outside the nest patch and is on the outer edge of the core -use area. Post-treatment, the stand would retain a minimum of 40 percent canopy cover and facilitate dispersal function.
- The proposed action ***may affect, and is not likely to adversely affect*** spotted owls because the NRF and dispersal-only habitat levels within the home range would not change due to the stands retaining their function post-treatment. As a result, spotted owl life history functions of reproduction and survival are not anticipated to be impacted (for reasons discussed above) due to the proposed action.

Site # 2005A

- The site has been monitored from 1988 through 2014 with pair status confirmed from 1990-2002. Spotted owls were also detected in 2003, 2009, and 2012; however, these detections did not meet resident status and most likely represented "floater" owls (Assessment Appendix B). In 2010 and 2011 six survey visits were conducted to this site and no spotted owls were detected. Additionally in 2013 and 2014, protocol surveys (USDI FWS 2012b) were conducted in NRF habitat on federal land throughout the home range of this site and no spotted owls were detected; a barred owl was detected once. Spot checks will continue in 2015 and subsequent years depending on the survey results and completion of the proposed action. Based on the longevity and annual consistency of surveys at this site through 2012 coupled with the recent protocol surveys, the Service anticipates the site is not currently occupied by spotted owls.
- In January, 2008, a winter wind storm blew down trees in NRF habitat resulting in 60 acres of NRF downgrade within the core-use area, including portions of the original and alternate site nest patches.
- Under the proposed action, NRF habitat would not be removed or downgraded within the home range, core-use area or nest patch of this site.
- Approximately 94 acres of NRF and 202 acres of dispersal habitat would be treated and maintained (timber sale units and plantation thinning) within the home range of this site. Of these acres, 11 acres of NRF habitat and 52 acres of dispersal-only habitat would be treated and maintained (timber sale units) within the core-use area. The 63 acres of treat and maintain within the core would represent approximately 32 percent of the NRF and dispersal habitat treated on federal lands within the core-use area.

- The magnitude, concentration and proximity of the treatments (NRF = 11 acres and Dispersal-only = 52 acres) within the core use area is of the extent the Service anticipates would be measurable due in large part that the core-use area of the site is lacking in NRF habitat, with only 13 percent currently being available, and located within a highly fragmented landscape due to the blowdown event and adjacent private lands that do not currently support spotted owl habitat. The low NRF habitat amount within the home range and core scales reduces the likelihood of pair occupancy and reproduction in the future regardless if the proposed action occurs. In addition, spotted owl use of the area is anticipated to be measurably altered due to the low habitat amounts combined with concentration of, primarily NRF habitat alteration within the core use area. Prey abundance, particularly flying squirrels, would likely diminish (see Prey Section below) resulting in less foraging opportunities for spotted owls. Because of these factors, it is the Service's opinion that the proposed action ***may affect and is likely adversely affect*** spotted owls associated with this site. If resident spotted owls are found during future surveys, the District plans to drop units or modify proposed prescriptions in an effort to reduce adverse effects to newly detected spotted owls, or reinitiate consultation.

Site # 2223A

- This site has been surveyed since 1990 with resident spotted owls confirmed in less than half of the survey years. The original site center is located on private land and there is very little NRF habitat remaining on these associated private lands. Surveys for spotted owls conducted between 2010 and 2014 have not confirmed resident spotted owls, including protocol surveys in 2013 and 2014. A male spotted owl was detected once at night during 2014 surveys but did not warrant residency status (see Appendix B of the Assessment). Because of the lack of detections and/or insufficient detections to warrant resident status, for the purposes of this consultation, the Service considers this site to be currently unoccupied by spotted owls. The District will continue spot checks in 2015 and in subsequent years as appropriate.
- Approximately 48 acres of NRF habitat and 175 acres of dispersal-only habitat would be treated and maintained (timber sale units and plantation thinning) within the home range of this site. This includes 14 acres of NRF habitat and 47 acres of dispersal-only habitat within the core-use area or approximately 20 percent of the spotted owl habitat on federal lands within the core-use area.
- In January, 2008, a winter wind storm blew down approximately 300 acres of NRF habitat within the core-use area, which resulted NRF habitat conditions similar to NRF habitat downgrade, meaning that canopy cover was reduced below 60 percent and other features of spotted owl habitat (roosting perches, hardwood cover, etc) were also reduced. The proposed action would further downgrade two acres of NRF habitat at the home range and core scales due to under-burning for restoration of an adjacent meadow. The term "downgrade" is used in this situation because only the understory would be affected, though the stand would function as Roosting/Foraging and dispersal habitat post-treatment. These two acres of treatment are proposed on a northern aspect, on the lower third of the slope, and in high habitat suitability according to the Service's Relative Habitat Suitability (RHS) model (USDI FWS 2011). All of these factors indicate these units are in a location where frequency of owl use and likelihood of nesting is higher.
- Construction of a 0.75 acre landing is planned to occur in NRF habitat within a treat and maintain unit. The unit and proposed landing construction occurs within the home range,

but outside of the core-use area of this site, in an area of high habitat suitability according to the RHS model (USDI FWS 2011).

- The magnitude, concentration and proximity of the treatments (NRF = 14 acres [the primary reason] and Dispersal-only = 47 acres) within the core use area is of the extent the Service believes would be measurable and due in large part that the core-use area of the site is lacking in spotted owl habitat. NRF downgrade acres are in areas of relatively higher habitat suitability for the spotted owl. The low habitat amounts within the home range and core scales reduces the likelihood of pair occupancy and reproduction in the future regardless if the proposed action occurs. For these reasons, similar to the reasons discussed for site 2223A, the Service's determination is that the proposed ***action may affect, and is likely to adversely affect*** spotted owls at this site. However, if resident spotted owls are found during future surveys, the District plans to drop units or modify proposed prescriptions in an effort to reduce adverse effects to newly detected spotted owls, or reinitiate consultation

Site # 2680O (U. S. Forest Service))

- This site occurs on Rogue River-Siskiyou National Forest lands and has consistently been surveyed from 1989 - 2014. Occupancy of the site by spotted owls has been somewhat infrequent, in particular, with no spotted owls detected from 1996-1997, 1999-2001, and 2005-2014. Barred owls have been detected from 2006 - 2012. Protocol surveys were conducted in 2013 and 2014 and no spotted owls were detected. Surveys are planned to continue in 2015 and subsequent years as appropriate. For the purposes of this consultation, the Service has determined the site to be unoccupied due to the consistency of surveys and results showing no detections from 2005 - 2014.
- Under the proposed action, five acres of NRF habitat would be treated and maintained (timber sale units), along with 0.85 acres of NRF habitat removal due to temporary road and landing construction. Both projects are located at the outer edge of the home range of this site. The temporary road/landing construction is in an area of high RHS. No treatments are proposed within the nest patch or core-use area of the site.
- The proposed less than one acre of NRF habitat removal is located at the outer perimeter of the home range and private timber land is located between the nest site and the proposed road construction on District land. According to the aerial photo, the entire 474 acres of non-federal land have been harvested within the past 20 years and currently do not provide habitat for spotted owls. Given the large expanse of non-habitat that would introduce predation risks and energetic costs to spotted owls attempting to move through or around this area, in the Service's view, it is a very low likelihood that spotted owls would use this portion of their home range, despite the RHS value. It is more likely that spotted owls would make use of the contiguous foraging habitat that extends on Forest Service land from the core-use area toward the east side of the home range, which would provide more available/accessible foraging opportunities for any resident spotted owls, compared to the area of the proposed habitat removal.
- For these reasons, the Service has determined the proposed action, including the treat and maintain of five acres of NRF habitat and removal of less than 1 acre of NRF habitat at this site ***may affect and is not likely to adversely affect*** spotted owls because life history functions are not anticipated to be impaired by the proposed action.

Site # 3256O

- Surveys conducted at this site since 1992 have shown resident spotted owls through 2007. Since 2008, surveys have resulted in no spotted owls being detected and surveys are planned to continue in 2015. Because of the consistency and longevity of surveys at this site, including protocol surveys in 2013 and 2014, for the purposes of this consultation, the Service anticipates the site to be unoccupied.
- Nineteen acres of NRF habitat treat and maintain are proposed at the outer edge of the home range. Otherwise, no other NRF habitat or dispersal-only habitat is proposed modification within the nest patch or core-use area of the site.
- The treated habitat is anticipated to retain a similar function post-treatment and therefore NRF habitat amounts are not expected to change within this home range. For these reasons, the Service anticipates the proposed action ***may affect, and is not likely to adversely affect*** spotted owls. However, if resident spotted owls are located during future surveys, the District plans to drop units or modify proposed prescriptions in an effort to reduce adverse effects to newly detected spotted owls, or reinitiate consultation as appropriate.

Site #4380O

- Surveys conducted from 1995 through 2007 confirmed resident spotted owls. Since 2008, single spotted owls have been detected, including a pattern of occupancy from 2011to 2014 that would suggest the site being occupied by a resident single spotted owl (Assessment Appendix B). Spot checks (USDI FWS 2012b) will be conducted in 2015 and later as appropriate depending on the survey findings and timing of the proposed action. For the purposes of this consultation, the site is considered occupied by resident spotted owls. A barred owl was detected at the site in 2008.
- Under the proposed action, approximately two acres of NRF habitat and 87 acres of dispersal-only habitat would be treated and maintained (timber sale units and small diameter thinning). Additionally, 1.1 acres of dispersal-only habitat would be removed (road construction) within the home range of this site. Of the 87 acres, approximately 50.6 acres of dispersal-only habitat would be treated within the core-use area and 44 of these acres fall under the small diameter thinning prescription. These small diameter stands are young-even aged and contain high stand densities of ponderosa pine and mixed confer, with dbh ranges of 10-15 inches. This treatment is designed to promote stand health, create structural diversity, and increase landscape resiliency to environmental disturbances. The remaining 6 acres of dispersal-only habitat within the core-use area would have a Selection Harvest prescription, which removes poor vigor trees from all diameter classes and the post-treatment and structure is anticipated to result in a multi-aged and multilayered stand on a better trajectory to functioning spotted owl habitat. Approximately 0.6 acres of dispersal would be removed (road construction) within the core-use area. No NRF habitat is proposed for treatment within the core-use area.
- The 50.6 acres of dispersal treatment within the core represents 35 percent of the existing spotted owl habitat on federal lands within the core-use area.
- The proposed action ***may affect, and is not likely to adversely affect*** spotted owls because the NRF habitat levels at the home range and 0.5 mile core scales would not change. However, this site is within a highly fragmented landscape due to the limited federal ownership and adjacent private lands that do not currently support spotted owl habitat which reduces the likelihood of pair occupancy, survival, and reproduction in the future.

As provided above, the proposed action includes activities that will treat and maintain NRF habitat in spotted owl core-use areas at two spotted owl sites: 2005A and 2223A (Table 4) within the action area. Generally, the Service has considered these activities that maintain spotted owl habitat as not likely to adversely affect spotted owls because best available information suggests that habitat function between pre and post-treatment habitat conditions is likely to persist. However, in some situations, such as when there's a relatively large proportion of treatments that maintain NRF habitat planned to occur within core use areas already deficit in NRF habitat, (Table 4), concentrated spatially in a small area close to the nest, and conducted within short duration, as is anticipated with sites 2005A and 2223A, the Service views some of these actions with the potential to result in adverse effects. For these reasons, the Service is giving conservation deference to the species and considers the proposed action at sites 2005A and 2223A likely to adversely affect spotted owls.

To assess the potential effects of habitat modification on spotted owls, the Service generally basis an effects analysis on the spatial use patterns exhibited by spotted owls which includes the home range, core-use area, and nest patch scales (Thomas et al. 1990, USDI/USDA 2008, Bart and Forsman 1992, Bart 1995, Forsman et al. 2005, Rosenberg and McKelvey 1999, Meyer et al. 1998, Zabel et al. 2003, Franklin et al. 2000, Dugger et al. 2005, Swindle et al. 1997, Perkins 2000, and USDI FWS 2009). As with any evaluation, local site specific conditions, for example, abiotic features like aspect, elevation and topography should be evaluated along with project location distance from treatment unit and spotted owl survey information, all should factor into such analyses to reach an effects determination.

NRF habitat associated with two spotted owl home ranges 2223A and 2680O (Table 4), will collectively be reduced by a total of 5.60 acres. Each home range currently consist of habitat amounts less than the best available information indicates as important to spotted owl-habitat fitness (see studies above in the Spotted Owl Resource Selection section). For site 2223A, the majority of acres (2.75 acres) proposed for removal occurs outside the core-use area which may help reduce impacts to a central place foraging species like the spotted owl. However, removal of this habitat as well as the downgrading of habitat (see site narrative above) contributes to the LAA determination for site. For site 2680O, rational for the NLAA determination is due to the extremely minor amount of NRF habitat removal, less than one acre, at the home range scale, and other site specific landscape conditions as discussed above in the site narrative. There is some potential for short-term foraging opportunities in harvested areas (Sisco 1990, Folliard 1993 and Irwin et al. 2013), for example, in habitat areas that have been downgraded, spotted owls may forage along these edges/ecotones due to prey abundance. As a result, we believe it is not reasonably certain that adverse impacts will occur to spotted owls at site 2680O.

Proposed Treatments Outside of Known Spotted Owl Home Ranges

The District is proposing approximately 42 acres of NRF removal, 44 acres of NRF downgrade, 19 acres of NRF treat and maintain, and 176 acres of dispersal treat and maintain outside of the home ranges of the known spotted owl sites within the Double Bowen Action Area. The District will conduct spotted owl protocol surveys (USDI FWS 2012b) in previously un-surveyed NRF habitat within 1.2 miles of the proposed treatment units to determine occupancy status of these areas. These surveys will continue over the next two to five years, depending on the harvest schedule. On adjacent Forest Service lands, spotted owl surveys are likely to continue as part of the SCDSA. If spotted owls are found during surveys, the District plans to drop units or modify

proposed prescriptions in an effort to reduce adverse effects to newly detected spotted owls, or reinitiate consultation.

Effects of the Action on Spotted Owl Prey Species

Spotted owl prey species in this portion of the spotted owl's range, including the Double Bowen action area, consist primarily of northern flying squirrels, woodrats and a variety of other small mammals (Forsman et al. 2004). The proposed action will remove and reduce habitat structure and canopy cover that spotted owl prey species depend on within the project area. For example, flying squirrels which are tied to complex mid-story canopies are likely to decrease in abundance as a result of the NRF habitat removal and some thinning activities in dispersal quality habitat due to the reduction in tree densities, canopy cover, and mid-story canopy, which are all key habitat features of flying squirrel habitat (Carey 2000, Forsman et al. 2004, Wilson 2010, and Manning et al. 2012).

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). 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).

Considering all of the available information, the Service anticipates both short and long-term reduction in the distribution and abundance of primary prey species (i.e.,woodrats and flying squirrels) of the spotted owl in the action area caused by the loss of 90 acres of NRF habitat and the thinning of some dispersal habitat as a result of the Double Bowen proposed action. These negative impacts to the prey base may be offset in the long-term by the on-site retention of snags and coarse wood as detailed in the Conservation Measures above, in addition to maintaining the majority of existing spotted owl habitats in all affected spotted owl sites. At the larger action area scale, the relatively small scale of NRF habitat removal is likely to ameliorate impacts on spotted owl prey species distribution and abundance in the action area. Further, spotted owl habitat post-thinning is anticipated to continue its pre-thinning function without measureable impacts to spotted owls.

Potential Influence of Barred Owls

The District did not conduct surveys specifically for barred owls in the Double Bowen action area. However, during spotted owl surveys, field biologists did detect at least one barred owl at three of the seven spotted owl sites associated with the Double Bowen project. In addition, the Service assumes that increasing barred owl abundance on the demography study areas adjacent to the action area is indicative of trends within the action area (see Status of the Species and Forsman et al. 2011). However, for the purposes of this consultation, the influence of barred owls on spotted owl occupancy is likely accounted for because of the consistency and longevity of surveys at the affected sites along with the District's recent use of a survey protocol that provides a reasonable likelihood of detecting spotted owls in the presence of barred owls. Therefore, spotted owls are likely not underrepresented in the analysis.

Available evidence suggests that the presence and distribution of barred owls may affect habitat quality for spotted owls (Wiens 2012, 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 A). 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 (E. Forsman, pers. comm. 2011 and USDI FWS 2013). Our evaluation herein focused on whether the proposed action could potentially exacerbate competitive interactions between the two species by reducing the availability of NRF habitat (see Recovery Plan section above), if the two species co-occur in the action area. The Service anticipates that the likelihood of inter-species competition being exacerbated is likely minimal because the effects of the proposed action on spotted owl NRF habitat are at a relatively small scale, and will not occur in forest stands that meet the criteria of high quality habitat under Recovery Action 32.

Effects of the Proposed Action on Spotted Owls due to Disturbance

As discussed above in the *Status of the Spotted Owl* section of this Opinion, the effects of noise on spotted owls are largely unknown. 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). According to the Assessment (USDI BLM 2014), the District plans to implement mandatory PDC that restrict activities to outside of the breeding season (March 1– June 30) and/or beyond recommended disturbance distance thresholds (Appendix A of the Assessment; USDI BLM 2014). Application of the Mandatory 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 due to disturbance are anticipated with implementation of the proposed action.

Effects of the Action from the Perspective of the Northwest Forest Plan and the Revised Recovery Plan for the Spotted Owl

<u>NWFP</u>

The proposed action is located within the matrix land use allocation (USDA FS USDI BLM 1994). Under the NWFP, the Matrix LUA represents the area in which most timber harvest and other silvicultural activities are expected to be conducted. 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 Spotted Owl* recommends conserving all spotted owl sites and high value spotted owl habitat to provide additional demographic support to the spotted owl population.

No treatments are proposed in the Known Spotted Owl Activity Center (KSOAC). In addition, no large LSR's occur with the action area; therefore, the intended functions of these reserve allocations are not anticipated to be impacted by the proposed action.

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 a subsequent 15-year monitoring report (Davis et al. 2011) on NWFP implementation, consultation records show timber harvest in the Matrix/AMA LUA was consistent with (and lower than) that assumption. Although habitat for spotted owls to disperse between LSRs does not appear to be limiting (Davis et al. 2011) (and per our analysis above), spotted owl occupancy data from local DSAs suggest reduced spotted owl demographic performance in LSRs and other LUAs likely due to the presence of barred owls (see below plus Dugger et al. 2013).

Recovery Plan

The *Revised Recovery Plan for the Spotted Owl* recommends continued application of the NWFP reserve network, and the maintenance and restoration of more occupied and high-value spotted owl habitat, including increased conservation of habitat on some Federal "Matrix" lands (USDI FWS 2011, p. III-41). The conservation of spotted owl occupied and high value habitat is expected to be accomplished through implementation of Recovery Actions 10 and 32 on all applicable lands (USDI FWS 2011, p. III-41).

Recovery Action 10

As discussed above, the Service's guidance under the recovery plan recommends land managers to "*conserve spotted owl sites and high value spotted owl habitat to provide additional demographic support to the spotted owl population*." The District worked to meet the intent of Recovery Action 10 by generally following the discretionary guidance for the Rogue Basin (USDA FS USDI BLM/FWS 2013) as developed by the local interagency Level 1 Team so as to avoid and minimize impacts to spotted owl sites within the project area. This approach resulted in locating NRF removal projects that are primarily outside of occupied spotted owl home ranges (Table 4). In addition, the projects deliberately prescribed treatments in younger stands, dispersal-only habitat, that will facilitate the development of spotted owl habitat, that otherwise would take longer to develop important forest structural features used by spotted owls. As a result, the proposed action will remove or downgrade about 90 acres of NRF habitat, of which only 3.6 acres overlap two known spotted owl home ranges; about 0.25 acres of the proposed action overlaps with the outer 0.5-mile core area circle of one of the three known spotted owl territories.

Treatments that occur in NRF habitat (non-Recovery Action 32 characterized stands – see below) are anticipated to maintain their current function but also reduce fire risk within the stand and across the local landscape.

Recovery Action 32

As mentioned previously, District biologists conducted surveys to identify forest stands that meet the characteristics of Recovery Action 32 (USDA FS and USDI BLM 2010 and USDI FWS 2011). Based on those surveys, approximately 30 acres were located in three different locations within the planning area that met the local characteristics of Recovery Action 32. According to the Assessment, no harvest activities, temporary road construction, yarding corridors, or skid roads are planned within these 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. These actions were identified in the Project Description section and are accounted for this analysis.

Summary of Adverse and Beneficial Effects of the Proposed Action on the Spotted Owl

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 2005A and 2223A. These impacts are attributed primarily to the concentration and amount of spotted owl NRF habitat proposed for thinning with core-use areas that are currently lacking NRF based on best available information. To determine if habitat modification likely to be caused by a proposed Federal action is also 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. Overall for the action area, only one of the seven known sites is considered to be occupied by spotted owls (Table 4:4380O) and for reasons described above, adverse effects to spotted owls are not anticipated to this occupied site. Because sites 2005A and 2223A are not currently considered to be occupied by spotted owls, the Service concludes that the effects of the proposed action are not reasonably certain to significantly disrupt the breeding, feeding, or sheltering behavior of any affected spotted owls to the extent that it actually injures or kills them these two sites.

As a result of the proposed action, short-term adverse effects though long-term benefits to spotted owl habitat are anticipated. For example, treated NRF habitat is more likely to be ecologically sustainable because residual stands should be less susceptible to suppression mortality. Thinning of young stands and/or capable habitat is more likely to improve the dispersal function of the stands and accelerate the development of future spotted owl habitat NRF habitat. Lastly, the treatment of the root rot is likely to reduce future loss of spotted owl habitat; however, the shift to more resistant tree species may preclude future nesting use by spotted owls.

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 15,326 acres (63 percent) of non-Federal land within the 24,274 acre Double Bowen 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 1994a).

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.

STATUS OF SPOTTED OWL CRITICAL HABITAT

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 proposed action is located within the Klamath East (KLE) spotted owl critical habitat unit (CHU)

10, in subunits 4 and 5. The intended conservation function of these two units 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 FOR SPOTTED OWL CRITICAL HABITAT

The Double Bowen action area overlaps portions of spotted owl critical habitat unit (CHU) 10. In particular, the action area overlaps 849 acres in the KLE 4 subunit, and an additional 4,890 acres of subunit KLE 5 (Table 5). Approximately 715 acres of critical habitat in subunit KLE 5 will be affected by the proposed action; whereas, no treatments are planned in subunit KLE 4. Therefore, the remainder of the analysis will focus on KLE 5.

Table 5. Current condition of spotted owl critical habitat within subunits KLE 4 and KLE 5 within Medford District BLM's Double Bowen action area.

Spotted Owl Critical Habitat	Total Acres	Acres NRF Habitat	Acres Dispersal Habitat (NRF + dispersal-only habitat)
Action Area	24,274	3,716	5,991
Subunit KLE 4[2]	256,079	141,075	224,946
Subunit KLE 4[1]	849	849	849
Subunit KLE 5[2]	38,252	18,606	31,799
Subunit KLE 5[1]	4,890[1]	1,140	3,212

[1] Acres that overlap the action area only.
2 Acres calculated using habitat data from Davis et al 2011 clipped to the 2012 Spotted Owl Critical Habitat units/subunits.

Critical Habitat Unit 10

CHU 10 encompasses 1,197,389 acres and consists of nine 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.

As of July 21, 2014, approximately 1,158,812 acres of spotted owl critical habitat in the Oregon Western Cascades Province provide spotted owl NRF habitat (see Appendix B, Table B-5). These acres account for the removal and downgrade of up to 224 and 2,724 acres of spotted owl NRF habitat within LSRs and outside of reserves, respectively, within critical habitat in the Oregon Western Cascades Province. Collectively, these 2,968 acres represent 25 percent of the total acres of spotted owl NRF habitat removed or downgraded in spotted owl critical habitat at the range-wide scale. 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.

Subunit KLE 5

The KLE-5 subunit occurs in Jackson County, Oregon, and comprises lands managed by the BLM. The BLM lands are managed per the NWFP (USDA and USDI 1994, entire). Special management considerations or protection are required in this subunit to address threats to the essential physical or biological features from current and past timber harvest, losses due to wildfire and the effects on vegetation from fire exclusion, and competition with barred owls. This subunit is expected to function primarily for north-south connectivity between subunits, but also for demographic support.

According to the Assessment (USDI BLM 2014) approximately 36 known spotted owl sites occur within this critical habitat sub-unit on District-managed lands. This critical habitat sub-unit does not occur within lands managed by the Forest Service.

Special Management Considerations

Oregon West Cascades Province

Special management considerations identified by the Service for the Oregon West Cascades Province or protection may be required to conserve or protect older stands that contain the conditions to support spotted owl occupancy (Recovery Action 10: USFWS 2011, p. 43) or contain high-value northern spotted owl habitat (Recovery Action32: USFWS 2011, p. 67). On Federal lands this recommendation applies to all land-use allocations (see also Thomas *et al.* 2006, pp. 284–285). Management emphasis needs to be placed on meeting spotted owl recovery goals and long-term ecosystem restoration and conservation. When there is a conflict between these goals, actions that would disturb or remove the essential physical or biological features of spotted owl critical habitat need to be minimized and reconciled with long-term ecosystem restoration goals. Continue to manage for large, continuous blocks of late-successional forest. In areas that are not currently late seral forest or high-value habitat and where more traditional forest management might be conducted (e.g. matrix), these activities should consider applying ecological forestry prescriptions.

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 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 District's Double Bowen action area overlaps a total of 5,739 acres (24 percent) (Table 2) of spotted owl critical habitat unit 10. The proposed action will affect approximately 715 acres of critical habitat PCEs, consisting of approximately 200 acres in PCE 2 (nesting and roosting habitat) and 514 acres in PCE 4 (dispersal-only habitat).

The action consists of the removal and downgrade of up to 48 acres of NRF habitat (PCE 1 and 2), one acre of dispersal-only habitat (PCE 3) and treat and maintain prescriptions on 153 acres of NRF habitat (PCE 1 and 2) and 513 acres of dispersal-only habitat within the KLE 5 critical habitat subunit (Table 6).

Table 6. Summary of affected (acres[1]) spotted owl critical habitat for KLE 5 subunit, Medford District Double Bowen action area.

Sub Unit	Project	NRF Removed (acres)	NRF Downgrade (acres)	NRF T&M (acres)	Dispersal Removed (acres)	Dispersal T&M (acres)	Total Acres Treated
KLE5	Double Bowen Timber Sale	0	44	153	0	429	**626**
	Double Bowen Plantation Thinning	0	0	0	0	76	**76**
	Double Bowen Temporary Road/Landing construction	2	0	0	1	0	**3**
	Double Bowen Underburn		2	0	0	8	**10**
	TOTAL	**2**	**46**	**153**	**1**	**513**	**715**

1 The habitat acres values in the table and accompanying text are rounded up and therefore may differ slightly that values presented elsewhere.

As discussed below, adverse effects to spotted owl critical habitat are expected due to the removal of NRF and dispersal habitat PCEs. However, we also anticipate some beneficial effects to critical habitat in younger stands because variable density thinning treatments are expected to accelerate the development of the relatively homogeneous stands towards late-successional habitat than if the stands were left untreated (Hayes et al. 1997). 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).

Effects from NRF (PCE 1 and 2) 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. Therefore utilizing a scale that is relevant to the needs and biology of the spotted owl can be applied when assessing effects to critical habitat. For this analysis the Level 1 Team used a 500 acre scale because this metric approximates a spotted owl core-use area (USDI FWS 2009 and USDI FWS 2012a and 77 Federal Register 233:71876-72068) and has been used in previous consultation analyses conducted by the Rogue Basin Level 1 Team. Therefore, the District delineated 500 acre (0.5 mile/800 meter radius) circle geographically centered on proposed treatment unit(s) that would remove or downgrade NRF habitat acres and that would likely be the most impactful in terms of acres within critical habitat and represent potential localized effects. This analysis was conducted on one unit (Assessment Table 9 and Table 7 herein). Pre-and post-treatment NRF habitat amounts within the 500 acre analysis areas were compared to determine effects to PCEs and PBFs of spotted owl critical habitat (Table 7).

The proposed action would remove up to two acres and downgrade up to 46 acres of NRF habitat within the KLE 5 critical habitat sub-unit (Table 6). In this case, downgraded habitat is expected to function as dispersal-only habitat post-treatment due to the retention of at least 40 percent canopy cover, flying space, and an average of trees 11 inches dbh or greater. As a result of this analysis, the estimated pre – to post – harvest change in NRF habitat ranges up to 16 percent

within the 500 acre analysis area. The reduction in available spotted owl NRF habitat is not insignificant or discountable because the ability of the area to support spotted owl nesting (PCE 2) is anticipated to be reduced in a meaningfully measureable manner (Dugger et al. 2005 and Franklin et al. 2000). The overstory removal is also likely to decrease northern flying squirrel abundance from those acres as well (Wilson 2010 and Manning et al. 2011) which could reduce spotted owl foraging opportunities. As a result of these factors the proposed Double Bowen project, for critical habitat subunit KLE5, ***may affect and is likely to adversely affect*** spotted owl critical habitat

Table 7. Pre- and Post- treatment NRF habitat amounts within a 500 acre analysis area within spotted owl critical habitat subunit KLE5, for the Medford District BLM's Double Bowen proposed action.

Project	CHU Sub-unit	Unit ID	NRF Acres Pre-Treatment	NRF Acres Post-Treatment	Percent Changed
Double Bowen Timber Sale	KLE5	168	292	246	- 16%

Dispersal-only Habitat (PCE 4) Removal within Critical Habitat

Up to one acre of dispersal-only habitat (Table 6) is proposed for removal. This one acre of removal represents much less than one percent of dispersal-only habitat acres available in KLE 5 subunit. Because of this situation, the Service believes this removal is likely insignificant in relationship to spotted owl dispersal function at both the local or landscape scales (see above discussion on dispersal landscape connectivity) and concludes the proposed action ***may affect but is not likely to adversely affect*** PCE 4 of spotted owl critical habitat.

Treat and Maintain NRF and Dispersal-only Habitat within Critical Habitat

Prescriptions with the intent of treating and maintaining 153 acres of spotted owl NRF habitat (PCE 1 and 2) and 513 acres of dispersal-only habitat (PCE 4) will have an insignificant effect to critical habitat. This is because the activity is broadly dispersed and canopy cover within treated NRF and dispersal stands will be retained at or above 60 and 40 percent (USDI FWS 2011), respectively. Additionally, other key within stand-structural features important to spotted owls such as decadent woody material, large snags and a multi-layered canopy are anticipated to be retained at sufficient levels.

Intended Function of Critical Habitat Unit

As described above, the Double Bowen proposed action is likely to have adverse effects to critical habitat at the project-level scale, due to the NRF removal/downgrade. At the larger subunit scale, the proposed removal of spotted owl habitat is not anticipated to diminish the intended conservation functions of critical habitat subunit KLE 5 because of the amount and condition of remaining habitat in the subunit, which is intended to provide for connectivity and demographic support. As provided above in the jeopardy analysis, the proposed removal of dispersal habitat (NRF plus dispersal-only) is not anticipated to diminish spotted owl dispersal

habitat at the landscape scale (see Davis et al. 2011) because both the action area and subunit (less than one percent impacted) will be comprised of what is anticipated to be sufficient dispersal habitat post-project, in that north-south and east-west connectivity is available for dispersing spotted owls.

The other intended function of the affected critical habitat subunit is for spotted owl demographic support. This may be best approximated by assessing the spotted owl demographic parameters such as site occupancy and fitness. All affected spotted owl sites under this proposed action occur in spotted owl critical habitat. Treatments that remove up to 2.75 acres of spotted owl NRF habitat are planned to occur only within the home range of site 2223A (Table 4). Because the site is considered as unoccupied for this consultation, the intended demographic support of KLE5 is not anticipated to be diminished by the Double Bowen proposed action. As a result, we anticipate the Double Bowen project will have an insignificant impact at the critical habitat subunit scale. Therefore, no additional analysis is warranted.

CUMULATIVE EFFECTS ON SPOTTED OWL CRITICAL HABITAT

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

Federal land managed by the District in the Double Bowen action area occurs in a checkerboard pattern of ownership of alternating sections of private and federal lands. Management practices occurring on private lands range from residential home site development to intensive industrial timber management. The majority of state and private forests in Washington, Oregon, and Northern California are managed for timber production. Non-federal lands are not expected to provide demographic support for spotted owls across and between physiographic provinces (Thomas et al. 1990; USDA and USDI 1994a). Historically, non-Federal landowners practiced even-aged management (clear-cutting) of timber over extensive acreages. Private industrial forestlands are managed for timber production and will typically be harvested between 40 and 60 years of age, in accordance with State Forest Practices Act Standards.

The Service assumes past management practices on private lands will continue, which will likely result in some loss of spotted owl habitat on private lands associated with the removal and fragmenting of existing habitat. In addition, disturbance to occupied spotted owl sites may occur as a result of harvest activities that take place adjacent to occupied sites during sensitive periods. However, private land harvest activity is generally not tracked by federal action agencies. The Oregon Forest Practice Rules (629-665-0210), protects known spotted owl nest sites (70-acre core areas) for at least three years after the last year of occupation.

Critical habitat for the spotted owl is not designated on non-Federal lands (although a few acres are designated on State managed lands) within or adjacent to the Project action area. Non-Federal lands within and adjacent to the action area are primarily concerned with timber production and recreation. While State and private lands comprise more than half of the area within 1.2 miles of the project area, these lands as described in the environmental baseline are not likely in amounts and quality sufficient to support spotted owls. The effects of non-Federal actions within and adjacent to the action area are not likely to indirectly affect spotted owl

critical habitat because these lands, in most cases, likely marginal habitat for spotted owls and do not provide contiguous habitat that would be beneficial to 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 proposed action is not likely to jeopardize the continued existence of the spotted owl and is not likely to 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 proposed action is located on Matrix lands which under the NWFP include a land-use allocation for timber production. The proposed action will not affect NWFP LSR reserve allocations. Therefore these reserve areas will continue to be managed to maintain and further restore older forest habitats to benefit a myriad of native species, including the spotted owl. 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.

The District worked to meet the intent of Recovery Action 10 and this approach resulted in locating projects that are primarily outside of occupied spotted owl home ranges (Table 4). In addition, the projects deliberately prescribed treatments in younger stands, dispersal-only habitat, that will facilitate the development of spotted owl habitat, that otherwise would take longer to develop important forest structural features used by spotted owls. Treatments will also occur in NRF habitat (non-Recovery Action 32 characterized stands – see below) that will maintain its current function but also reduce fire risk within the stand and the local landscape.

District biologists conducted surveys to identify forest stands that meet the characteristics of Recovery Action 32. Based on these surveys no harvest activities, temporary road construction, yarding corridors, or skid roads are planned within these stands.

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. As described above, the Double Bowen action area is located with the Oregon West Cascades Mountain Province which also serves as a recovery unit for the spotted owl. The Service does not anticipate the Double Bowen proposed action as likely impairing or precluding the capacity of the recovery unit's conservation contribution to the species as a whole for the following reasons.

As discussed above, the Revised Recovery Plan recommends continued implementation of the NWFP conservation framework. This proposed action conforms to the NWFP. The amount of habitat loss under the NWFP to date has been lower than projected. In addition for the Cascade Province, over 2 million acres of spotted owl NRF habitat still remains and only approximately 1 percent of the provincial baseline has been impacted to date (Appendix B herein). The removal of up to 44 acres of NRF as proposed in the Double Bowen project is not anticipated to reduce the unit's capacity for recovery.

Spotted owl occupancy on the adjacent SCDSA has declined (Dugger et al. 2014). This decline was also evident in earlier years and during that time frame the meta-analysis (Forsman et al. 2011) showed a stationary population estimate for the study area. There are 13 spotted owl sites associated with the Double Bowen action area and 95 percent of the proposed action occurs outside of the known spotted owl home ranges. Further, while adverse effects are anticipated to two sites, significant disruption of breeding, feeding or sheltering of spotted owls is not anticipated for reasons discussed above. In particular, most of the sites are likely not occupied; despite intensive survey efforts which we believe accurately represents the current occupancy situation of known sites across the action area for reasons discussed above. Because of these factors, we do not anticipate the demographic capability of spotted owls at the province scale to be impaired due to the proposed action. When considering and stepping up these factors to the range-wide scale, the Service does not anticipate the proposed action jeopardizing the spotted owl.

As a result of the proposed action, short-term adverse effects though long-term benefits to spotted owl habitat are anticipated. For example, treated NRF habitat is more likely to be ecologically sustainable because residual stands should be less susceptible to suppression mortality. Thinning of young stands and/or capable habitat is more likely to improve the dispersal function of the stands and accelerate the development of future spotted owl habitat NRF habitat. Lastly, the treatment of the root rot is likely to reduce future loss of spotted owl habitat; however, the shift to more resistant tree species may preclude future nesting use by spotted owls.

Up to 48 acres of spotted owl NRF habitat are likely to be impacted within critical habitat subunit KLE 5 due to the proposed action. Based on the analysis provided in the Effects to Critical Habitat section above, the Service anticipates this removal/downgrade may affect and is likely to adversely affect the primary constituent elements of critical habitat. However, as explained above, the Service does not anticipate that this level of effect will adversely modify critical habitat at the subunit or range wide scale.

INCIDENTAL TAKE STATEMENT

Based on the findings presented in the “Effects of the Action on the Spotted Owl” section above, the Service neither anticipates nor authorizes the incidental take of spotted owls associated with the implementation of activities associated with the Double Bowen proposed action.

Reasonable and Prudent Measures

The Service believes the following reasonable and prudent measure(s) are necessary and appropriate to minimize impacts of incidental take of the species.

No reasonable and prudent measures, other than a monitoring requirement, are set forth below, because the PDC and conservation measures that are part of the proposed action are adequate to minimize the impacts of anticipated take caused by the Project on the spotted owl.

Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the Act, the District must comply with the following terms and conditions, which implement the reasonable and prudent measures,

described above and outline required reporting/monitoring requirements. These terms and conditions are non-discretionary.

The District shall 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 each year during the term of the Project. The annual submittal shall summarize Project impacts to spotted owl habitat that occurred in the preceding 12 months and describe anticipated impacts to spotted owl habitat caused by the Project for the upcoming 12 months.

Implementation of the PDC is monitored through the District's sale-contracting program in coordination with the District's Resource Area wildlife biologist.

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:

1. The Service recommends that spotted owl protocol surveys continue in the action area. Survey findings should be reported annually to the Level 1 Team and used to inform and refine project placement so as to avoid and minimize Project impacts to spotted owls.

2. 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.

3. The Service recommends that the Level 1 Team be involved in pre-project layout in selected areas to ensure calibration on PDC implementation.

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 opinion; (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 Opinion; 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 2014).

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.

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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 closure (60 to 90 percent); a multi-layered, multi-species canopy with large overstory trees (with dbh of greater than 30 inches); a high incidence of large trees with various deformities (large cavities, broken tops, mistletoe infections, and other evidence of decadence); large snags; large accumulations of fallen trees and other woody debris on the ground; and sufficient open space below the canopy for spotted owls to fly (Thomas et al. 1990, p. 19). Forested stands with high canopy closure also provide thermal cover (Weathers et al. 2001, p. 686) and protection from predators (Franklin et al. 2000, p. 578).

Spotted owls nest almost exclusively in trees. Like roosts, nest sites are found in forests having complex structure dominated by large diameter trees (Forsman et al. 1984, p. 30; Hershey et al. 1998, p. 1402). Even in forests that have been previously logged, spotted owls select forests having a structure (i.e., larger trees, greater canopy closure) different than forests generally 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 closure and large diameter trees in the overstory.

Foraging habitat is the most variable of all habitats used by territorial spotted owls (Thomas et al. 1990; USDI FWS 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 closure (Irwin et al. 2000, p. 180; Courtney et al. 2004, pp. 5-15), snag volume, density of snags greater than 20 in (50 cm) dbh (North et al. 1999, p. 524; Irwin et al. 2000, pp. 179-180; Courtney et al. 2004, pp. 5-15), density of trees greater than or equal to 31 in (80 cm) dbh (North et al. 1999, p. 524), volume of woody debris (Irwin et al. 2000, pp. 179-180), and young forests with some structural characteristics of old forests (Carey et al.1992, pp. 245-247; Irwin et al. 2000, pp. 178-179).

Northern spotted owls select old forests for foraging in greater proportion than their availability at the landscape scale (Carey et al. 1992, pp. 236-237; Carey and Peeler 1995, p. 235; Forsman et al. 2004, pp. 372-373), but will forage in younger stands with high prey densities and access to prey (Carey et al. 1992, p. 247; Rosenberg and Anthony 1992, p. 165; Thome et al. 1999, pp. 56-57).

Dispersal habitat is essential to maintaining stable populations by filling territorial vacancies when resident northern spotted owls die or leave their territories, and to providing adequate gene flow across the range of the species. Dispersal habitat, at a minimum, consists of stands with adequate tree size and canopy closure to provide protection from avian predators and at least minimal foraging opportunities (USDI FWS 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 closure more often than expected for roosting during the non-breeding season. Spotted owls also used young forest (trees of 20 to 50 centimeters (7.9 inches to 19.7 inches) dbh with greater than 60 percent canopy closure) less often than expected based on this habitat's availability (Herter et al. 2002, p. 437).

In the Coast Ranges, Western Oregon Cascades and the Olympic Peninsula, radio-marked spotted owls selected 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).

<u>Inbreeding Depression, Genetic Isolation, and Reduced Genetic Diversity</u>
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. 71885). 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. 71885). 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. 2011, p. 123).

Potential changes in temperature and precipitation have important implications for spotted owl reproduction and survival. Wet, cold weather during the winter or nesting season, particularly the early nesting season, has been shown to negatively affect spotted owl reproduction (Olson et al. 2004, p. 1039, Dugger et al. 2005, p. 863), survival (Franklin et al. 2000 pp. 576-577, Olson et al. 2004, p. 1039, Glenn et al. 2011, p. 1279), and recruitment (Glenn et al. 2010, pp.2446-2547). Cold, wet weather may reduce reproduction and/or survival during the breeding season due to declines or decreased activity in small mammal populations so that less food is available during reproduction when metabolic demands are high (Glenn et al. 2011, pp. 1288-1289). Cold, wet nesting seasons may increase the mortality of nestlings due to chilling and reduce the number of young fledged per pair per year (Franklin et al. 2000, p.557, Glenn et al. 2011, p. 1286).

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 range-wide 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 December 2, 2013

Between 1994 and November 17, 2013, the Service has consulted on the proposed removal/downgrade of approximately 684,294 acres or 7.7 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 since 1992 have documented the eventual loss of over 414,630 acres of habitat on non-NWFP lands. 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 NRF1 Habitat Acres from Activities Subject to Section 7 Consultations and Other Causes (1994 to Present).

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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)	204,252	547,042	251,276	39,720
Bureau of Indian Affairs / Tribes	111,662	28,372	2,398	0
Habitat Conservation Plans/Safe Harbor Agreements	303,007	14,539	N/A	N/A
Other Federal, State, County, Private Lands	68,713	28,447	2,392	0
Total Changes	**687,634**	**618,400**	**256,066**	**39,720**

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 December 2, 2013

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-1 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. **Mon Jul 21 10:20:54 MDT 2014**

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	6.08
	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	529	831	1,360	3	0	3	1,363	0.11	1.25
	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	7,484	10,478	7,639	1,981	9,620	20,098	5.33	18.44
	Cascades West	1,275,200	939,600	2,214,800	1,183	22,995	24,178	0	0	0	24,178	1.09	22.18
	Coast Range	494,400	113,400	607,800	750	1,623	2,373	0	0	0	2,373	0.39	2.18
	Klamath Mountains	549,400	334,900	884,300	2,985	5,209	8,194	1,468	3,696	5,164	13,358	1.51	12.26
	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	0.31
	Coast	132,900	10,100	143,000	274	1	275	0	175	175	450	0.31	0.41
	Klamath	910,900	501,200	1,412,100	75	646	721	19,072	20,409	39,481	40,202	2.85	36.88
Total		**5,961,000**	**2,594,200**	**8,555,200**	**11,506**	**41,028**	**52,534**	**30,066**	**26,394**	**56,460**	**108,994**	**1.27**	**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 108,994 acres or 1.27 percent of 8.55 million acres of northern spotted owl habitat were removed/downgraded as a result of land management activities (Table B-2). Of these, about 52,534 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 56,460 acres range-wide have been lost, with the California Klamath province contributing the majority (39,481 acres or 70 percent) of habitat lost, followed by the Oregon Cascades East province (9,620 acres or 19 percent). Effects to spotted owl habitat from 2013 fires are incorporated in the tables provided in this section of the Opinion. These fires affected primarily portions of the Oregon Klamath, Oregon East Cascades, and the eastern portions of Oregon Coast Ranges.

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. **Mon Jul 21 10:30:11 MDT 2014**

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]	8,100	38,469	46,569
Removed/Downgraded (other management activities)[5]	3,406	2,559	5,965
Subtotal	11,506	41,028	52,534
Removed/Downgraded (natural disturbance)[6]	30,066	26,394	56,460
Total Net Change	41,572	67,422	108,994
Baseline Balance	**5,919,428**	**2,526,778**	**8,446,206**
Habitat Maintained[7]	37,603	61,471	99,074

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) 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.

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 2012a, 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.

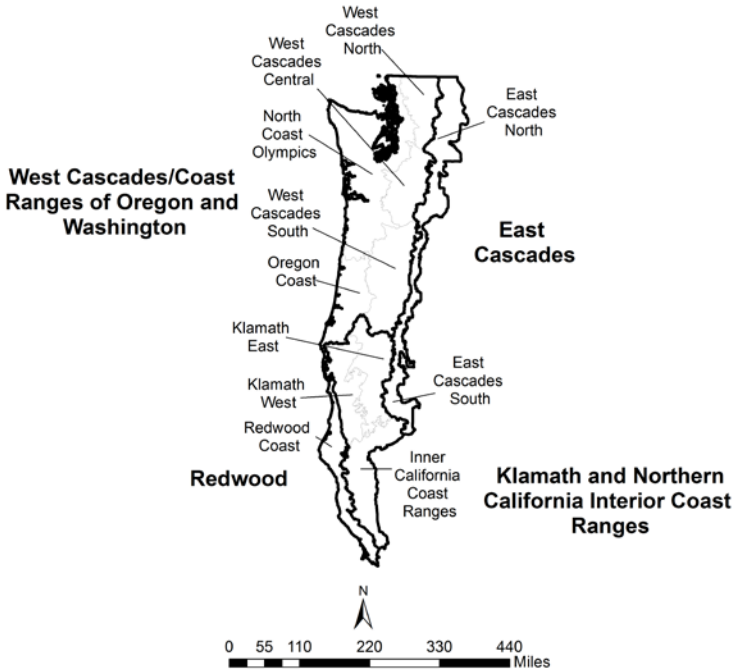
PCE 4: Dispersal Habitat

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 July 21, 2014, the database reports 11,874 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 (2,713 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 NRF1 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. Mon Jul 21 10:42:19 MDT 2014

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	0	265	0	265	0.06	2.23
	Olympic Peninsula	507,165	238,390	6	0	6	0	6	0.00	0.05
	Western Cascades	1,387,567	667,173	18	0	18	0	18	0.00	0.15
OR	**Cascades East**	529,652	181,065	887	1,262	2,149	0	2,149	1.19	18.10
	Cascades West	1,965,407	1,161,780	244	2,724	2,968	0	2,968	0.26	25.00
	Coast Range	1,151,874	535,602	1	1,132	1,133	0	1,133	0.21	9.54
	Klamath Mountains	911,681	481,577	1,292	1,102	2,394	2,941	5,335	1.11	44.93
CA	**Cascades**	243,205	98,243	0	0	0	0	0	0.00	0.00
	Coast	149,044	58,278	0	0	0	0	0	0.00	0.00
	Klamath	1,708,787	752,131	0	0	0	0	0	0.00	0.00
Total		**9,577,342**	**4,590,308**	**2,713**	**6,220**	**8,933**	**2,941**	**11,874**	**0.12%**	**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)					
☐ Harm	Disturbance Effects	FY'	FY'	FY'	FY'	FY'	FY'
☐ Harass	Acres (wo/ LOPs)						
	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)					
☐ Harm	Non-Habitat Effects	FY'	FY'	FY'	FY'	FY'	FY'
☐ Harass	Unsurveyed Suitable Habitat (Acres)						
	Occupied Suitable Habitat (Acres)						
	# Individuals						

Section II & III: General Note and Comments

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