United States Department of the Interior

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Lisa A Northrop
Forest Supervisor, Mt. Hood National Forest
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SUBJECT: Formal consultation on North Fork Mill Creek Planning Area activities proposed by the Mt. Hood National Forest's Hood River and Barlow Ranger Districts and their effects to the northern spotted owl, and spotted owl critical habitat [FWS *reference*: 01EOFW00-2014-F-0253].

Dear Ms. Northrop:

This letter and enclosed Biological Opinion (BO) responds to your request for reinitiation of formal consultation with the U.S. Fish and Wildlife Service pursuant to section 7 of the Endangered Species Act of 1973 (16 U.S.C. 1531 *et seq.*), as amended. At issue in this consultation are the potential habitat modification and disturbance effects to the northern spotted owl (*Strix occidentalis caurina*) (spotted owl), and spotted owl critical habitat, from North Fork Mill Creek Planning Area activities proposed by the Mt. Hood National Forest's Hood River and Barlow Ranger Districts. Your request for formal consultation was received in our office on August 25, 2014. Our conclusion for formal consultation is that the North Fork Mill Creek Planning Area activities at the anticipated levels would not jeopardize the continued existence of spotted owls, nor would it adversely modify spotted owl critical habitat.

If you have any questions regarding this BO, please contact Bridgette Tuerler at (503) 231-6956, or Brendan White at (503) 231-6179.

Sincerely,

for Paul Henson
State Supervisor

Enclosure: BO
cc: OFWO~spotted owl binder, Attn: Brendan White

Biological Opinion
Regarding the Effects of Habitat Modification Activities
within the North Fork Mill Creek Planning Area,
Proposed by the
Mt. Hood National Forest;
on
the Northern Spotted Owl (*Strix occidentalis caurina*),
and it's Critical Habitat
(FWS Reference Number 01EOFW00-2014-F-0253)

Prepared by the Oregon Fish and Wildlife Office
U.S. Fish and Wildlife Service
Portland, Oregon

for Judy S. Calicco

Paul Henson, Ph.D., State Supervisor

October 3, 2014

Date

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INTRODUCTION

This document transmits the U.S. Fish and Wildlife Service's (Service or USFWS) Biological Opinion (BO) based on our review of the North Fork Mill Creek Planning Area activities described below that are proposed for implementation by the Mt. Hood National Forest's (NF) Hood River and Barlow Ranger Districts and their effects to the northern spotted owl (*Strix occidentalis caurina*) (spotted owl), and spotted owl critical habitat. This document was prepared in accordance with section 7 of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*). The August 22, 2014, request for formal consultation was received by the Service on August 25, 2014.

This BO is based on the following major sources of information: the August 22, 2014, letter from Mt. Hood NF, which included a biological assessment of the projects (BA); Forest Ecosystem Management: an Ecological, Economic, and Social Assessment (FEMAT) (Thomas and Raphael 1993); the Northwest Forest Plan (NWFP) (USDA and USDI 1994a); the Final Supplemental Environmental Impact Statement on Management of Habitat for Late-Successional and Old-Growth Forest Related Species Within the Range of the Northern Spotted Owl (USDA and USDI 1994b) (FSEIS); the Service's Biological Opinion (BO) on the NWFP (USFWS 1994); Scientific Evaluation of the Status of the Northern Spotted Owl (Courtney et al. 2004); Recovery Plan for the Northern Spotted Owl (USFWS 2011); Revised Critical Habitat for the Northern Spotted Owl (USFWS 2012a); our files; and informal consultation between the various administrative units and Service staff.

CONSULTATION HISTORY

Mt. Hood NF requested reinitiation of parts of the North Fork Mill Creek Restoration projects. These projects had previously been consulted on in the 1-7-06-F-0179 batched consultation for the Willamette Planning Province and were then reinitiated in the 01EOFW00-2013-F-0149 consultation due to new spotted owl critical habitat.

As a result of the Government Flats Fire on August 16, 2013, there has been a significant reduction in nesting, roosting, and foraging habitat within the territories of four spotted owls. Additionally, two sold timber sales (Roan and Eques stewardship sales) need to be reconfigured to meet the existing contractual and economic obligations. These changes triggered the need to reinitiate consultation.

The underlying needs of the North Fork Mill Creek Revised project are to:

- Modify the existing stewardship contracts, including adding salvaging dead and dying trees[1];
- Improve the health and vigor of forested stands, including within Riparian Reserves;

[1] A dying tree is any tree that would die as a result of Government Flats Complex Fire. The Scott's Species Specific Guidelines (Scott, Schmitt and Spiegel 2002) would be used to assess individually dying trees. These guidelines are available in the project record located at the Hood River Ranger District. See Section 2.2.1 for more information.

- Reforest with the desired tree species (where natural, on-site, seed sources are lacking) to aid in the accelerated development of forest conditions consistent with management plan objectives; and,
- Improve public, administrative and operational safety along Forest Service roads.

The Service assumes that proposed actions will comply with the Record of Decision and the Standards and Guidelines of the NWFP (USDA and USDI 1994a), and with the Mt. Hood National Forest Land and Resource Management Plan, as stated in the BA.

Although this consultation started as a reinitiation, the Service is proving a new BO due to the significant changes in the baseline and proposed project; and this consolation does not hinge on past consolations.

BIOLOGICAL OPINION

1.0 DESCRIPTION OF THE PROPOSED ACTION

The Proposed Action includes restoration thinning (253 acres – 146 acres in moderate to high severity burn and 107 acres in low severity burn), hazard tree removal (134 acres), and reforestation treatments (which include snag removal on 622 acres), see Table 1. In addition to these treatments, the Proposed Action includes less than one mile of temporary road re-construction as a connected action. There is no impact to spotted owl habitat from this road construction. All activities will occur in matrix, except a portion of the reforestation treatments will occur in 100 acre Late Successional Reserves (LSRs).

Restoration Thinning treatments would harvest timber from 253 acres within the Government Flats Complex Fire perimeter. These units are all under existing stewardship contracts (Roan and Eques), and the Forest Service has a contractual obligation to analyze continued operations on these lands in order to make the purchasers whole and/or to provide the necessary context for contract modifications. Fire-killed and dying trees would be harvested and removed from areas of high to moderate severity burn (146 acres). The dying trees are trees that experienced damage as a result of the fire activity. A subset of the snags within the units will be retained to meet habitat requirements for the spotted owl and snag and down log associated species, as much as possible. If additional trees are needed for soil stability or soil productivity, these trees would be retained and limbed as needed. A minimum of 10 snags per acre would be retained. Restoration thinning would also occur on the unburned to low severity burns (107 acres).

Restoration thin units in all burn severities may be made available for firewood and/or restoration log removal, if the harvest operations are not able to be conducted while the product is viable. Vegetation treatment over most of the area would involve the use of available roads and skid trails existing from past activities. Less than one mile of temporary roads would be constructed for removal of vegetation in some stands, but these roads would be rehabilitated at the end of the project.

Hazard trees would be removed on 134 acres. These treatments would remove any tree that is classified as a hazard tree and that is predicted to strike or damage the road up to 200-feet from either side of the center line of the road. All hazard (danger) tree evaluation and identification

must follow the "Field Guide for Danger Tree Identification and Response" (Toupin et. al. 2008). Any slash exceeding Forest Plan standards and guidelines would be machine and/or hand-piled to reduce the resulting fuel loading. If additional trees are needed for soil stability or soil productivity, these also would be felled and left on site. Approximately 125 hazard trees have already been felled along Forest Service Road 1711-630 as part of the Burned Area Emergency Response (BAER) work. These trees would be removed, if they exceed Forest Plan standards and guidelines. On lands within Riparian Reserves (Units 87A, 106A, 107A, and 108A), the hazard trees would be felled and left on-the-ground in order to comply with the Northwest Forest Plan.

Approximately 622 acres would be planted to reforest moderate to high severity burn areas in naturally forested areas but not in grass or meadow plant communities. Hazard trees within the stand would be hand-felled in order to facilitate safe tree planting operations. These trees would be left on-the-ground and used as contour trees whenever possible. These trees would be used to provide micro-siting for planted tree seedlings as well. All other treatment areas would be reforested as needed in order to establish slow growing, shade intolerant, rot resistant species, such as ponderosa pine, western white pine and western larch. Any slash along the roads within these units that exceeds NWFP standards and guidelines and that are not needed for soil stability or soil productivity would be piled to reduce the resulting fuel loading. These units were all originally analyzed under the North Fork Mill Creek Restoration Opportunities EA, but they have not met the desired future condition given the severity of the burn and anticipated natural regeneration.

Table 1. Description of proposed action, Mt. Hood NF.

East Side Cascades, and Critical Habitat subunit East Cascades North, ECN-7	Acres within low severity burned area	Acres within moderate to high severity burned area
Restoration thin (nesting and roosting habitat – removed)	15	0
Restoration thin (dispersal only habitat – removed)	70	0
Restoration thin (non-habitat)	22	0
Restoration thin that (In non- habitat that was nesting and roosting habitat – removed)	0	146
Hazard tree removal within 200 feet of roads and predicted to strike or damage the road (non-habitat - removed)	0	134
Subtotal affecting habitat: 346 acres	107	280
Reforestation acres (non- spotted owl habitat – will improve habitat function)		622
Total treatment acres: 1009	107	902

1.1 **Definitions**

The proposed activities were analyzed, in part, using the following definition of terms.

1.1.1 *Spotted Owl*
1.1.1.1 *Habitat* in this BO refers to both suitable and dispersal spotted owl habitat (unless specifically identified as either suitable or dispersal habitat).

1.1.1.2 *Non-habitat* refers to land which is capable of growing habitat, but does not currently function as either suitable or dispersal habitat.

1.1.1.3 *Suitable habitat*: Consists of forested stands used by spotted owls for nesting, roosting and/or foraging. Features that support nesting and roosting typically include a moderate to high canopy closure (60-90%); 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. This habitat is described as nesting and roosting habitat in the revised spotted owl recovery plan (hereafter referred to as the Recovery Plan; USFWS 2011, p. A-10).

Foraging habitat generally has attributes similar to those of nesting and roosting habitat, but such habitat may not always support successfully nesting pairs (USFWS 2011, p. A-10). Together, these comprise suitable habitat in this document.

1.1.1.4 *Dispersal habitat:* Dispersal habitat is typically 40-120 years old. It consists of stands with adequate tree size and canopy closure to provide protection from avian predators and at least minimal foraging opportunities (USFWS 2011, p. A-10). It is comprised of conifer and mixed mature conifer-hardwood habitats with a canopy cover greater than or equal to 40 percent and conifer trees greater than or equal to 11 inches average diameter at breast height (dbh) with open space beneath the canopy to allow spotted owls to fly. Generally, non-territorial spotted owls use dispersal habitat to roost, forage, and survive until they can establish a nest territory. Juvenile owls also use dispersal habitat to move from natal areas. Dispersal habitat thus includes habitat that will provide some roosting and foraging opportunities during the colonization phase of dispersal. The scale for looking at an area to support dispersing spotted owls is usually much larger than that for nesting spotted owls, such as a sub-watershed etc.

Suitable habitat also functions as dispersal habitat as it supports both territorial and dispersing spotted owls. However, in an effort to not double count effects, effects to spotted owl habitat are shown by suitable habitat plus the remainder of the dispersal habitat that was not accounted for in the suitable habitat quantity. Therefore, in this document, the term "dispersal habitat" generally refers to stands that are 40-79 years old.

1.1.1.5 *Known owl site:* A site that was or is occupied by a pair or resident single (1990 to present) as defined by survey protocol. The specific site location is determined by the unit

biologist based on the best and/or most recent information. A known site may be determined to be inactive only in accordance with the survey protocol (USFWS 2012b).

1.1.1.6 *Potential spotted owl site*: The 2011 Revised Recovery Plan for Northern Spotted Owls (USFWS 2011) it is stated: "In unsurveyed spotted owl habitat, the agencies and the Service should work cooperatively through the Endangered Species Act consultation process to minimize impacts to potential spotted owl sites. It is likely to be most beneficial to address these areas as early in the planning process as possible." Appendix A outlines how potential owl sites are addressed in this document.

1.1.1.7 *Nest Patch (or stand)*: 300-meter (985 feet) radius circle around a point (known owl or potential site), where a spotted owl would likely select a nesting tree. Nesting habitat models developed by Swindle et al. (1997, p.52) and Perkins (2000) showed that the 200-300 meter radius (and sometimes greater), encompassing approximately up to 75 acres, around a nest is important to spotted owls and having as much of the 300-meter radius area in suitable habitat was critical to nest position on the landscape. Coincidentally, Miller (1989) found that on average, the extent of forested area used by juvenile owls prior to dispersal averaged approximately 70 acres. Lastly, Meyer et al. (1998) found that old-growth patch size (i.e., larger patches) was strongly related to spotted owl site selection in Oregon. See Appendix A for a detailed explanation of nest patch.

1.1.1.8 *Core area*: 0.5 mile (radius circle) around a known owl or potential site, which delineates the area most heavily used during the nesting season for nesting, foraging and rearing young. Bingham & Noon (1997) defined the core area as that portion of a spotted owl home range that received disproportionately high use for nesting, roosting and access to prey; they suggested that 60-70% of owl reproducing season activity occurred in about 20% of the home range. Although Courtney et al. (2004:5-5) observed that core area sizes varied greatly among owls, Bingham & Noon (1997), Wagner & Anthony (1998), Franklin et al. (2000), and Irwin et al. (2000) collectively suggested a core area of about 500 acres. See Appendix A for a detailed explanation of core area.

1.1.1.9 *Home Range*: An estimated area for habitat use of a spotted owl pair. For the Willamette Province, this estimate is a 1.2 mile radius circle around a known or potential owl site (Thomas et al. 1990, Courtney et al. 2004, USFWS et al. 2008). See Appendix A for a detailed explanation of home range.

1.1.2 *Disturbance/Disruption Distances*
1.1.2.1 *Breeding Period*: the breeding period for spotted owls is March 1 through September 30. The critical breeding period is March 1 through July 15.

1.1.3.2 *Disturbance distance*: the distance from the project boundary outward within which the action is likely to cause a listed species, if present, to be distracted from its normal activity. Except as stated in Tables 2, the disturbance distance is 0.25 mile from nesting spotted owls. Note that disturbance has both temporal and spatial components.

1.1.2.3 *Disruption distance*: The distance from the project boundary outward within which the action is likely to cause spotted owls, if present, to be distracted to such an extent as to significantly disrupt normal behavior and create the likelihood of harm or loss of reproduction. The disruption distance is a subset of the disturbance distance. Proposed activities that would occur within the distances shown in Table 2 might disrupt the normal behavior patterns of individual owls, or breeding spotted owls if present. Note that disruption has both temporal and spatial components.

Table 2. Disturbance/disruption distances for spotted owls during the breeding period (March 1 – September 30). Distances are measured from the edge of the 300 meter nest patch, unless the nest tree is known, in which case the distance is measured from that tree.

Disturbance Source	**Disturbance Distances During the Nesting Season (Mar 1 – Sep 30)** *NLAA when distance is beyond disruption distances*	**Disruption Distances During the Early "Critical" Nesting Season (Mar 1–Jul 7)**	**Disruption Distances During the Late Nesting Season (Jul 8–Sep 30)**
Light maintenance of roads, campgrounds, and administrative facilities	0.25 mile	NA[1]	NA
Log hauling on open roads	0.25 mile	NA[1]	NA
Chainsaws (includes felling hazard/danger trees)	0.25 mile	65 yards[2]	NA
Heavy equipment for road construction, road repairs, bridge construction, culvert replacements, etc.	0.25 mile	65 yards[2]	NA
Pile-driving (steel H piles, pipe piles) Rock Crushing and Screening Equipment	0.25 mile	120 yards[3]	NA
Blasting	1 mile	0.25 mile[3] 100 yards (injury)[4]	100 yards (injury)[4]
*Helicopter: Chinook 47d (described as a large helicopter in the rest of this document)	0.5 mile	265 yards[5]	100 yards[6] (hovering only)
*Helicopter: Boeing Vertol 107, Sikorsky S-64 (SkyCrane)	0.25 mile	150 yards[7]	50 yards[6] (hovering only)
*Helicopters: K-MAX, Bell 206 L4, Hughes 500	0.25 mile	110 yards[8]	50 yards[6] (hovering only)
*Small fixed-wing aircraft (Cessna 185, etc.)	0.25 mile	110 yards	NA
Tree Climbing	25 yards	25 yards[9]	NA
Burning (prescribed fires, pile burning)	0.25 mile	0.25 mile[10]	NA

1. NA = not applicable. Based on information presented in Tempel and Gutiérrez (2003, p. 700), Delaney et al. (1999, p. 69), and Kerns and Allwardt (1992, p. 9), we anticipate that the few spotted owls that select nest sites in close proximity to open roads either are undisturbed by or habituate to the normal range of sounds and activities associated with these roads.
2. Based on Delaney et al. (1999, p. 67) which indicates that spotted owl flush responses to above-ambient equipment sound levels and associated activities are most likely to occur at a distance of 65 yards (60 m) or less.

3. Impulsive sound associated with blasts and pile-driving is highly variable and potentially injurious at close distances. We selected a 0.25-mile radius around blast sites as a disruption distance based on observed prairie falcon flush responses to blasting noise at distances of 0.3 – 0.6 miles from blast sites (Holthuijzen et al. 1990, p. 273). We have conservatively chosen a distance threshold of 120 yards for impact pile-driving and rock-crushing operations to avoid potential hearing loss effects and to account for significant behavioral responses (e.g. flushing) from exposure to continuous sounds from impact pile driving.
4. Exposure to peak sound levels that are >140 dBA are likely to cause injury in the form of hearing loss in birds (Dooling and Popper 2007, pp. 23-24). We have conservatively selected 100 yards as an injury threshold distance based on sound levels from experimental blasts reported by Holthuijzen et al. (1990, p. 272), which documented peak sound levels from small blasts at 138 – 146 dBA at a distance of 100 m (110 yards).
5. Based on an estimated 92 dBA sound-contour from sound data for the Chinook 47d presented in Newman et al. (1984, Table D.1).
6. Rotor-wash from large helicopters is expected to be disruptive at any time during the nesting season due the potential for flying debris and shaking of trees located directly under a hovering helicopter. Hovering rotor-wash distance is based on a 300-ft radius rotor-wash zone for large helicopters hovering at < 500 above ground level (from WCB 2005, p. 2 – logging safety guidelines). We reduced the hovering helicopter rotor-wash zone to a 50-yard radius for all other helicopters based on the smaller rotor-span for all other ships.
7. Based on an estimated 92 dBA sound contour from sound data for the Boeing Vertol 107 the presented in the San Dimas Helicopter Logging Noise Report (USFS 2008, chapters 5, 6).
8. Based on Delaney et al. (1999, p. 74), which concluded that a buffer of 105 m (115) yards for helicopter overflights would eliminate flush responses from military helicopter overflights. The estimated 92 dBA sound contours for these helicopters is less than 110 yards (e.g., K-MAX (100 feet) (USFS 2008, chapters 5, 6), and Bell 206 (85-89 dbA at 100 m) (Grubb et al. 2010, p. 1277).
9. Based on Swarthout and Steidl (2001, p. 312) who found that 95 percent of flush responses by spotted owls due to the presence of hikers on trails occurred within a distance of 24 m.
10. Based on recommendations presented in *Smoke Effects to Northern Spotted Owls* (USFWS 2008a, p. 4).

*Aircraft normally use above ground level (AGL) as a unit of measure. For instance to not cause a disruption by medium and small helicopters during the late breeding season, the AGL would be 350 feet. 350 feet AGL would account for 200 foot tall trees that NSOs would be occupying plus the 50 yards disruption distance.

1.2 **Action Area**

The action area is defined in the implementing regulations for section 7 at 50 CFR 402 as, "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action." All treatment units, located at T1S, R11E, Sections 4-9 in Wasco County, Oregon and Federal and non-federal lands within quarter mile. A quarter mile radius is being used because noise disruption from heavy machinery is expected to be back down to ambient levels at that distance from treatment units.

2.0 **FRAMEWORK FOR JEAPARDY AND ADVERSE MODIFICATION ANALSES**

2.1 **Analytical Framework for the Jeopardy Determination**

The following analysis 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 role of the action area in the spotted owl's survival and recovery; (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 with the aggregate effects of everything that has led 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, given the aggregate of all of these effects, 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 following analysis places an emphasis on using the range-wide survival and recovery needs of the spotted owl and the role of the action area in meeting those needs as the context for evaluating the effects of the proposed Federal action combined with other relevant effects. In short, a non-jeopardy determination is warranted if the proposed action is consistent with maintaining the role of habitat and the spotted owl population in the action area for the survival and recovery of the spotted owl. The jeopardy determination is made on the range-wide scale of the spotted owl.

2.2 **Analytical Framework for the Adverse Modification Determination**

This BO does not rely on the regulatory definition of "destruction or adverse modification" of CH at 50 CFR 402.02. Instead, we have relied upon the statutory provisions of the ESA to complete the following analysis with respect to CH.

The following analysis relies on four components to support the adverse modification determination: (1) the *Status of CH*, which evaluates the range-wide and provincial condition of designated CH for the spotted owl in terms of primary constituent elements (PCEs), the factors responsible for that condition, and the intended recovery function of the CH overall, as well as the intended recovery function of CH outside the action area at the provincial and unit scales; (2) the *Environmental Baseline*, which evaluates the condition of the CH in the action area, the factors responsible for that condition, and the recovery role of the CH 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 CH 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 CH 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 CH are evaluated with the aggregate effects of everything that has led to the current status of the CH range-wide and, for non-federal activities in the action area, those actions likely to affect the CH in the future, to determine if, given those aggregate effects, the CH 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 the intended recovery role for the species 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 CH and the role of the action area relative to those intended functions as the context for evaluating the effects of the proposed Federal action with other relevant effects. In short, a non-adverse modification determination is warranted if the proposed action is consistent with maintaining the intended recovery role of spotted owl CH in the action area. The adverse modification determination is made at the provincial scale of the spotted owl CH.

3.0 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, lambda (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.

Two recent meta-analyses of spotted owl demographic data modeled rates of spotted owl population change for up to 24 years (Appendix B). 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. The HJ Andrews study area is the closest to the Willamette Planning Province action area.

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 (Forsman et al. 2011), 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 (1989 - 2008). 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 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.

3.1 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. However, the recent best available information strongly indicates barred owls may be the most pressing threat.

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 (USFWS 2011).

3.2 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.

3.3 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. 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 (USFWS 2011, p. III-1). In this way, analysis of proposed project effects at the recovery unit scale helps inform the range-wide jeopardy analysis/determination at the range-wide scale for the listed species. The proposed Project is within the western Oregon Cascades Province.

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 (USFWS 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 (USFWS 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* (USFWS 2011).

4.0 STATUS OF THE SPOTTED OWL CRITICAL HABITAT

When designating CH, 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; USFWS 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" (USFWS 2012a, p. 71897). The final rule for spotted owl CH 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" (USFWS 2012a, p. 71897). The final

rule provides an in-depth discussion of the PBFs; that discussion is herein incorporated by reference (USFWS 2012a, pp. 71897-71906).

The primary constituent elements (PCEs) of spotted owl CH 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 (USFWS 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 (USFWS 2012a, p. 71904). Within the areas considered essential for the conservation of the spotted owl, the USFWS (2012a, pp. 72051-72052) has defined the PCEs of spotted owl CH 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 CH 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 CH and a detailed discussion of the range-wide status of that CH.

Additional details on the range-wide status of the spotted owl CH are provided in Appendix B.

5.0 **ENVIRONMENTAL BASELINE**

5.1 **Spotted Owl**

There are four spotted owl home ranges affected by the proposed action (Table 3 and 4). No surveys for spotted owl occupancy have been completed since the early 1990s for the spotted owls affected by this project. Mt. Hood NF and the Service is giving the benefit of the doubt to the species and considering the action area occupied for the effects analysis.

There was a reduction of 1214 acres within these home ranges from the Government Flats fire.

Mt. Hood NF spotted owl baseline status information is in Table 5.

Table 3. Effects of the Government Flats Fire on suitable habitat to spotted owl sites.

Owl Pair	Suitable Habitat Acres in Home Range Before Fire	% Suitable in Home Range Before Fire	Suitable Habitat in Home Range Post Fire	% Suitable in Home Range Post Fire	Suitable Habitat in Home Range Post **Harvest**	% Suitable in Home Range Post **Harvest**	Suitable Habitat Acres in Core Before Fire	% Suitable in Core Before Fire	Suitable Habitat in Core Post Fire	% Suitable in Core Post Fire	Suitable Habitat in Core Post **Harvest**	% Suitable in Core Post **Harvest**
1031T96	623	22	495	17	495	17	111	22	111	22	111	22
6030P95	474	16	218	8	203	7	100	20	83	17	83	17
6038P90	856	30	331	11	331	11	304	61	30	6	30	6
6101P90	472	16	167	6	167	6	146	29	81	16	81	16

Table 4. Suitable habitat impacts from the proposed project within spotted owl sites.

Owl Pair	Suitable Habitat Acres in Home Range Post Fire	Acres of Suitable habitat removed in home range	Suitable Habitat Acres in Home Range Post Project	Percent of Suitable habitat in Home Range Post Harvest	Suitable Habitat in Core Post Fire	Acres of Suitable habitat removed in Core	Suitable Habitat Acres in Core Post Project	Percent of Suitable Habitat in Core Post Harvest
1031T96	Spotted owl affected by fire but no units in the Home Range							
6030P95	218	15	203	7	83	0	83	17
6038P90	331	0	331	11	30	0	30	6
6101P90	167	0	167	6	81	0	81	16

Figure 1. Landscape view of suitable and dispersal only habitat surrounding the Government Flats Fire area and the proposed project. Proposed project units are the historic boundaries. They have been adjusted to avoid impacts to owl nests and 100 acre LSRs.

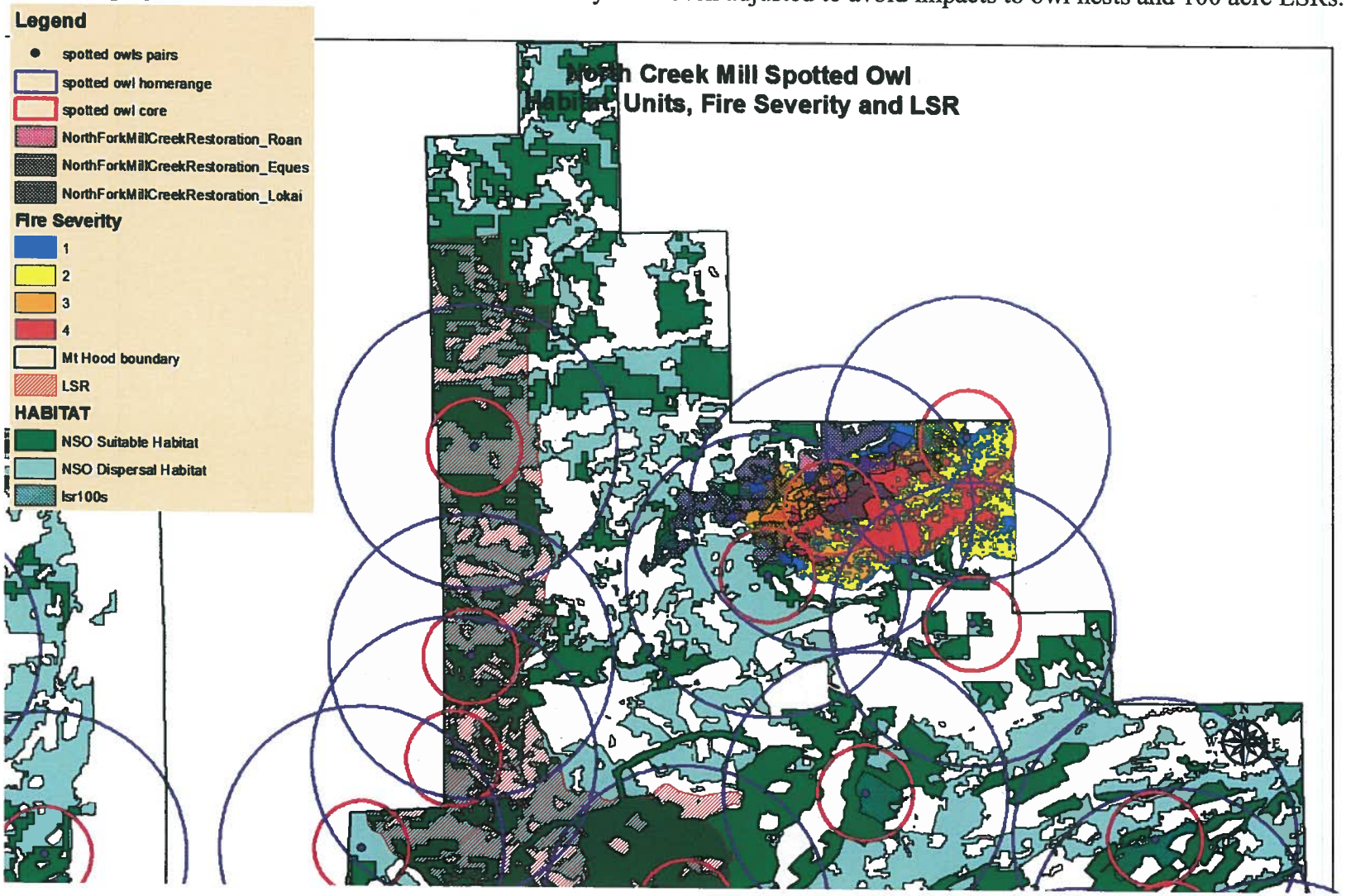

Table 5. Status of the spotted owl and its habitat on the Mt Hood National Forest.

MT HOOD NATIONAL FOREST	Total Acres	Protected[1]		Unprotected[2]		Non Forest Service land within administrative unit boundary	
		Total Acres	% of Total	Total Acres	% of Total	Total Acres	% of Total
Acres within Boundary[3]	1,067,017	500,685	47%	566,332	53%	46,662	4%
Acres of Ownership[4]	1,020,355	500,685	49%	519,670	51%		
Suitable Habitat – Capable Acres[5]	272,694	87,262	32%	185,432	68%		
Suitable Habitat – Current Acres[6]	399,905	227,946	57%	171,959	43%		

Spotted Owl Sites	Number of Sites	Protected Sites	Protected % of Total	Unprotected Sites	Unprotected % of Total
Spotted Owl Sites[7]	279	216	77%	63	23%
Spotted Owl Sites with > 40% suitable habitat in the provincial home range	206	160	78%	46	22%

[1] Acres in this column are comprised of: Late Successional Reserves (LSR) and associated Riparian Reserves, 100-acre LSRs, Congressionally Withdrawn Areas.

[2] Acres in this column are comprised of: Matrix, Adaptive Management Areas, and Administratively Withdrawn Areas including associated Riparian Reserves. Administratively Withdrawn Areas are included in the unprotected column because technically these areas are not designed to provide spotted owl habitat but rather to serve some other function such as "recreation and visual areas, back country, and other areas where management emphasis precludes scheduled timber harvest" (USDA, and USDI 1994a, p. A-4). The administrative land and resource management plan may protect and/or reduce the likelihood that spotted owl habitat located within Administratively Withdrawn Areas would be modified.

[3] Acres include both private and federal lands within administrative boundaries (in this row only). Acres are derived from corporate GIS data. **Unprotected column includes all non-NF acres.**

[4] Does not include approximately 3,042 acres (total) of Mt Hood NF land managed by the Willamette NF (for this and subsequent ROWs).

[5] Federal land that is capable of producing suitable spotted owl habitat, regardless of its current habitat.

[6] Suitable habitat is defined as nesting, roosting, foraging habitat.

[7] Spotted owl sites represent pairs or resident singles 1990-2011. Location of site center is shown either in protected or unprotected Land Use Allocations.

Data has been updated to reflect changes due to the Government Camp Fire, past harvest, land exchanges, GIS updates or new locations of spotted owl sites.

5.2 **Spotted Owl Critical Habitat**

The entire proposed project falls within critical habitat. The action area is contributing to four territories (Table 6).

Table 6. Effects of the Government Flats Fire on critical habitat supporting spotted owl territories associated with the action area.

Owl Pair	Suitable Habitat Acres in Home Range Before Fire	% Suitable in Home Range Before Fire	Suitable Habitat in Home Range Post Fire	% Suitable in Home Range Post Fire	Suitable Habitat in Home Range Post **Harvest**	% Suitable in Home Range Post **Harvest**	Suitable Habitat Acres in Core Before Fire	% Suitable in Core Before Fire	Suitable Habitat in Core Post Fire	% Suitable in Core Post Fire	Suitable Habitat in Core Post **Harvest**	% Suitable in Core Post **Harvest**
1031T96	623	22	495	17	495	17	111	22	111	22	111	22
6030P95	474	16	218	8	203	7	100	20	83	17	83	17
6038P90	856	30	331	11	331	11	304	61	30	6	30	6
6101P90	472	16	167	6	167	6	146	29	81	16	81	16

The entire proposed project falls within unit 7: East Cascades North (ECN), subunit 7. ECN and includes a total of 1,345,523 acres in 9 subunits. ECN-7 subunit consists of approximately 139,983 ac in Hood River and Wasco Counties, Oregon, and is comprised of only Federal lands managed by the U.S. Forest Service under the NWFP (USDA and USDI 1994). Special management considerations or protections are required in this subunit to address threats from current and past timber harvest, removal or modification of habitat by forest fires and the effects on vegetation from fire exclusion, and competition with barred owls. This subunit is expected to function primarily for demographic support to the overall population, as well as north-south and east-west connectivity between subunits and other CH units.

An evaluation of sites known to be occupied at the time of listing indicates that nearly 100 percent of the area of ECN-7 was covered by verified spotted owl home ranges. When combined with likely occupancy of suitable habitat and occupancy by non-territorial owls and dispersing subadults, we consider this subunit to have been largely occupied at the time of listing. In addition, there may be some smaller areas of younger forest within the habitat mosaic of this subunit that were unoccupied at the time of listing.

The CH Rule determined that all of the unoccupied and likely occupied areas in this subunit are essential for the conservation of the species to meet the recovery criterion that calls for the continued maintenance and recruitment of spotted owl habitat (USFWS 2011). The increase and enhancement of spotted owl habitat is necessary to provide for viable populations of spotted owls over the long term by providing for population growth, successful dispersal, and buffering from competition with the barred owl.

6.0 **EFFECTS OF THE ACTION**

Effects of the action refer to the permanent or temporary direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated and interdependent with that action that will be added to the environmental baseline. Indirect effects are those that are caused by the proposed action, occur later in time, but are still reasonably certain to occur.

7.0 EFFECTS TO SPECIES

7.1 Spotted Owl

7.1.1 *Disturbance Effects*

The Service has concluded that noise, smoke and human presence in the canopy can result in a significant disruption of breeding, feeding, or sheltering behavior of the spotted owl such that it creates the potential for injury to the individuals. For a significant disruption of spotted owl behavior to occur as a result of disturbance caused by a proposed action, the disturbance and the spotted owl(s) must be in close proximity to one another (see Table 9, USFWS 2005). Human presence on the ground is not expected to cause a significant disruption of behavior because spotted owls do not seem to be startled by those situations (USFWS 2005).

Spotted owl reactions to smoke and close human presence in the canopy, and excessive noise levels at or in the immediate vicinity of spotted owls are expected to include the following: flushing from the nest site, which would leave eggs or young exposed to predation; causing a juvenile to prematurely fledge, which would increase the young's risk of predation; interrupting foraging activities, which would result in the reduced fitness or even mortality of an individual; or disrupting roosting activities which would cause a spotted owl to relocate. A spotted owl that may be disturbed at a roost site is presumably capable of moving away from disturbance without a significant disruption of its behavior. Spotted owls forage primarily at night. Therefore, projects that occur during the day are not likely to disrupt its foraging behavior; the potential for effects is mainly associated with breeding behavior at an active nest site.

In the late breeding period, potential effects from disturbance decline because juvenile spotted owls are increasingly more capable of moving as the nesting season progresses. Once capable of sustained flight, young owls are presumably able to distance themselves from disturbance and minimize their risk of predation. To ensure that more than 86 percent of juvenile spotted owls in the Willamette Planning Province are able to move away from disturbances without increasing their risk of predation or harm, the critical nesting period is considered to be March 1 through July 15. This is based on fledge data (Turner 1999) and includes an additional two weeks to allow for development of flight skills. After July 15, it is estimated that most fledgling spotted owls are capable of sustained flight and can move away from most harmful disturbances.

However, excessive noise from blasting and rotor wash produced by helicopter use, which could cause a chick to fall off a nest branch, are disruption sources that may still have adverse effects to spotted owls in the late nesting season (Table 8). Thus, these activities would require fledglings to move greater distances and potentially increase their risk of predation or harm. Therefore, these disturbance types may still adversely affect spotted owls during the entire nesting breeding period (March 1 – September 30) (Table 9).

Log-hauling on open roads is not expected to have adverse effects during anytime of the year, since spotted owls rarely nest at or immediately adjacent to a road or edge (Kerns and Allwardt 1992, Perkins 2000). Additionally open roads have a baseline of disturbance from the public and

other private timber operators, further minimizing the impact from disrupt noise from hauling trucks.

The sound from project activities would not adversely affect the breeding behavior of spotted owls during their critical breeding period because no heavy equipment, chainsaw use, or helicopter use would occur within the 35 to 120 yard disruption distances. Some activities would take place during the critical nesting season between March 1 and July 15, but these activities would be beyond the disruption distance of an actively nesting spotted owl pair or beyond the disruption distance from the nest patch. Since the proposed project avoids disruption of spotted owl nest or nest patches when nest site is not currently known, the proposed projects may cause disturbance, but adverse effects from disruption will be avoided.

7.1.2 *Habitat Effects*

The decline of the spotted owl throughout its range is linked to several factors including the removal and degradation of suitable habitat (USFWS 2001, Courtney et al. 2004). Specific vegetational and structural components are associated with spotted owl suitable habitat (USFWS 2001, Courtney et al. 2004). The removal of any of those components can cause adverse effects to affected spotted owls by:

- Displacing spotted owls from nesting, roosting, or foraging areas;
- Concentrating displaced spotted owls into smaller, fragmented patches of suitable habitat that may already be occupied;
- Increasing intra-specific competition with barred owls for suitable nest sites;
- Decreasing survival of displaced spotted owls and their offspring by increasing their exposure to predators and/or limiting the availability of food resources;
- Diminishing the future reproductive productivity of displaced nesting pairs that may forgo nesting temporarily following their displacement; and
- Diminishing spotted owl population size due to declines in productivity and recruitment.

The effects of habitat modification activities and the duration of those effects on spotted owls depend upon the type of silvicultural prescriptions used and the location of the harvest relative to suitable habitat. The impacts of timber harvest may include the removal or downgrading of suitable habitat and/or altering of suitable habitat by the creation of exposed habitat edges. Harvest prescriptions that remove spotted owl suitable habitat and that result in even-aged, monotypic forest stands that would not be suitable for nesting, roosting, or foraging, are likely to adversely affect spotted owls by reducing the available amount of suitable habitat. Silvicultural prescriptions that promote multi-aged and multi-storied stands may retain the suitability of habitat within affected stands for spotted owls and may increase the quality of that habitat over time (USFWS 2007).

Silvicultural-thinning of a second growth Douglas-fir stand within proximity to spotted owl nesting areas may result in adverse impacts to affected spotted owls. Meiman et al. (2003) reported changes in spotted owl use following a commercial thinning in stands near nest core areas in the Clatsop State Forest in Oregon. Although the sample sizes were not large, proportional use of the thinned areas by spotted owls was significantly less during and after harvest operations than during the pre-harvest period. The cause of the reduced spotted owl use

of the affected areas is not clear, but the commercial thinning may have reduced prey availability or altered microclimate conditions, or created more open habitat in the affected stands that spotted owls naturally tend to avoid because they are more exposed to predators. Meiman et al. (2003) also reported home range expansion of one spotted owl, and a shift of the core use area away from a thinned stand. This response by the spotted owl suggests that commercial thinning within spotted owl activity centers may have adverse impacts on affected spotted owls by excluding their use of previously used areas within their home range. The duration of those adverse effects depends upon the time it takes for the vegetational and structural components of spotted owl suitable habitat to be re-established. Other types of forest thinning, such as variable density thinning, may not have the same effects on spotted owls. As noted above, silvicultural prescriptions that promote multi-aged and multi-storied stands may retain the suitability of habitat within affected stands for spotted owls and may increase the quality of that habitat over time (USFWS 2007).

7.1.3 *Restoration Thin*
The suitable habitat removed, 15 acres, is located in the home range of 6030P95. This habitat would be impacted by reducing the canopy cover from approximately 70 percent to less than 40 percent and the loss of some down wood, shrubs and snags, which provide habitat for prey species. These units would no longer function as suitable and dispersal habitat after treatments.

The loss of suitable habitat may adversely affect spotted owls using site 6030P65, as the habitat being removed contributes to the area of the home range. However, this site does not have current surveys and the percent of suitable habitat is down to eight percent post fire. Even before the proposed action, the Service is not reasonably certain spotted owls are still present, but is giving the benefit of the doubt to the species and considering the action area occupied for the effects analysis.

Restoration thin in dispersal only habitat will eliminate dispersal habitat on 70 acres. These units would no longer function as dispersal habitat after treatments. The reduction of dispersal only habitat, plus the above suitable habitat acres will decrease the amount of habitat available to support dispersing spotted owls. Dispersal of spotted owls will still be supported by the remaining suitable and dispersal only habitat to the south, west, and north-west of the units (Figure 1).

Mt hood NF estimated that these units would again provide dispersal habitat approximately 20 years after harvest, and it would be approximately 60 years before the habitat will function as foraging habitat (a subset of suitable habitat).

7.1.4 *Hazard Tree Removal*
No habitat will be impacted from hazard tree removal.

7.1.5 *Reforestation*
No habitat will be impacted from reforestation.

7.1.6 *Road Construction*
Less than one mile of re-construction will occur on existing temporary roads in suitable habitat. Only young trees and shrubs will be removed within suitable habitat. As this is a limited temporary road and no nest trees will be removed, road re-construction will not significantly impact the ability of the stand to function to support spotted owls.

7.2 **Spotted Owl Designated Critical Habitat**

Designation of critical habitat serves to identify those lands that are essential for the survival and recovery of the listed species. Spotted owl critical habitat currently includes approximately 9,577,969 acres in 11 units and 60 subunits in California, Oregon, and Washington. The Service's primary objective in designating critical habitat was to identify capable and existing spotted owl habitat and highlight specific areas where management of the spotted owl and its habitat should be given highest priority. This objective will likely require habitat conservation in concert with the implementation of recovery actions identified by the Northern Spotted Owl Revised Recovery Plan (USFWS 2012a, p 71879) that address other, non-habitat-based threats to the species, including the barred owl.

The PCEs are described in the proposed rule as the specific elements that comprise the PBFs needed for the conservation of the spotted owl. The PBFs are the forested areas that are used or likely to be used by the spotted owl for nesting, roosting, foraging, or dispersing (USFWS 2012a, p. 14082). The PCEs are the specific characteristics that make habitat areas suitable for nesting, roosting, foraging, and dispersal (USFWS 2012a, pp. 14092-14093, 14148-49). The PCEs include: 1) Forest types in early-, mid-, or late-seral stages and that support the spotted owl across its geographic range; and habitat that provides for 2) nesting and roosting, 3) foraging, and 4) transience and colonization phases of dispersal.

Eight special management considerations or protections were identified for CH Unit 7: East Cascades North in the Final Critical Habitat Rule:

1. Conserve older stands that contain the conditions to support spotted owl occupancy or high-value spotted owl habitat as described in Recovery Actions 10 and 32 (USFWS 2011, pp. III-43, III-67). On Federal lands this recommendation applies to all land-use allocations (see also Thomas et al. 2006, pp. 284–285).
2. Emphasize vegetation management treatments outside of spotted owl territories or highly suitable habitat;
3. Design and implement restoration treatments at the landscape level;
4. Retain and restore key structural components, including large and old trees, large snags, and downed logs;
5. Retain and restore heterogeneity within stands;
6. Retain and restore heterogeneity among stands;
7. Manage roads to address fire risk; and
8. Consider vegetation management objectives when managing wildfires, where appropriate.

7.2.1 *Restoration Thin*
The suitable habitat removed, 15 acres, is located in the territory 6030P95. This habitat would be impacted by reducing the canopy cover from approximately 70 percent to less than 40 percent and the loss of some down wood, shrubs and snags, which provide habitat for prey species. These units would no longer function as suitable and dispersal habitat after treatments. Mt hood NF estimated that these units would again provide dispersal habitat approximately 20 years after harvest, and approximately 60 years before the habitat will function as foraging habitat (a subset of suitable habitat). This impact will reduce the ability of the remaining suitable habitat acres to support a territory. Specifically, the reduction of suitable habitat may adversely affect the 6030P65 territory to support spotted owls. Though over time, the forests will grow and occupancy is not precluded.

Restoration thin in dispersal only habitat will eliminate dispersal habitat on 70 acres. These units would no longer function as dispersal habitat after treatments. The reduction of dispersal only habitat, plus the above suitable habitat acres will decrease the amount of habitat available to support dispersing spotted owls. Dispersal of spotted owls will still be supported by the remaining suitable and dispersal only habitat to the south, west, and north-west of the units (Figure 1). Therefore, the action area is still supporting north-south connectivity with lands north and south of the units and east-west connectivity with lands to the west. To the east are non-federal lands that are not part of the critical habitat system.

Restoration thin to 146 acres of non-habitat will lengthen the time needed for these acres to develop spotted owl habitat.

The Mt. hood NF estimated that these units would again provide dispersal habitat approximately 20 years after harvest, and approximately 60 years before the habitat will function as foraging habitat (a subset of suitable habitat).

7.2.2 *Hazard Tree Removal*
Hazard tree removal will occur on 134 acres of non-habitat and will lengthen the time needed for these acres to develop spotted owl habitat.

7.2.3 *Reforestation*
Reforestation will occur on 622 acres of non-habitat and will shorten the time needed for this stand to develop spotted owl habitat.

7.2.4 *Road Construction*
Less than one mile of re-construction will occur on existing temporary roads in suitable habitat. Only young trees and shrubs will be removed within suitable habitat. As this is a limited temporary road and no nest trees will be removed, road re-construction will not significantly impact the ability of the stand to provide for spotted owls.

7.3 Combined Effects Relative to the Northwest Forest Plan

7.3.1 *Reserve Land Use Allocations*
No restoration thinning or hazard tree removal will occur within LSRs, Congressionally Reserved Areas, nor Adaptive Management LSRs. Reforestation will occur within 100 acres LSRs. As reforestation is it add in the recovery of the units after the fire, the proposed project will not reduce the intended conservation role of reserve Land Use Allocations (LUAs) at the local or larger scales.

7.3.2 *Connectivity between Reserve Land Use Allocations*
Under the NWFP, it is expected that protected LUAs outside of LSRs, Congressionally Reserved Areas and Adaptive Management LSRs will provide adequate habitat to facilitate spotted owl movement and survival between protected LUAs (USDA and USDI 1994a). The Mt. Hood NF analyzed the impacted habitat and determined that dispersal of spotted owls was still supported by the remaining habitat. Therefore, the Service concurs that the proposed actions will not reduce connectivity between reserve land use allocations for spotted owls within the Mt. Hood NF or rangewide.

7.4 Combined Effects Relative to the Recovery Plan for the Northern Spotted Owl

The proposed project is consistent with the current Recovery Plan for northern spotted owl. In particular it conforms to the following Recovery Actions:

Recovery Action 10: Conserve spotted owl sites and high value spotted owl habitat to provide additional demographic support to the spotted owl population (USFWS 2011, page III-43). Though the proposed project was designed to minimize impacts to spotted owls, forest management activities are likely to diminish a home range's capability to support spotted owl occupancy, survival and reproduction, that conflicts with Recovery Action 10.

The one territory that will be impacted to an extent that will adversely affect the habitat's ability to support the territory is prioritized low for conservation, due to the lack of suitable habitat that is supporting the territory post-fire (8 percent in the home range and 17 percent in the core). Treatments occurring are not designed to have spotted owl benefits, but suitable habitat treatments are limited to 15 acres and will not occur within the core area.

Recovery Action 12: In lands where management is focused on development of spotted owl habitat, post-fire silvicultural activities should concentrate on conserving and restoring habitat elements that take a long time to develop (e.g., large trees, medium and large snags, downed wood).

Treatments occurring are not designed to have spotted owl benefits, but suitable habitat treatments are limited to 15 acres and will not occur within the core area.

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 (USFWS 2011, page III-67). No treatment will occur within recovery action 32 stands.

7.5 Combined Effects to the Spotted Owl Population

The effects discussed above are considered insignificant or discountable to the spotted owl population for the following reasons:

1. The areas affected by the proposed action will still be able to meet the conservation needs of the spotted owl because the quantity of suitable spotted owl habitat will be reduced by only 15 acres in a territory that is already at extremely low levels. It is our opinion that these low levels of suitable habitat within this territory make it unlikely that this is a functioning territory and is not contributing from reproduction to the viability of the spotted owl population;

2. The removal of 70 acres of dispersal only spotted owl habitat will not limit the ability for spotted owls to disperse on the landscape;

3. The affected areas are a relatively very small portion of large blocks of spotted owl suitable habitat within the Mt Hood NF (15 acres impacted are less than 0.001 percent of Mt Hood NF suitable habitat lands: 399,905 acres);

4. Potential effects from disturbance to reproductive success is related to the proximity to a spotted owl pair's nest site, located within an estimated 2,955 acre home range, and the reproduction status of the pair, which has been shown to be variable from year to year. Therefore, given that the spotted owl has a large home range, that spotted owl pairs do not nest every year, and known activity centers/nest sites and potential spotted owl nest patches will be avoided, the likelihood of affecting reproduction at an unknown site is small; and

5. Potential effects from diurnal disturbance to foraging are minimal because spotted owls are primarily nocturnal.

7.6 Combined Effects to Critical habitat

Critical habitat PCEs will be impacted, with 387 acres (302 non-habitat, 70 acres dispersal habitat, and 15 acres suitable habitat) being set back in their development of complex suitable spotted owl habitat, but due to the location of the impacts within spotted owl territories with low levels of suitable habitat pretreatment, these impacts are not expected to reduce the potential of critical habitat to support spotted owl territories.

As discussed above, the action area has eight special considerations for impacts to critical habitat. As the purposes of this project are to meet the existing contractual and economic obligations within the existing Roan and Eques stewardship sales, the eight special considerations for critical habitat were not the main goal for the proposed project.

The following is how this proposed project is or is not consistent with these considerations:

(1) None of the stands being impacted are Recovery Action 32 stands. One territory will be impacted to an extent that will adversely affect the habitat's ability to support the territory (Recovery Action 10). The condition of this territory is very low, due to the lack of suitable habitat that is supporting the territory post-fire (8 percent in the home range and 17 percent in the core). Treatments occurring are not designed to have spotted owl benefits, but treatments in suitable habitat are limited to 15 acres and will not occur within the core area.

(2) Nest patches have been avoided and suitable habitat removal has been minimized to 15 acres.

(3) Although the proposed project is at a large scale, reducing impacts to spotted owls was taken into account in the planning of the project.

(4) Health and vigor of forested stands was an objective and the proposed project does include retaining a substantial amount of fire killed trees for wildlife habitat.

(5) The proposed project was not designed to restore heterogeneity within the stands.

(6) The fire introduced a large amount of heterogeneity among stands. The proposed treatments are not expected to significantly change the overall heterogeneity for the area.

(7) Areas along roads will have snags removed reducing the fire risk associated with roads.

(8) The proposed project did take into account retaining a substantial amount of fire killed trees to produce a vegetation management objective of snags at a volume that would provide for wildlife habitat.

8.0 **Cumulative Effects**

Cumulative effects are those effects of future State or private activities (not involving Federal activities) that are reasonably certain to occur within the action area of the Federal action subject to consultation (50 CFR 402.02 Definitions). A Memorandum to the Director of Fish and Wildlife Service, August 27, 1982, Cumulative Effects to be Considered Under Section 7 of the Endangered Species Act set forth the legal requirements for consideration by federal agencies of the cumulative effects. "A non-federal action is reasonably certain to occur if the action requires approval of a state or local resource or land use control agency and such agencies have approved the action, and the project is ready to proceed...these indicators must show more than the possibility that the non-federal project will occur; they must demonstrate with reasonable certainty that it will occur."

Although the Service is lacking information on spotted owls or spotted owl habitat for non-federal lands within the action area, non-federal lands within the Mt. Hood NF boundaries usually only support marginal habitats, and do not notably contribute to the viability of the spotted owl. These lands, however, support some dispersal habitat for spotted owls and may

contribute to the reproduction, health, and condition of spotted owls on adjacent Federal land. Habitat conditions on these lands are not expected to improve significantly within the foreseeable future and, as a result, are not expected to contribute to the survival and recovery of the spotted owl.

Cumulative effects to spotted owls are an ongoing concern and will likely continue in the future within the action area. To date, the Oregon Forest Practice Rules have not adopted regulations that provide adequate protection to spotted owl sites or a mechanism to identify sites on the landscape (e.g. surveys in suitable habitat). The rules require protection of a 70-acre core area around active nest sites only, and do not provide any protection or conservation of other surrounding habitat. For a species that requires up to several thousand acres of habitat to persist, these rules allow for the progressive elimination of active spotted owl sites. Removal of large amounts of habitat around 70-acre cores will eventually render the core nest areas non-functional and displacement of spotted owls is the likely outcome.

The Service is unaware of any proposed actions on non-Federal land within the action area.

9.0 **CONCLUSION**

After reviewing the current status of the spotted owl, the environmental baseline for the action area, the effects of the proposed action on the spotted owl and it's CH, and the cumulative effects, it is the Service's biological opinion that the activities, as proposed, are not likely to jeopardize the continued existence of the spotted owl and are not likely to adversely modify spotted owl CH.

The Service reached these conclusions because the proposed action is not likely to appreciably diminish the effectiveness of the conservation program established under the Recovery Plan for the Spotted Owl, the NWFP, or CH to protect the spotted owl and its habitat on Federal lands including designated spotted owl CH. Additionally, no known cumulative impacts changed the determinations made under the effects of the proposed action, as adjacent non-federal lands provide little contribution to spotted owl conservation.

The Service reached these conclusions for the following reasons:

1. The conservation needs of the spotted owl will continue to be met at the subunit, unit, provincial and range-wide scale because the proposed action will conform to the guidance of the Recovery Plan for the Spotted Owl as currently interpreted.

2. The proposed project will not appreciably reduce the likelihood of survival or recovery for the spotted owl population, because dispersal of spotted owls will still be supported post treatment and that the one territory adversely impacted from 15 acres of suitable habitat being thinned is a territory that is not likely to be providing demographic support to the overall population due to the extremely low levels of suitable habitat remaining in the spotted owl site's home range and core after the Government Flats Fire.

3. The conservation value of spotted owl CH will not significantly be reduced at the subunit, unit, and range-wide scale because the proposed action will not significantly reduce the function of spotted owl CH, which also provides for large blocks of breeding habitat throughout the range of the spotted owl. After evaluating effects to PCEs, including eight special considerations, the Service believes the proposed action will not significantly impair the conservation function of critical habitat to support both the survival and recovery of the species. Therefore, the Service believes this project will not appreciably diminish the value of CH for both the survival or recovery of the spotted owl.

INCIDENTAL TAKE STATEMENT

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

The measures described below are non-discretionary, and must be undertaken by Mt. Hood NF so that they become binding conditions of any grant or permit issued to any applicant, as appropriate, for the exemption in section 7(o)(2) to apply. The Mt. Hood NF has a continuing duty to regulate the activities covered by this Incidental Take Statement. If the Mt. Hood NF (1) fails to assume and implement the terms and conditions or (2) fails to require cooperators to adhere to the terms and conditions of the Incidental Take Statement through enforceable terms that are added to the permit or grant document, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, the Mt. Hood NF must report the progress of the action and its impact on the species to the Service as specified in this Incidental Take Statement. [50 CFR §402.14(i)(3)]

10.0 AMOUNT OR EXTENT OF TAKE

The estimation of the number of spotted owls affected by this project relies on survey data from the early 1990s before additional habitat loss due to the Government Flats Fire in 2013. Due to the low amounts of suitable habitat left in the territories and that there is no current survey data, the Service is not reasonably certain spotted owls would still be using effected territories.

Therefore, the Service does not anticipate the proposed action will incidentally take any listed species. Although the "Effects of the Action" section above includes a finding that implementation of the proposed action has the potential to cause biological effects to the spotted owls that conform to the regulatory definition of take, the mere potential for take is not a legitimate basis for a take exemption. If take is detected during implementation of the proposed action, reinitiation of formal consultation should be requested, and any operations causing such take must cease pending the outcome of the reinitiated consultation.

11.0 **REASONABLE AND PRUDENT MEASURES**

The Service worked closely with the Mt. Hood NF to develop the proposed action; adequately reducing risks to spotted owls. Therefore, the only reasonable and prudent measure is to monitor the proposed project to ensure actual levels of effects do not exceeded effects consulted on.

12.0 **TERMS AND CONDITIONS**

Mt. Hood NF shall:

1) Monitor project implementation to ensure that actual levels of effects do not exceed the effects anticipated by this BO.

2) Complete a project implementation and monitoring form to show actual levels of effect at the end of each calendar year. This form shall be forwarded to the Service by the Mt. Hood NF to fulfill the monitoring report requirements. Monitoring completes the regulatory requirements of the ESA by documenting the actual effects to the subject species.

13.0 CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs Federal agencies to use their authorities to further the purposes of the Act by implementing conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities designed to minimize or avoid adverse effects of a proposed action on listed species or designated CH, to assist in the implementation of recovery plans, or to obtain information.

The Service believes the following conservation recommendation will reduce the impact of the proposed action on nesting spotted owls within the action area:

1. Delay activities that may disturb spotted owls as late as possible into the nesting season.

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.

14.0 REINITIATION NOTICE

This concludes formal consultation and conferencing on the actions outlined in your BA. As provided in (50 CFR § 402.16), reinitiation of formal 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 incidental take is exceeded; (2) new information reveals effects of the agencies' action that may affect listed species or CH in a manner or to an extent not considered in this BO; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or CH that was not considered in this BO; or (4) a new species is listed or CH designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending re-initiation of formal consultation.

This concludes formal consultation on North Mill Creek. If further information is needed, please contact Bridgette Tuerler at (503) 231-6956, or Brendan White at (503) 231-6179.

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APPENDIX A: POTENTIAL SPOTTED OWL SITE CONSIDERATIONS

Scientific Basis for Analysis

The information in this appendix informs the analysis conducted by the Willamette Province Level 1 Team within this BO. Collectively, this information provides the contextual information used to develop the general analytical framework described within this document through a synthesis of the best available science.

Since the complete range-wide population surveys for the spotted owls 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. Effects are based on how habitat modification activities 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 (USDI BLM et al. 1994, Lehmkuhl and Raphael 1993, Raphael et al. 1996, Meyer et al. 1998, and Courtney et al. 2004).

The 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 (Thomas et al. 1990; Courtney et al. 2004). In addition, the basis for 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 consistent patterns of habitat association, and these patterns 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 on National Parks, public or private land. In 2011, the Revised Recovery Plan for the Northern Spotted Owl (USFWS 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)."

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 (Hunter et al. 1995, Meyer et al. 1998, Zabel et al. 2003, Weins et al. 2014) and the relationships of habitat to spotted owl fitness (Franklin et al. 2000, Olson et al. 2004, Dugger et al. 2005, Weins et al. 2014). Generally, guidance for management activities addressing territorial organisms is spatially explicit and such activities are applied to an area corresponding to the movements and activity patterns of the individuals occupying the territory or territories. Spotted owls are territorial predators that range widely in search of food but are 'anchored' during the breeding season to a nest site (Rosenberg and McKelvey 1999). That is, spotted owls are central-place foragers. Foraging close to the nest reduces travel time and energetic expenditures of adults and also increases the ability of the adults to remain nearby and protect their young. Several studies have shown that the selection of nest sites by spotted owls is related to the amount of older forest habitat at multiple spatial scales (Ripple et al. 1991, Ripple et al. 1997, Swindle et al. 1999, and Perkins 2000). Based on this research, evaluations of spotted owl use of an area appear to be most meaningful at two spatial scales: 1) the home range and 2) the core area. Habitat selection at a larger home range scale is likely dependent on habitat selection at the smaller core area (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 generally not able to conduct this type of study for specific projects. Therefore, for purposes of assessing a project's potential impacts to the spotted owl, circles centered on spotted owl nest sites or activity centers that approximate the median core areas and home range areas of spotted owls monitored in previous radio telemetry studies (see home range estimates in Thomas et al. 1990 and reaffirmed in Courtney et al. 2004) will be used unless more specific information is available.

These circles serve as proxies for the area where the amount and configuration of habitat has been shown to affect occupancy, survival, reproduction, and related fitness. Local data from the HJ Andrews demography study and other local information from the Willamette Province were used to determine home range and core area configurations to evaluate effects to spotted owls in this BO.

Resources such as food availability as well as breeding and resting sites can be distributed in patches on heterogeneous landscapes, such as those prevalent throughout the Northwest Forest Plan (NWFP) provinces. In such landscapes, animals are likely to disproportionately use areas that contain relatively higher 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 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) 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 (USFWS 2009 and USFWS 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.

The Willamette Planning Province Level 1 team uses circles as surrogates for approximating spotted owl home range and core 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 exactly overlap with actual areas used by spotted owls. The latter may be 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; 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 to provide a uniform method for quantifying (comparing/contrasting) spotted owl habitat (Thomas et al. 1990; Ripple et al. 1991; Lehmkuhl and Raphael 1993; Ripple et al. 1997; Swindle et al. 1999; Perkins 2000; Franklin et al. 2000; Olson et al. 2004; Dugger et al. 2005, and summary in Courtney et al. 2004). The use of circles also seems appropriate for species, like the spotted owl, characterized as a central place species.

The following estimates by NWFP Province help inform a spotted owl spatial analysis for Oregon: Coast Ranges Province = 4,524 acres or a circle with a 1.5-mile radius; West Cascades Province = 2,895 acres or a circle with a 1.2-mile radius; and the Klamath Province = 3,398 acres or a circle with a 1.3- mile radius. Within a home range, the smaller core-use area estimate of 500 acres or a circle with a 0.5 mile radius inform the spotted owl core-use area analysis for each of the aforementioned provinces (Thomas et al. 1990; USFWS 1992; Carey et al. 1992; Anthony and Wagner 1998; Irwin et al. 2000; Courtney et al. 2004; Glenn et al. 2004; USFWS 2011). In general for analysis purposes, 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. Where available, local information on home range and core use areas is used, recognizing that circles are rough proxies and their value is that the amount and configuration of habitat within those radii has been shown to affect occupancy, survival, reproduction, and related fitness.

Habitat Availability in Core Areas and Home Ranges

Core Area

The 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, Weins et al. 2014). Habitat-based fitness, or habitat fitness potential (HFP), is the "fitness conferred on an individual occupying a territory of certain habitat characteristics" (Franklin et al. 2000). HFP is a function of both the survival and reproduction of individuals within a given territory. For example, the datasets 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 2007, pp. 134-136), 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[2] 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.

Mean percent cover of old forest within spotted owl core areas in southwest Oregon and northwest California have varied widely among studies (about 35 to 60 percent) (Hunter et al. 1995; Ripple et al. 1997; Gutiérrez et al.. 1998; Meyer et al. 1998; Franklin et al. 2000; Dugger et al. 2005). 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.

Home Range

Bart (1995) evaluated the suggestion in the 1992 draft recovery plan for the spotted owl (USFWS 1992) 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 nesting, roosting and forage[3] habitat in the home range is 30 to 50 percent. In the Oregon Coast Ranges, Olson et al. (2004) found that spotted owl occupancy was positively correlated with the amount of mid and late-seral forest. 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 USFWS 2009) have been consistent with those of Bart (1995). Weins et al. (2014) found a positive relationship between the six month survival rate of spotted owls and the percent of older forest in the individual home range.

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. Spotted owl demographic performance,

[2] HFP greater than 1

[3] Nesting, roosting, forage habitat is called "suitable" habitat in this document.

particularly occupancy, increases with increasing amounts of suitable 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 30 percent or more older forest within the 500 acres surrounding the site[4] and that site occupancy decreased following the harvest of suitable habitat in the vicinity of the core area. In their northwest California study area, Zabel et al. (2003) found that the highest probability of spotted owl occupancy occurred when the core area was 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 included less than 40 to 60 percent nesting, roosting and forage habitat, they were more likely to have lower occupancy and fitness.

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 increases 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; Dugger et al. 2005).

[4] This predictive value decreased with increasing distance from the site.

Spotted Owl Habitat at Known and Potential Site Scales

This assessment uses the areas of home range, core area, and nest patch depicted in Table E-1 to determine effects of activities to known sites and to delineate and determine effects within potential sites.

As shown in Table 1, this assessment uses the established 1.2 mile radius home range (also referred to as provincial home range), 0.5 mile radius core area, and 300 meter nest patch distances appropriate within the Willamette Planning Province. Known sites are also referred to as "spotted owl sites" in this document. The described analytical process, including all effects determinations, was developed to assess the effects of proposed federal actions in the Willamette Planning Province evaluated in this document. This assessment is not intended to represent mandatory guidance or be applicable to other planning provinces or future biological assessments.

Table E-1. Size of home range, core area and estimated nest patch in the Willamette Planning Province

Province	Median Home Range Radius and Area	Mean Core Area Radius and Area	Estimated Nest Patch Radius and Area
Willamette Planning Province Oregon Cascades	**1.2 miles = 2,895 acres** *Thomas et al. 1990; Courtney et al. 2004; Wiens et al. 2014*	**0.5 mile = 500 acres** *Swindle et al. 1999; Irwin et al. 2000, 2005*	**300 meters = 70 acres** *Swindle et al. 1999; Perkins et al. 2000*
	40% = 1,158 acres	**50% = 250 acres**	**100% = 70 acres**

Home Range (1.2 mile radius or 2,895 acres)

The home range represents a minimum area for spotted owls to carry out all life history needs, particularly during the nesting season. Home range sizes of spotted owl pairs have been estimated on five study areas in Washington, Oregon and California since 1990 (Courtney et al. 2004, Table 5-1). Fourteen years after Thomas et al. (1990), Courtney et al. (2004: Chapter 9) concluded that, although subsequent spotted owl research refined these conservation needs, home range estimates remained similar and valid. This is supported by later researchers such as Wiens et al. (2014). The home range surrounds the nest patch and core area and, barring more site specific information (e.g., habitat type and orientation), was delineated using a 1.2 mile radius circle.

Core Area (0.5 mile radius or 503 acres)

The core area represents the area most heavily used during the nesting season for nesting, foraging and rearing young. Bingham & Noon (1997) defined the core area as that portion of a spotted owl home range that received disproportionately high use for nesting, roosting and access to prey. Although Courtney et al. (2004:5-5) observed that core area sizes varied greatly among spotted owls, Bingham & Noon (1997), Wagner & Anthony (1999), Franklin et al. (2000) and Irwin et al. (2000) collectively suggested a core area of about 500 acres. The core area surrounds a nest patch and is located in the best available habitat that is likely to support concentrated use for nesting, roosting and rearing of young during the nesting season. Barring more site specific information (e.g., habitat type and orientation), this area was delineated using a 0.5 mile radius circle.

Nest Patch (300 meters or 70 acres)

The nest patch represents an area where a spotted owl would be likely to select a nest tree or trees. This is based on habitat usage of spotted owls within the Central Cascades Study Area, located on the Willamette National Forest. Nest patch size has been shown to be an important attribute for site selection by spotted owls. More specifically, models developed by Swindle et al. (1997) and Perkins (2000) showed that the 200-300 meter radius (sometimes greater) encompassing approximately 75 acres around a Nest Patch is important to spotted owls. Having as much of the 300 meter radius in suitable habitat was critical to nest position on the landscape. Miller (1989) found that, on average, the extent of forested area used by juvenile spotted owls prior to dispersal averaged approximately 70 acres.

Meyer et al. (1998) found that old-growth patch size (i.e., larger patches) was strongly related to spotted owl site selection in Oregon. In reviewing the results of Table 5-2 (Courtney et al. 2004), it appears that spotted owls select nest sites on the landscape to maximize the amount of older forest habitat near the nest (USFWS, 2005).

Known site centers and corresponding nest patches are based on nest trees or pair activity centers. Potential site centers and nest patches are located in the best available habitat likely to facilitate spotted owl nesting by providing suitable nest trees and forage habitat for rearing of young immediately after leaving the nest tree. Potential site center locations considered the typical nearest neighbor distance (see Table 2) to nearby known and potential sites, and avoidance of barred owl "core use areas," when this information was available. Barring more site specific information, (e.g., habitat type and orientation), this area was delineated using a 300 meter radius circle.

Potential Site (1.2 miles or 2,895 acres

This assessment uses the term "potential sites" to describe areas equivalent to the home range for known sites that support breeding spotted owls based on habitat conditions, but where surveys are nonexistent, outdated or otherwise insufficient to establish known sites. Potential sites are an analytical concept to address "potential spotted owl sites" and, when applicable, "unsurveyed habitat" used in the Revised Recovery Plan for the Northern Spotted Owl (U.S. Fish and Wildlife Service, 2011; "Recovery Plan"). The Recovery Plan excerpts below reflect an approach to define and manage for potentially occupied areas outside of known sites as part of the spotted owl recovery strategy.

> "In unsurveyed spotted owl habitat, the agencies and the Service should work cooperatively through the Endangered Species Act consultation process to minimize impacts to potential spotted owl sites" (p. III-45);
>
> "There is a wide breadth of spotted owl occupancy data throughout the species' range. Where spotted owl occupancy data are unavailable (e.g., unsurveyed habitat), land managers have a variety of tools to assist in determining where likely occupied habitat is and how to implement this recovery action, including assumption of occupancy (a common practice during section 7 consultation), surveys, spotted owl modeling results, forest stand data, etc." (p. III-46);
>
> "Spotted Owl Site: Any location where territorial spotted owls are known to be present, were historically present, or may be present in unsurveyed habitat. Spotted owl sites can be identified through surveys where spotted owls were detected (USFWS 2010). In cases where survey data are unavailable, spotted owl sites can be identified by 1) conducting surveys, or 2) using a modeling approach that uses habitat and landscape characteristics to identify areas with a high probability of being occupied by spotted owls."(p. G-4).

Potential Site Delineation

Potential sites could support breeding spotted owl pairs and management of such areas is recommended in the Recovery Plan. Therefore, this assessment recognizes the need for the delineation and analysis of potential sites to determine the effects of proposed activities. Potential site delineation is based on guidance in the Recovery Plan, decades of knowledge acquired from spotted owl surveys, and the best commercial and scientific information available. Spotted owl habitat associations and habitat requirements for reproduction were considered. Collectively, this information constitutes a synthesis of the best available science that was used to develop the general analytical framework described below.

Assessment of habitat within the home range, core area, and nest patch scales considered habitat quality, amount, orientation, contiguity and interior forest conditions, as well as specific spotted owl life history needs within each of these three scales (e.g., nest patches contain known or potential suitable nest trees). This information was used to evaluate and determine if an area possessed the characteristics that could support spotted owls. Habitat age and function was assessed by unit biologists using a variety of best available information such as agency forest operations inventory data, MaxEnt modeling, Lidar or other suitable aerial imagery or modeling. When necessary, field examination was also conducted to accurately evaluate habitat type. In all cases, area-specific conditions were assessed and the best available information was utilized in delineating a potential site. Survey data, when available, also provided known or probable locations of spotted owls within known or potential sites.

A general outline of the process used follows:

1. Geographic areas beyond 1.2 miles from known or potential site centers were identified. This value represents the median distance between known sites within the Central Cascades Demographic Study Area, commonly called the "nearest neighbor" distance.
2. Within such areas, spotted owl habitat was identified and mapped. It was then determined if there was sufficient habitat quality, amount and spatial orientation to identify a potential site center. A consideration was that amount and quality of habitat present

should be able to support a resident pair. Potential sites should also be able to support reproductive resident pairs. Ideally these areas would be close to or above thresholds which the literature indicates is necessary for successful reproduction (suitable habitat of approximately 40% or more in the home range and 50% or more in the core area with adequate habitat in the nest patch to support a nesting pair). Where available, site specific data were used to adjust these thresholds to more closely reflect actual conditions on the ground in the localized area. Local survey data were also used to establish or refine potential site locations. Based on local conditions, potential sites were delineated in some situations where habitat may be below the previously described thresholds. For example, where survey data indicated that owls could be residing in the area, or where nearby known sites occupied by spotted owls exhibited similar type, quality and quantity of habitat.

3. Proposed management activity locations were examined to see if they would be within the home range of an existing known or potential site. If so, effects were determined based on the general analytical framework described in this assessment.

Potential site center locations considered the typical nearest neighbor distance to nearby known and potential sites and avoidance of barred owl core use areas, if known. The "nearest neighbor" distance of 1.2 miles was used as a minimum spacing between new potential sites and nearby known or potential sites.

Potential site centers and their nest patches were located in the best available habitat likely to facilitate spotted owl nesting by providing suitable nest trees and forage habitat for rearing of young immediately after leaving the nest tree. Barring more site specific information, (e.g., habitat type and orientation), the nest patch was delineated using a 300 meter radius circle. Potential site core areas were located in the best available habitat likely to support concentrated use for nesting, roosting and rearing of young during the entire nesting season. Barring more site specific information (e.g., habitat type and orientation), this area was delineated using a 0.5 mile radius circle.

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APPENDIX B: STATUS OF THE SPOTTED OWL AND IT'S CRITICAL HABITAT

1.0 STATUS OF THE NORTHERN SPOTTED OWL

1.1 Legal Status

The spotted owl was listed as threatened on June 26, 1990 due to widespread loss and adverse modification of suitable habitat across the owl's entire range and the inadequacy of existing regulatory mechanisms to conserve the owl (USDI FWS 1990a, p. 26114). The northern spotted owl was originally listed with a recovery priority number of 3C, but that number was changed to 6C in 2004 during the five-year review of the species (USDI FWS 2004, p. 55). Priority numbers are assigned on a scale of 1C (highest) to 18 (lowest). This number reflects a high degree of threat, a low potential for recovery, and the owl's taxonomic status as a subspecies (USDI FWS 1983b, p. 51895). The "C" reflects conflict with development, construction, or other economic activity (USDI FWS 1983a, p. 43104). The most recent five-year status review was completed on September 29, 2011, and did not propose changes to the listing status or introduce any new threats (USDI FWS 2011a).

1.2 Life History

1.2.1 Taxonomy

The northern spotted owl is one of three subspecies of spotted owls currently recognized by the American Ornithologists' Union. The taxonomic separation of these three subspecies is supported by genetic (Barrowclough and Gutiérrez 1990, pp.741-742; Barrowclough et al. 1999, p. 928; Haig et al. 2004, p. 1354), morphological (Gutiérrez et al. 1995, p. 2), and biogeographic information (Barrowclough and Gutiérrez 1990, p.741-742). The distribution of the Mexican subspecies (*S. o. lucida*) is separate from those of the northern and California (*S. o. occidentalis*) subspecies (Gutiérrez et al. 1995, p.2). Recent studies analyzing mitochondrial DNA sequences (Haig et al. 2004, p. 1354; Chi et al. 2004, p. 3; Barrowclough et al. 2005, p. 1117) and microsatellites (Henke et al., 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 introgression of Mexican spotted owls into the northernmost parts of the northern spotted owl populations in Washington was made, indicating long-distance dispersal of Mexican spotted owls into the northern spotted owl range (Funk et al. 2008, pp. 1-11). Some hybridization of northern spotted owls with barred owls has been recorded (Hamer et al. 1994, pp. 487-491; Dark et al. 1998, pp. 50-56; Kelly 2001, pp. 33, 38).

1.2.2 Physical Description

The northern spotted owl is a medium-sized owl and is the largest of the three subspecies of spotted owls (Gutiérrez et al. 1995, p. 2). It is approximately 46 to 48 centimeters (18 inches to 19 inches) long and the sexes are dimorphic, with males averaging about 13 percent smaller than females. The mean mass of 971 males taken during 1,108 captures was 580.4 grams (1.28 pounds) (out of a range 430.0 to 690.0 grams) (0.95 pound to 1.52 pounds), and the mean mass of 874 females taken during 1,016 captures was 664.5 grams (1.46 pounds) (out of a range 490.0 to 885.0 grams) (1.1 pounds to 1.95 pounds) (P. Loschl and E. Forsman, pers. comm. cited in USDI FWS 2011b, p. A-1). The northern spotted owl is dark brown with a barred tail and white spots on its head and breast, and it has dark brown eyes surrounded by prominent facial disks. Four age classes can be distinguished on the basis of plumage characteristics (Forsman 1981; Moen et al. 1991, p. 493). The northern spotted owl superficially resembles the barred owl, a species with which it occasionally hybridizes (Kelly and Forsman 2004, p. 807). Hybrids exhibit physical and vocal characteristics of both species (Hamer et al. 1994, p. 488).

1.2.3 Current and Historical Range

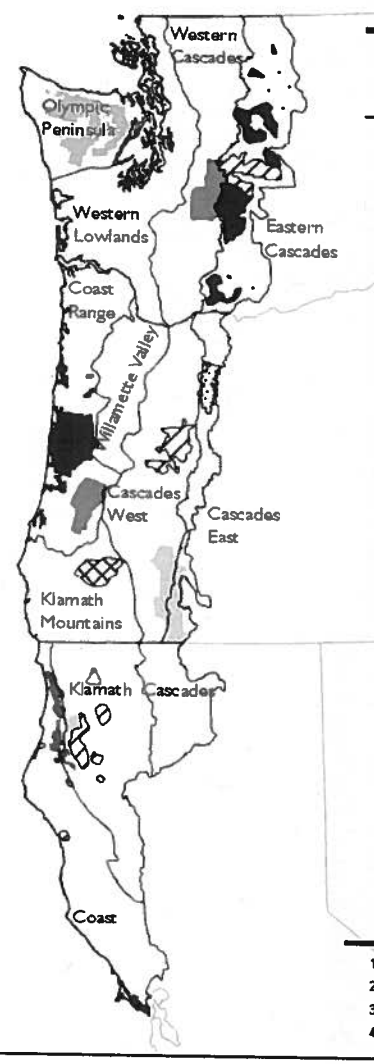
The current range of the spotted owl extends from southwest British Columbia through the Cascade Mountains, coastal ranges, and intervening forested lands in Washington, Oregon, and California, as far south as Marin County (USDI FWS 1990a, p. 26115). The range of the spotted owl is partitioned into 12 physiographic provinces (see Figure 1) based on recognized landscape subdivisions exhibiting different physical and environmental features (USDI FWS 2011b, 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 2011b, pp. B-1 to B-4; Thomas and Raphael 1993).



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).

1.2.4 Behavior

Northern spotted owls are primarily nocturnal (Forsman et al. 1984, pp. 51-52) and spend virtually their entire lives beneath the forest canopy (Courtney et al. 2004, p. 2-5). They are adapted to maneuverability beneath the forest canopy rather than strong, sustained flight (Gutiérrez et al. 1995, p. 9). They forage between dusk and dawn and sleep during the day with peak activity occurring during the two hours after sunset and the two hours prior to sunrise (Gutiérrez et al. 1995, p. 5; Delaney et al. 1999, p. 44). They will sometimes take advantage of vulnerable prey near their roosts during the day (Layman 1991, pp. 138-140; Sovern et al. 1994, p. 202).

Northern spotted owls seek sheltered roosts to avoid inclement weather, summer heat, and predation (Forsman 1975, pp. 105-106; Barrows and Barrows 1978; Barrows 1981; Forsman et al. 1984, pp. 29-30). Northern spotted owls become stressed at temperatures above 28°C, but there is no evidence to indicate that they have been directly killed by temperature because of their ability to thermoregulate by seeking out shady roosts in the forest understory on hot days (Barrows and Barrows 1978; Forsman et al. 1984, pp. 29-30, 54; Weathers et al. 2001, pp. 678, 684). During warm weather, spotted owls seek roosts in shady recesses of understory trees and occasionally will even roost on the ground (Barrows and Barrows 1978, pp. 3, 7-8; Barrows 1981, pp. 302-306, 308; Forsman et al. 1984, pp. 29-30, 54; Gutiérrez et al. 1995, p. 7). Glenn et al. (2010, p. 2549) found that population growth was negatively associated with hot summer temperatures at their southernmost study area in the southern Oregon Cascades, indicating that warm temperatures may still have an effect on the species. Both adults and juveniles have been observed drinking water, primarily during the summer, which is thought to be associated with thermoregulation (Gutiérrez et al. 1995, p. 7).

Spotted owls are territorial; however, home ranges of adjacent pairs overlap (Forsman et al. 1984, p. 22; Solis and Gutiérrez 1990, p. 746) suggesting that the area defended is smaller than the area used for foraging. They will actively defend their nests and young from predators (Forsman 1975, p. 15; Gutiérrez et al. 1995, p. 11). Territorial defense is primarily effected by hooting, barking and whistle type calls. Some spotted owls are not territorial but either remain as residents within the territory of a pair or move among territories (Gutiérrez 1996, p. 4). These birds are referred to as "floaters." Floaters have special significance in spotted owl populations because they may buffer the territorial population from decline (Franklin 1992, p. 822). Little is known about floaters other than that they exist and typically do not respond to calls as vigorously as territorial birds (Gutiérrez 1996, p. 4).

Spotted owls are monogamous and usually form long-term pair bonds. "Divorces" occur but are relatively uncommon. There are no known examples of polygyny in this owl, although associations of three or more birds have been reported (Gutiérrez et al. 1995, p. 10).

1.2.5 Habitat Relationships

1.2.5.1 Home Range

Home-range sizes vary geographically, generally increasing from south to north, which is likely a response to differences in habitat quality (USDI FWS 1990a, p. 26117). Estimates of median size of their annual home range (the area traversed by an individual or pair during their normal

activities (Thomas and Raphael 1993, pp. IX-15)) vary by province and range from 2,955 acres in the Oregon Cascades (Thomas et al. 1990, p. 194) to 14,211 acres on the Olympic Peninsula (USDI FWS 1994a, p. 3). Zabel et al. (1995, p. 436) showed that these provincial home ranges are larger where flying squirrels are the predominant prey and smaller where wood rats are the predominant prey. Home ranges of adjacent pairs overlap (Forsman et al. 1984, p. 22; Solis and Gutiérrez 1990, p. 746), suggesting that the defended area is smaller than the area used for foraging. Within the home range there is a smaller area of concentrated use during the breeding season (approximately 20 percent of the home range), often referred to as the core area (Bingham and Noon 1997, pp. 133-135). Spotted owl core areas vary in size geographically and provide habitat elements that are important for the reproductive efficacy of the territory, such as the nest tree, roost sites and foraging areas (Bingham and Noon 1997, p. 134). Spotted owls use smaller home ranges during the breeding season and often dramatically increase their home range size during fall and winter (Forsman et al. 1984, pp. 21-22; Sisco 1990, p. iii).

Although differences exist in natural stand characteristics that influence home range size, habitat loss and forest fragmentation effectively reduce habitat quality in the home range. A reduction in the amount of suitable habitat reduces spotted owl abundance and nesting success (Bart and Forsman 1992, pp. 98-99; Bart 1995, p. 944).

1.2.5.2 Habitat Use and Selection

Forsman et al. (1984, pp.15-16) reported that spotted owls have been observed in the following forest types: Douglas-fir (*Pseudotsuga menziesii*), western hemlock (*Tsuga heterophylla*), grand fir (*Abies grandis*), white fir (*Abies concolor*), ponderosa pine (*Pinus ponderosa*), Shasta red fir (*Abies magnifica shastensis*), mixed evergreen, mixed conifer hardwood (Klamath montane), and redwood (*Sequoia sempervirens*). The upper elevation limit at which spotted owls occur corresponds to the transition to subalpine forest, which is characterized by relatively simple structure and severe winter weather (Forsman 1975, p. 27; Forsman et al. 1984, pp. 15-16).

Spotted owls generally rely on older forested habitats because such forests contain the structures and characteristics required for nesting, roosting, and foraging. Features that support nesting and roosting typically include a moderate to high canopy closure (60 to 90 percent); a multi-layered, multi-species canopy with large overstory trees (with diameter at breast height [dbh] of greater than 30 inches); a high incidence of large trees with various deformities (large cavities, broken tops, mistletoe infections, and other evidence of decadence); large snags; large accumulations of fallen trees and other woody debris on the ground; and sufficient open space below the canopy for spotted owls to fly (Thomas et al. 1990, p. 19). Forested stands with high canopy closure also provide thermal cover (Weathers et al. 2001, p. 686) and protection from predators (Franklin et al. 2000, p. 578).

Spotted owls nest almost exclusively in trees. Like roosts, nest sites are found in forests having complex structure dominated by large diameter trees (Forsman et al. 1984, p. 30; Hershey et al. 1998, p. 1402). Even in forests that have been previously logged, spotted owls select forests having a structure (i.e., larger trees, greater canopy closure) different than forests generally 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 2011b, p. G-2). Descriptions of foraging habitat have ranged from complex structure (Solis and Gutiérrez 1990, pp. 742-744) to forests with lower canopy closure and smaller trees than forests containing nests or roosts (Gutiérrez 1996, p. 5). Foraging habitat for northern spotted owls provides a food supply for survival and reproduction. Foraging activity is positively associated with tree height diversity (North et al. 1999, p. 524), canopy closure (Irwin et al. 2000, p. 180; Courtney et al. 2004, pp. 5-15), snag volume, density of snags greater than 20 in (50 cm) dbh (North et al. 1999, p. 524; Irwin et al. 2000, pp. 179-180; Courtney et al. 2004, pp. 5-15), density of trees greater than or equal to 31 in (80 cm) dbh (North et al. 1999, p. 524), volume of woody debris (Irwin et al. 2000, pp. 179-180), and young forests with some structural characteristics of old forests (Carey et al. 1992, pp. 245-247; Irwin et al. 2000, pp. 178-179). Northern spotted owls select old forests for foraging in greater proportion than their availability at the landscape scale (Carey et al. 1992, pp. 236-237; Carey and Peeler 1995, p. 235; Forsman et al. 2004, pp. 372-373), but will forage in younger stands with high prey densities and access to prey (Carey et al. 1992, p. 247; Rosenberg and Anthony 1992, p. 165; Thome et al. 1999, pp. 56-57).

Dispersal habitat is essential to maintaining stable populations by filling territorial vacancies when resident northern spotted owls die or leave their territories, and to providing adequate gene flow across the range of the species. Dispersal habitat, at a minimum, consists of stands with adequate tree size and canopy closure to provide protection from avian predators and at least minimal foraging opportunities (USDI FWS 2011b, p. G-1; USDI FWS 2012b, p. 71906). Dispersal habitat may include younger and less diverse forest stands than foraging habitat, such as even-aged, pole-sized stands, but such stands should contain some roosting structures and foraging habitat to allow for temporary resting and feeding for dispersing juveniles (USDI FWS 2011b, p. G-1; USDI FWS 2012b, p. 71906). 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.

1.2.6 Reproductive Biology

The spotted owl is relatively long-lived, has a long reproductive life span, invests significantly in parental care, and exhibits high adult survivorship relative to other North American owls (Forsman et al. 1984; Gutiérrez et al. 1995, p. 5). Spotted owls are sexually mature at 1 year of age, but rarely breed until they are 2 to 5 years of age (Miller et al. 1985, p. 93; Franklin 1992, p. 821; Forsman et al. 2002, p. 17). Breeding females lay one to four eggs per clutch, with the average clutch size being two eggs; however, most spotted owl pairs do not nest every year, nor are nesting pairs successful every year (USDI FWS 1990b; Forsman et al. 1984, pp. 32-34; Anthony et al. 2006, p. 28), and renesting after a failed nesting attempt is rare (Gutiérrez 1996, p. 4). The small clutch size, temporal variability in nesting success, and delayed onset of breeding all contribute to the relatively low fecundity of this species (Gutiérrez 1996, p. 4).

Courtship behavior usually begins in February or March, and females typically lay eggs in late March or April. The timing of nesting and fledging varies with latitude and elevation (Forsman et al. 1984, p. 32). After they leave the nest in late May or June, juvenile spotted owls depend on their parents until they are able to fly and hunt on their own. Parental care continues after fledging into September (USDI FWS 1990a; Forsman et al. 1984, p. 38). During the first few weeks after the young leave the nest, the adults often roost with them during the day. By late summer, the adults are rarely found roosting with their young and usually only visit the juveniles to feed them at night (Forsman et al. 1984, p. 38). Telemetry and genetic studies indicate that close inbreeding between siblings or parents and their offspring is rare (Haig et al. 2001, p. 35; Forsman et al. 2002, p. 18). Hybridization of northern spotted owls with California spotted owls and barred owls has been confirmed through genetic research (Hamer et al. 1994, pp. 487-492; Gutiérrez et al. 1995, pp. 2-3; Dark et al. 1998, p. 52; Kelly 2001, pp. 33-35; Funk et al. 2008, pp. 161-171).

1.2.7 Dispersal Biology

Natal dispersal of spotted owls typically occurs in September and October with a few individuals dispersing in November and December (Miller et al. 1997; Forsman et al. 2002, p. 13). Natal dispersal occurs in stages, with juveniles settling in temporary home ranges between bouts of dispersal (Forsman et al. 2002, pp. 13-14; Miller et al. 1997, p. 143). The median natal dispersal distance is about 10 miles for males and 15.5 miles for females (Forsman et al. 2002, p. 16). Dispersing juvenile spotted owls experience high mortality rates, exceeding 70 percent in some studies (USDI FWS 1990a; Miller 1989, pp. 32-41). Known or suspected causes of mortality during dispersal include starvation, predation, and accidents (Miller 1989, pp. 41-44; USDI FWS 1990a; Forsman et al. 2002, pp. 18-19). Parasitic infection may contribute to these causes of mortality, but the relationship between parasite loads and survival is poorly understood (Hoberg et al. 1989, p. 247; Gutiérrez 1989, pp. 616-617; Forsman et al. 2002, pp. 18-19). Successful dispersal of juvenile spotted owls may depend on their ability to locate unoccupied suitable habitat in close proximity to other occupied sites (LaHaye et al. 2001, pp. 697-698).

There is little evidence that small openings in forest habitat influence the dispersal of spotted owls, but large, non-forested valleys such as the Willamette Valley apparently are barriers to both natal and breeding dispersal (Forsman et al. 2002, p. 22). The degree to which water bodies, such as the Columbia River and Puget Sound, function as barriers to dispersal is unclear,

although radio telemetry data indicate that spotted owls move around large water bodies rather than cross them (Forsman et al. 2002, p. 22). Analysis of the genetic structure of spotted owl populations suggests that gene flow may have been adequate between the Olympic Mountains and the Washington Cascades, and between the Olympic Mountains and the Oregon Coast Range (Haig et al. 2001, p. 35).

Breeding dispersal occurs among a small proportion of adult spotted owls; these movements were more frequent among females and unmated individuals (Forsman et al. 2002, pp. 20-21). Breeding dispersal distances were shorter than natal dispersal distances and also are apparently random in direction (Forsman et al. 2002, pp. 21-22). In California spotted owls, a similar subspecies, the probability for dispersal was higher in younger owls, single owls, paired owls that lost mates, owls at low quality sites, and owls that failed to reproduce in the preceding year (Blakesley et al. 2006, p.77). Both males and females dispersed at near equal distances (Blakesley et al. 2006, p. 76). In 72 percent of observed cases of dispersal, dispersal resulted in increased habitat quality (Blakesley et al. 2006, p. 77).

Dispersal can also be described as having two phases: transience and colonization (Courtney et al 2004, p. 5-13). Fragmented forest landscapes are more likely to be used by owls in the transience phase as a means to move rapidly between denser forest areas (Courtney et al 2004, p. 5-13; USDI FWS 2012, p. 71901). Movements through mature and old growth forests occur during the colonization phase when birds are looking to become established in an area (Miller et al 1997, p. 144; Courtney et al 2004, p. 5-13). Transient dispersers use a wider variety of forest conditions for movements than colonizing dispersers, who require habitats resembling nesting/roosting/foraging habitats used by breeding birds (USDI FWS 2012, p. 71902). Dispersal success is likely highest in mature and old growth forest stands where there is more likely to be adequate cover and food supply (USDI FWS 2012, p. 71902).

1.2.8 Food Habits

Spotted owls are mostly nocturnal, although they also forage opportunistically during the day (Forsman et al. 1984, p. 51; 2004, pp. 222-223; Sovern et al. 1994, p. 202). The composition of the spotted owl's diet varies geographically and by forest type. Generally, flying squirrels (*Glaucomys sabrinus*) are the most prominent prey for spotted owls in Douglas-fir and western hemlock (*Tsuga heterophylla*) forests (Forsman et al. 1984, pp. 40-41) in Washington and Oregon, while dusky-footed wood rats (*Neotoma fuscipes*) are a major part of the diet in the Oregon Klamath, 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).

1.2.9 Population Dynamics

The spotted owl is relatively long-lived, has a long reproductive life span, invests significantly in parental care, and exhibits high adult survivorship relative to other North American owls (Forsman et al. 1984; Gutiérrez et al. 1995, p. 5). The spotted owl's long reproductive life span allows for some eventual recruitment of offspring, even if recruitment does not occur each year (Franklin et al. 2000, p. 576).

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.

1.3 Threats

1.3.1 Reasons for Listing

The spotted owl was listed as threatened throughout its range "due to loss and adverse modification of suitable habitat as a result of timber harvesting and exacerbated by catastrophic events such as fire, volcanic eruption, and wind storms" (USDI FWS 1990a, p. 26114). More specifically, threats to the spotted owl included low populations, declining populations, limited habitat, declining habitat, inadequate distribution of habitat or populations, isolation of provinces, predation and competition, lack of coordinated conservation measures, and vulnerability to natural disturbance (USDI FWS 1992a, pp. 33-41). These threats were characterized for each province as severe, moderate, low, or unknown (USDI FWS 1992a, pp. 33-41). Declining habitat was recognized as a severe or moderate threat to the spotted owl throughout its range, isolation of populations was identified as a severe or moderate threat in 11 provinces, and a decline in population was a severe or moderate threat in 10 provinces. Together, these three factors represented the greatest concerns about range-wide conservation of the spotted owl. Limited habitat was considered a severe or moderate threat in nine provinces, and low populations were a severe or moderate concern in eight provinces, suggesting that these factors were also a concern throughout the majority of the spotted owl's range. Vulnerability to natural disturbances was rated as low in five provinces.

The degree to which predation and competition might pose a threat to the spotted owl was unknown in more provinces than any of the other threats, indicating a need for additional information. Few empirical studies exist to confirm that habitat fragmentation contributes to increased levels of predation on spotted owls (Courtney et al. 2004, pp. 11-8 to 11-9). However, great horned owls (*Bubo virginianus*), an effective predator on spotted owls, are closely associated with fragmented forests, openings, and clearcuts (Johnson 1992, p. 84; Laidig and Dobkin 1995, p. 155). As mature forests are harvested, great horned owls may colonize fragmented forests, thereby increasing spotted owl vulnerability to predation.

1.3.2 New Threats

The Service conducted a 5-year review of the spotted owl in 2004 (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 2011b, Appendix B).

1.3.2.1 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.106), 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 2011b, 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. 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 dated February 7, 2011, "2011 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.

1.3.2.2 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 2011b, 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).

1.3.2.4 West Nile Virus

West Nile virus (WNV), caused by a virus in the family Flaviviridae, has killed millions of wild birds in North America since it arrived in 1999 (McLean et al. 2001; Caffrey 2003; Caffrey and Peterson 2003, pp. 7-8; Marra et al. 2004, p. 393). Mosquitoes are the primary carriers (vectors) of the virus that causes encephalitis in humans, horses, and birds. Mammalian prey may also play a role in spreading WNV among predators, like spotted owls. Owls and other predators of mice can contract the disease by eating infected prey (Garmendia et al. 2000, p. 3111; Komar et al. 2001). One captive spotted owl in Ontario, Canada, is known to have contracted WNV and died.

Health officials expect that WNV will eventually spread throughout the range of the spotted owl (Courtney et al. 2004; Blakesley et al. 2004, pp. 8-31), but it is unknown how WNV will ultimately affect spotted owl populations. Susceptibility to infection and the mortality rates of infected individuals vary among bird species (Blakesley et al. 2004, pp. 8-33), but most owls appear to be quite susceptible. For example, breeding Eastern screech owls (*Megascops asio*) in Ohio experienced 100 percent mortality (T. Grubb pers. comm. in Blakesley et al. 2004, pp. 8-33). Barred owls, in contrast, showed lower susceptibility (B. Hunter pers. comm. in Blakesley et al. 2004, pp. 8-34). Some level of innate resistance may occur (Fitzgerald et al. 2003), which could explain observations in several species of markedly lower mortality in the second year of exposure to WNV (Caffrey and Peterson 2003). Wild birds also develop resistance to WNV through immune responses (Deubel et al. 2001). The effects of WNV on bird populations at a regional scale have not been large, even for susceptible species (Caffrey and Peterson 2003), perhaps due to the short-term and patchy distribution of mortality (K. McGowan, pers. comm., cited in Courtney et al. 2004) or annual changes in vector abundance and distribution.

Blakesley et al. (2004, pp. 8-35) offer competing propositions for the likely outcome of spotted owl populations being infected by WNV. One scenario is that spotted owls can tolerate severe, short-term population reductions due to WNV, because spotted owl populations are widely distributed and number in the several hundreds to thousands. An alternative scenario is that WNV will cause unsustainable mortality, due to the frequency and/or magnitude of infection, thereby resulting in long-term population declines and extirpation from parts of the spotted owl's current range. Thus far, no mortality in wild, northern spotted owls has been recorded; however, WNV is a potential threat of uncertain magnitude and effect (Blakesley et al. 2004, pp. 8-34).

1.3.2.5 Sudden Oak Death

Sudden oak death was recently identified as a potential threat to the spotted owl (Courtney et al. 2004). This disease is caused by the fungus-like pathogen, *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).

1.3.2.6 Inbreeding Depression, Genetic Isolation, and Reduced Genetic Diversity

Inbreeding and other genetic problems due to small population sizes were not considered an imminent threat to the spotted owl at the time of listing. Recent studies show no indication of reduced genetic variation and past bottlenecks in Washington, Oregon, or California (Barrowclough et al. 1999, p. 922; Haig et al. 2004, p. 36). Canadian populations may be more adversely affected by issues related to small population size including inbreeding depression, genetic isolation, and reduced genetic diversity (Courtney et al. 2004, pp. 11-9). A 2004 study (Harestad et al. 2004, p. 13) indicates that the Canadian breeding population was estimated to be less than 33 pairs and annual population decline may be as high as 35 percent. In 2007, a recommendation was made by the Spotted Owl Population Enhancement Team to remove northern spotted owls from the wild in British Columbia (USDI FWS 2012, p. 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 2012, 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).

1.3.2.7 Climate Change

Climate change, combined with effects from past management practices is influencing current forest ecosystem processes and dynamics by increasing the frequency and magnitude of wildfires, insect outbreaks, drought, and disease (USDI FWS 2011b, pp. III-5 - III-11). In the Pacific Northwest, mean annual temperatures rose 0.8° C (1.5° F) in the 20th century and are expected to continue to warm from 0.1° to 0.6° C (0.2° to 1° F) per decade (Mote and Salathe 2010, p. 29). Climate change models generally predict warmer, wetter winters and hotter, drier summers and increased frequency of extreme weather events in the Pacific Northwest (Salathe et al. 2010, pp. 72-73).

Predicted climate changes in the Pacific Northwest have implications for forest disturbances that affect the quality and distribution of spotted owl habitat. Both the frequency and intensity of wildfires and insect outbreaks are expected to increase over the next century in the Pacific Northwest (Littell et al. 2010, p. 130). One of the largest projected effects on Pacific Northwest forests is likely to come from an increase in fire frequency, duration, and severity. Westerling et al. (2006, pp. 940-941) analyzed wildfires and found that since the mid-1980s, wildfire

frequency in western forests has nearly quadrupled compared to the average of the period from 1970-1986. The total area burned is more than 6.5 times the previous level and the average length of the fire season during 1987-2003 was 78 days longer compared to 1978-1986 (Westerling et al. 2006, p. 941). The area burned annually by wildfires in the Pacific Northwest is expected to double or triple by the 2080s (Littell et al. 2010, p. 140). Wildfires are now the primary cause of spotted owl habitat loss on Federal lands, with over 236,000 acres of habitat loss attributed to wildfires from 1994 to 2007 (Davis et al. 2011, p. 123).

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

Drought or hot temperatures during the summer have also been linked to reduced spotted owl recruitment (Glenn et al. 2010, p. 2549). Drier, warmer summers and drought conditions during the growing season strongly influence primary production in forests, food availability, and the population sizes of small mammals that spotted owls prey upon (Glenn et al. 2010, p. 2549).

In summary, climate change is likely to exacerbate some existing threats to the spotted owl such as the projected potential for increased habitat loss from drought-related fire, tree mortality, insects and disease, as well as affecting reproduction and survival during years of extreme weather.

1.3.2.8 Disturbance

Northern spotted owls may also respond physiologically to a disturbance without exhibiting a significant behavioral response. In response to environmental stressors, vertebrates secrete stress hormones called corticosteroids (Campbell 1990, p. 925). Although these hormones are essential for survival, extended periods with elevated stress hormone levels may have negative effects on reproductive function, disease resistance, or physical condition (Carsia and Harvey 2000, pp. 517-518; Saplosky et al. 2000, p. 1). In avian species, the secretion of corticosterone is the primary non-specific stress response (Carsia and Harvey 2000, p. 517). The quantity of this hormone in feces can be used as a measure of physiological stress (Wasser et al. 1997, p. 1019). Recent studies of fecal corticosterone levels of northern spotted owls indicate that low intensity noise of short duration and minimal repetition does not elicit a physiological stress response (Tempel and Gutiérrez 2003, p. 698; Tempel and Gutiérrez 2004, p. 538). However, prolonged activities, such as those associated with timber harvest, may increase fecal corticosterone levels depending on their proximity to northern spotted owl core areas (Wasser et al. 1997, p.1021; Tempel and Gutiérrez 2004, p. 544).

The effects of noise on spotted owls are largely unknown, and whether noise is a concern has been a controversial issue. The effect of noise on birds is extremely difficult to determine due to the inability of most studies to quantify one or more of the following variables: 1) timing of the disturbance in relation to nesting chronology; 2) type, frequency, and proximity of human disturbance; 3) clutch size; 4) health of individual birds; 5) food supply; and 6) outcome of previous interactions between birds and humans (Knight and Skagan 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.

1.4 Conservation Needs of the Spotted Owl

Based on the above assessment of threats, the spotted owl has the following habitat-specific and habitat-independent conservation (i.e., survival and recovery) needs:

1.4.1 Habitat-specific Needs

1. Large blocks of habitat capable of supporting clusters or local population centers of spotted owls (e.g., 15 to 20 breeding pairs) throughout the owl's range;

2. Suitable habitat conditions and spacing between local spotted owl populations throughout its range that facilitate survival and movement;

3. Suitable habitat distributed across a variety of ecological conditions within the northern spotted owl's range to reduce risk of local or widespread extirpation;

4. A coordinated, adaptive management effort to reduce the loss of habitat due to catastrophic wildfire throughout the spotted owl's range, and a monitoring program to clarify whether these risk reduction methods are effective and to determine how owls use habitat treated to reduce fuels; and

5. In areas of significant population decline, sustain the full range of survival and recovery options for this species in light of significant uncertainty.

1.4.2 Habitat-independent Needs

1. A coordinated research and adaptive management effort to better understand and manage

competitive interactions between spotted and barred owls; and

2. Monitoring to understand better the risk that WNV and sudden oak death pose to spotted owls and, for WNV, research into methods that may reduce the likelihood or severity of outbreaks in spotted owl populations.

1.4.3 Conservation Strategy

Since 1990, various efforts have addressed the conservation needs of the 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 1992a), the Draft Recovery Plan (USDI FWS 1992b), and the Scientific Analysis Team report (Thomas et al. 1993), report of the Forest Ecosystem Management Assessment Team (Thomas and Raphael 1993); and they culminated with the NWFP (USDA FS and 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.

1.4.4 Federal Contribution to Recovery

Since it was signed on April 13, 1994, the NWFP has guided the management of Federal forest lands within the range of the spotted owl (USDA FS and USDI BLM 1994a, 1994b). The NWFP was designed to protect large blocks of old growth forest and provide habitat for species that depend on those forests including the spotted owl, 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 and USDI BLM 1994a, USDI FWS 1994b) which would persist into future managed timber stands.

The NWFP with its rangewide system of LSRs was based on work completed by three previous studies (Thomas et. al. 2006): the 1990 Interagency Scientific Committee (ISC) Report (Thomas et. al. 1990), the 1991 report for the Conservation of Late-successional Forests and Aquatic Ecosystems (Johnson et. al. 1991), and the 1993 report of the Scientific Assessment Team (Thomas et. al. 1993). In addition, the 1992 Draft Recovery Plan for the Northern Spotted Owl (USDI FWS 1992b) 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 and 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 2011b, 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 2011b). The recovery plan identifies threats from competition with barred owls, ongoing loss of northern spotted owl habitat as a result of timber harvest, loss or modification of northern spotted owl habitat from uncharacteristic wildfire, and loss of amount and distribution of northern spotted owl habitat as a result of past activities and disturbances (USDI FWS 2011b, 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 2011b, p. II-2). The recovery plan lists recovery actions that address each of these items, some of which were retained from the 2008 recovery plan. The Managed Owl Conservation Areas and Conservation Support Areas recommended in the 2008 recovery plan are not a part of the recovery strategy outlined in the revised recovery plan. The Service completed a range-wide, multi-step habitat modeling process to help evaluate and inform management decisions and critical habitat development (USDI FWS 2011b, Appendix C).

The final recovery plan (USDI FWS 2011b) recommended implementing a robust monitoring and research program for the spotted owl. The recovery plan encourages these efforts by laying out the following primary elements to evaluate progress toward meeting recovery criteria: monitoring spotted owl population trends, comprehensive barred owl research and monitoring, continued habitat monitoring; inventory of spotted owl distribution, and; explicit consideration for climate change mitigation goals consistent with recovery actions (USDI FWS 2011b, p. II-5). The revised recovery plan also strongly encourages land managers to be aggressive in the implementation of recovery actions. In other words, land managers should not be so conservative that, to avoid risk, they forego actions that are necessary to conserve the forest ecosystems that are necessary to the long-term conservation of the spotted owl. But they should also not be so aggressive that they subject spotted owls and their habitat to treatments where the long-term benefits do not clearly outweigh the short-term risks. Finding the appropriate balance to this dichotomy will remain an ongoing challenge for all who are engaged in spotted owl conservation (USDI FWS 2011b, p. II-12). The revised recovery plan estimates that recovery of the spotted owl could be achieved in approximately 30 years (USDI FWS 2011b, p. II-3).

1.4.5 Conservation Efforts on Non-Federal Lands

In the report from the Interagency Scientific Committee (Thomas et al. 1990, pp. 3, 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 2011b, p. A-15). The CPs range in size from 76 acres to more than 1.8 million acres, although not all acres are included in the mitigation for northern spotted owls. In total, the CPs cover approximately 3 million acres (9.4 percent) of the 32 million acres of non-Federal forest lands in the range of the northern spotted owl. The period of time that the HCPs will be in place ranges from 20 to 100 years. While each CP is unique, there are several general approaches to mitigation of incidental take:

- Reserves of various sizes, some associated with adjacent Federal reserves
- Forest harvest that maintains or develops nesting habitat
- Forest harvest that maintains or develops foraging habitat
- Forest management that maintains or develops dispersal habitat
- Deferral of harvest near specific sites

Washington. In 1996, the State Forest Practices Board adopted rules (Washington Forest Practices Board 1996) that would contribute to conserving the spotted owl and its habitat on non-Federal lands. Adoption of the rules was based in part on recommendations from a Science Advisory Group that identified important non-Federal lands and recommended roles for those lands in spotted owl conservation (Hanson et al. 1993, pp. 11-15; Buchanan et al. 1994, p. ii). The 1996 rule package was developed by a stakeholder policy group and then reviewed and approved by the Forest Practices Board (Buchanan and Swedeen 2005, p. 9). Spotted owl-related HCPs in Washington generally were intended to provide demographic or connectivity support (USDI FWS 1992b, p. 272). There are over 2.1 million acres of land in six HCPs and two SHAs (USDI FWS 2011b, p. A-15). Some of these CPs focus on providing nesting/roosting habitat throughout the area or in strategic locations; while others focus on providing connectivity through foraging habitat and/or dispersal habitat. In addition, there is a long term habitat management agreement covering 13,000 acres in which authorization of take was provided through an incidental take statement (section 7) associated with a Federal land exchange (USDI FWS 2011b, p. A-15).

Oregon. The Oregon Forest Practices Act provides for protection of 70-acre core areas around sites occupied by an adult pair of spotted owls capable of breeding (as determined by recent protocol surveys), but it does not provide for protection of spotted owl habitat beyond these areas (Oregon Department of Forestry 2007, p. 64). In general, no large-scale spotted owl habitat protection strategy or mechanism currently exists for non-Federal lands in Oregon. The three spotted owl-related HCPs currently in effect cover more than 300,000 acres of non-Federal lands. These HCPs are intended to provide some nesting habitat and connectivity over the next few decades (USDI FWS 2011b, p. A-16). On July 27, 2010, the Service completed a programmatic SHA with the Oregon Department of Forestry that will enroll up to 50,000 acres of non-federal lands within the State over 50 years. The primary intent of this programmatic SHA is to increase time between harvests and to lightly to moderately thin younger forest stands

that are currently not habitat to increase tree diameter and stand diversity (USDI FWS 2011b, p. A-16).

California. The California State Forest Practice Rules, which govern timber harvest on private lands, require surveys for spotted owls in suitable habitat and to provide protection around activity centers (California Department of Forestry and Fire Protection 2007, pp. 85-87). Under the Forest Practice Rules, no timber harvest plan can be approved if it is likely to result in incidental take of federally listed species, unless the take is authorized by a Federal incidental take permit (California Department of Forestry and Fire Protection 2007, pp. 85-87). The California Department of Fish and Game initially reviewed all timber harvest plans to ensure that take was not likely to occur; the Service took over that review function in 2000. Several large industrial owners operate under spotted owl management plans that have been reviewed by the Service and that specify basic measures for spotted owl protection. Four HCPs and two SHAs authorizing take of spotted owls have been approved; these HCPs cover more than 622,000 acres of non-Federal lands. Implementation of these plans is intended to provide for spotted owl demographic and connectivity support to NWFP lands (USDI FWS 2011b, p. A-16).

1.5 Current Condition of the Spotted Owl

The current condition of the species incorporates the effects of all past human activities and natural events that led to the present-day status of the species and its habitat (USDI FWS and USDC NMFS 1998, pp. 4-19).

1.5.1 Range-wide Habitat and Population Trends

1.5.1.1 Range-wide Habitat Baseline

The Service has used information provided by the USFS, BLM, and National Park Service to update the habitat baseline conditions by tracking relative habitat changes over time on Federal lands for northern spotted owls on several occasions, since the northern spotted owl was listed in 1990 (USDA and USDI 1994b, USDI FWS 2001, Lint 2005, Davis et al. 2011). The estimate of 7.4 million acres used for the NWFP in 1994 (USDA and USDI 1994b) was believed to be representative of the general amount of northern spotted owl habitat on NWFP lands at that time. 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 and USDI 1994b), are necessary to determine

if the rate of potential change to northern spotted owl habitat is consistent with the change anticipated in the NWFP: a reduction in suitable habitat of approximately 2.5 percent per decade (USDA and USDI 1994a, p. 46). 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 and USDI 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.

1.5.1.2 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.

1.5.1.3 Range-wide Consultation Effects: 1994 to July 18, 2014

Between 1994 and July 18, 2014, the Service has consulted on the proposed removal/downgrade of approximately 686,658 acres or 7.8 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. 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 1994 have documented the eventual loss of over 483,382 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 1: Range-wide Aggregate of Changes to NRF[1] Habitat Acres from Activities Subject to Section 7 Consultations and Other Causes (1994 to July 18, 2014)

Land Ownership	Consulted On Habitat Changes[2]		Other Habitat Changes[3]	
	Removed/ Downgraded	Maintained/ Improved	Removed/ Downgraded	Maintained/ Improved
NWFP (FS,BLM,NPS)	203,276	545,826	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	**686,658**	**617,184**	**256,066**	**39,720**

Table 1 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, Oregon, and California, but does not include foraging only (F) for California.
2. Includes both effects reported in USFWS 2001 and subsequent effects reported in the Northern Spotted Owl Consultation Effects Tracking System (web application and database.)
3. Includes effects to suitable NRF habitat (as generally documented through technical assistance, etc.) resulting from wildfires (not from suppression efforts), insect and disease outbreaks, and other natural causes, private timber harvest, and land exchanges not associated with consultation.

1.5.1.4 Range-wide Consultation Effects: 2006/2007 to July 18, 2014

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 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 (Davis et al. 2011, p. 123). 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 2 summarizes the habitat impacts on Federal lands that have occurred since 2006/2007.

Habitat loss from Federal lands since 2006/2007 due to land management activities and natural events has varied among the individual provinces with most of the impacts concentrated within the 'Non-Reserves' land-use allocations relative to the 'Reserve' land-use allocations (Table 2).

When habitat loss is evaluated as a proportion of the affected acres range-wide, the most pronounced losses have occurred within Oregon (54.6 percent; especially within its Cascades West [22.4 percent] and Cascades East [18.6 percent] provinces; Table 2), followed by California (40 percent; with nearly all [37.2 percent] from the Klamath Province; Table 2). In contrast, much smaller habitat losses have occurred in Washington (7.4 percent; Table 2). When habitat loss is evaluated as a proportion of provincial baselines, the Oregon Cascades East (5.3 percent), and the California Klamath (2.9 percent) provinces have proportional losses greater than the loss of habitat across all provinces (1.26 percent; Table 2).

Of the total Federal acres consulted on for 'Habitat Removed/Downgraded', approximately 51,558 acres or 0.60 percent of 8.55 million acres of northern spotted owl habitat were removed/downgraded as a result of land management activities (Table B-3). Of these, about 46,532 acres 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 have been lost, with the California Klamath province contributing the majority (39,481 acres or 77 percent) of habitat lost, followed by the Oregon Cascades East province (9,620 acres or 19 percent)(Table 2).

Table 2. Summary of northern spotted owl suitable habitat (NRF[1]) 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 July18, 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	**6.14**
	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	**1.26**
	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	**18.61**
	Cascades West	1,275,200	939,600	2,214,800	1,183	22,995	24,178	0	0	0	24,178	1.09	**22.38**
	Coast Range	494,400	113,400	607,800	184	1,586	1,770	0	0	0	1,770	0.29	**1.64**
	Klamath Mountains	549,400	334,900	884,300	2,617	5,204	7,821	1,468	3,696	5,164	12,985	1.47	**12.02**
	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	**0.42**
	Klamath	910,900	501,200	1,412,100	75	646	721	19,072	20,409	39,481	40,202	2.85	**37.22**
Total		**5,961,000**	**2,594,200**	**8,555,200**	**10,572**	**40,986**	**51,558**	**30,066**	**26,394**	**56,460**	**108,018**	**1.26**	**100**

Table 2 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 in this database; however, California consultations use locally derived information to assess effects to foraging only.
2. Defined in the Revised Recovery Plan for the Northern Spotted Owl (USDI FWS 2011b, pp. III-1 and A-3) 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 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 consultations 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 that is independent of Nesting/Roosting habitat but is 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.

Table 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 July 18, 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	38,432	46,532
Removed/Downgraded (other management activities)[5]	2,472	2,554	5,026
Subtotal	10,572	40,986	51,558
Removed/Downgraded (natural disturbance)[6]	30,066	26,394	56,460
Total Net Change	40,638	67,380	108,018
Baseline Balance	**5,920,362**	**2,526,820**	**8,447,182**
Habitat Maintained[7]	37,136	60,722	97,858

Table 3 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; California consultations use locally derived information to assess effects to foraging only.
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 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.

1.5.1.5 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, abstract) 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, p. 100). 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, pp. 43-55) 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 (Davis et al. 2011, p. 49). The largest increase in dispersal habitat was in the Oregon Coast Range province.

Davis *et al.* (2011, p. 43) 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 nonreserves. Timber harvest accounted for about 45 percent (37,400 ac) in nonreserves, 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, pp. 70-79) 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.

1.5.2 Spotted Owl Population Trends and Distribution

There are no estimates of the historical population size and distribution of spotted owls, although they are believed to have inhabited most old-growth forests throughout the Pacific Northwest prior to modern settlement (mid-1800s), including northwestern California (USDI FWS 1989, pp. 2-17).

The current range of the spotted owl extends from southwest British Columbia through the Cascade Mountains, coastal ranges, and intervening forested lands in Washington, Oregon, and California, as far south as Marin County (USDI FWS 1990a, p. 26114). The range of the spotted owl is partitioned into 12 physiographic provinces (Figure 1) based on recognized landscape subdivisions exhibiting different physical and environmental features (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 2011b, 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 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 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 2011b, p. A-6). Prior to initiating the captive-breeding program, the population of spotted owls in Canada was declining by as much as 10.4 percent per year (Chutter et al. 2004, p. v). The amount of previous interaction between spotted owls in Canada and the United States is unknown.

1.5.3 Spotted Owl Recovery Units

The 2011 Final Revised Recovery Plan for the Northern Spotted Owl determined that the 12 existing physiographic provinces meet the criteria for use as recovery units (USFWS 2011, p. III 1-2). The proposed project is within the Eastern Oregon Cascades Physiographic Province. 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 (USFWS 2011, p III-3).

1.6 Legal Status of Critical Habitat

On January 15, 1992, the Service designated spotted owl CH within 190 CH units which

encompassed nearly 6.9 million acres of Federal lands in California, Oregon, and Washington (USFWS 1992b). In 2008 the Service revised spotted owl CH into 29 units, comprising 174 sub-units, on approximately 5,312,300 acres of Federal lands in California, Oregon, and Washington (USFWS 2008b) in a geographic manner designed to protect clusters of reproductively-capable spotted owls and facilitate demographic interchange. On December 4, 2012, consistent with the best scientific data available, the standards of the Act and applicable regulations, the Service published a final rule (FR 77 71876) designating 9,577,969 ac in 11 units and 60 subunits in California, Oregon, and Washington that meet the definition of CH. The final rule became effective January 3, 2013.

1.6.1 Purpose and Intent

Through designation of revised CH, the Service has encouraged land managers to consider implementation of forest management practices recommended in the Recovery Plan (USFWS 2011) to restore natural ecological processes where they have been disrupted or suppressed (*e.g.*, natural fire regimes), and application of ecological forestry management practices within CH to reduce the potential for adverse impacts associated with commercial timber harvest when such harvest is planned within or adjacent to CH. In the final rule, the Service encourages land managers to consider the conservation of existing high-quality spotted owl habitat, the restoration of forest ecosystem health, and the ecological forestry management practices recommended in the Recovery Plan that are compatible with both the goals of spotted owl recovery and Standards and Guidelines of the Forest Plan.

The final revised CH designation is based on the current status and recent scientific research on spotted owl populations. The Service used the best scientific information available to identify those specific areas within the geographical area occupied by the species at the time it was listed on which are found those physical or biological features essential to the conservation of the species, and which may require special management considerations or protection. For the spotted owl, these features include particular forest types that are used or likely to be used by spotted owls for nesting, roosting, foraging, or dispersing habitat. In addition, the Service used the best available information to identify those areas that are otherwise determined to be essential to the conservation of the species.

Relying on the recovery criteria set forth in the Recovery Plan to determine what is essential to the conservation of the species the Service identified a habitat network that meets the following criteria:

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

The Service integrated habitat and demographic information relating to occupancy, survival, reproduction, and movement to develop a modeling tool that assesses the distribution of habitat quality and population dynamics across the range, and provides a more accurate picture of where

high-quality spotted owl habitat exists. This model synthesized more than 20 years of data from on-the-ground demographic surveys, and allowed for analysis of how spotted owl populations would fare under different habitat conservation scenarios. The Service determined what is essential to recovery of the spotted owl by evaluating the performance of each potential CH scenario considered against the recovery needs of the spotted owl.

1.6.2 Primary Constituent Elements (PCEs)

The PCEs in the final rule (77 FR 71876-72068) are described as: (i) forest types in early-, mid-, or late-seral stages that support the spotted owl across its geographical range, and that occur in concert with (ii) habitat that provides for spotted owl nesting and roosting; or (iii) habitat that provides for spotted owl foraging, which varies widely across the spotted owl's range, in accordance with ecological conditions and disturbance regimes that influence vegetation structure and prey species distributions; or (iv) habitat that supports the transience and colonization phases of spotted owl dispersal, which in all cases would optimally be composed of spotted owl nesting, roosting, or foraging habitat (PCEs ii or iii above), but which may also be composed of other forest types that occur between larger blocks of nesting, roosting, and foraging habitat.

1.6.3 Special considerations for PCEs in the action area (77 FR 71909-71910)

West Cascades/Coast Ranges of Oregon and Washington
Special management considerations or protection may be required in areas of moist forests to conserve or protect older stands that contain spotted owl sites or contain high-value spotted owl habitat. Silvicultural treatments are generally not needed to maintain existing old-growth forests on moist sites. In contrast to dry and mesic forests, short-term fire risk is generally lower in the moist forests that dominate on the west side of the Cascade Range, and occur east of the Cascades as a higher elevation band or as peninsulas or inclusions in mesic forests. Disturbance based management for forests and spotted owls in moist forest areas should be different from that applied in dry or mesic forests. Efforts to alter either fuel loading or potential fire behavior in these sites could have undesirable ecological consequences as well. Furthermore, commercial thinning has been shown to have negative consequences for spotted owls and their prey. Active management may be more appropriate in younger plantations that are not currently on a trajectory to develop old-growth structure. These stands typically do not provide high-quality spotted owl habitat, although they may occasionally be used for foraging and dispersal.

In general, to advance long-term spotted owl recovery and ecosystem restoration in moist forests in the face of climate change and past management practices, special management considerations or protections may be required that follow these principles as recommended in the 2011 Recovery Plan (USFWS 2011, p. III–18):

(1) Conserve older stands that have occupied or high-value spotted owl habitat as described in Recovery Actions 10 (includes all territories, occupied or not), and Recovery Action 32 (older, high quality, and more structurally complex stands that support spotted owl recovery). On Federal lands, this recommendation applies to all land-use allocations.

(2) 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 PBFs of spotted owl CH need to be minimized and reconciled with long-term ecosystem restoration goals.

(3) Continue to manage for large, continuous blocks of late-successional forest.

(4) 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.

These special management considerations or protections apply to Units 1, 2, 4, 5 and 6 of 2012 CH.

1.6.4 Conservation Role of Critical Habitat

Section 2 of the Act states, "The purposes of this Act are to provide a means whereby the ecosystems upon which endangered species and threatened species depend may be conserved. Although the conservation of the listed species is the specific objective of a CH designation, the essential physical or biological features that serve as the basis of CH are often essential components of the ecosystem upon which the species depends. In such cases, a fundamental goal of CH management is not only to conserve the listed species, but also to conserve the ecosystem upon which that species depends." This is the case with the spotted owl.

An ecosystem is defined as a biological community of interacting organisms and their physical environment, or as the complex of a community of organisms and its environment functioning as an ecological unit (Krebs 1972, pp. 10–11; Ricklefs 1979, pp. 31–32, 869). These ecosystem interactions and functions are often referred to as ecological relationships or processes. Thus, to conserve the spotted owl as directed by the Act, one must also conserve the ecological processes that occur within the ecological landscape inhabited by the species. These processes—such as vegetation succession, forest fire regimes, and nutrient cycling—create and shape the physical or biological features that form the foundation of CH. The spotted owl was initially listed as a threatened species largely due to the loss or degradation of the late-successional forest ecosystems upon which it depends. A complex interaction of physical or biological factors contribute to the development and maintenance of these ecosystems, which in turn provide the spotted owl with the environmental conditions required for its conservation and survival, such as large areas of suitable habitat, nest structures, and sufficient prey to sustain interconnected populations of spotted owls across the landscape. A *fundamental goal of CH management should thus be* to understand, describe, and conserve these processes, which in turn will maintain the physical or biological features essential to the conservation of the species. This ecosystem approach will ultimately have the highest likelihood of conserving listed species such as the spotted owl in the long term (Knight and Skagen1998, p. 43).

1.6.5 Current Condition of Critical Habitat

1.6.5.1 Range-wide: With the revision of spotted owl CH the Environmental Baseline has been

"reset" as of January 3, 2013. See Table 12 for a total of current suitable spotted owl habitat within each physiographic province and rangewide.

Table 5. Summary of Spotted Owl Critical Habitat NRF[1] Acres Removed or Downgraded as documented through Section 7 Consultations on NWFP Lands; Environmental Baseline and Summary of Effects By State, Physiographic Province and Land Use Function. (July 31 14:50:20 MDT 2014)

Physiographic Province[2]		Evaluation Baseline		Habitat Removed/Downgraded					% Provincial Baseline Affected	% Range-wide Effects
				Land Use Allocations[5]						
		Total Designated Critical Habitat Acres[3]	Nesting/Roosting Acres[4]	Reserves	Non-Reserves	Total	to Natural Events	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	18.07
	Cascades West	1,965,407	1,161,780	244	2,724	2,968	0	2,968	0.26	24.95
	Coast Range	1,151,874	535,602	1	1,132	1,133	0	1,133	0.21	9.53
	Klamath Mountains	911,681	481,577	1,292	1,102	2,394	2,941	5,335	1.11	44.85
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	5	16	21	0	21	0.00	0.18
Total		**9,577,342**	**4,590,308**	**2,718**	**6,236**	**8,954**	**2,941**	**11,895**	**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 Spotted Owl (USFWS 2011) as Recovery Units as depicted on page A-3.
3. Spotted owl CH as designated December 4, 2012 (77 FR 71876). Total designated CH 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.

1.6.5.2 Critical Habitat Unit West Cascades South: The proposed action for this consultation occurs within CH unit West Cascades South (WCS), subunits WCS-3 and WCS-4 (77 FR 71918). CH unit WCS contains 1,397,642 acres and comprises six subunits. This CH unit extends from the Columbia River south to the ridge separating the North Umpqua River and South Umpqua River watersheds. This CH unit was separated from the northern sections (West Cascades North and West Cascades Central) due to its relatively milder temperatures, reduced summer precipitation due to the influence of the Willamette Valley to the west, lower elevations, and greater proportion of western hemlock/Douglas-fir forest. The southern portion of this CH unit exhibits a gradient between Douglas-fir/western hemlock and increasing Klamath-like vegetation (mixed conifer/evergreen hardwoods), which continues across the Umpqua divide area. The southern boundary of this CH unit is novel and reflects a transition to mixed-conifer forest (Franklin and Dyrness 1988, pp. 23–24, 137–143). The importance of Douglas-fir dwarf mistletoe increases to the south in this CH unit, but most spotted owl nest sites are found in defective large trees, and occasionally nests of other raptors.

1.6.5.3 Critical Habitat Subunits Affected: All projects analyzed in this BO are in subunits 2, 3 or 4 of the WCS CH Unit (also referred to as Unit 6). Unit 6 contains 1,355,198 acres within its boundaries, including 209 acres of Oregon State Land; the remainder is in Federal ownership. It contains 6 subunits on the west side of the Oregon Cascades from the Columbia River south to the North Umpqua River.

1.6.5.4 WCS 3: This subunit contains about 319,736 acres in Clackamas, Marion, Linn and Lane Counties, Oregon. About 184 acres are on State lands managed primarily for recreation and the remainder is on federal lands managed by the BLM and FS. Table 13 shows the number of functional or non-functional spotted owl territories in subunits WCS 3 and WCS 4 by administrative unit. Functional spotted owl territories in this document are those which currently have $\geq$ 50% suitable habitat in their core area and $\geq$ 40% suitable habitat in their provincial home range as defined in the Owl Estimation Methodology (USFWS et al. 2008) and that have not been consulted on for harm to the nest site. Spotted owls may successfully fledge young in home ranges below these threshold levels, but the likelihood of this decreases as suitable habitat declines below threshold levels. WCS 3 contains 204 spotted owl territories of which 65% are at or above the threshold levels for functional home ranges. The remaining sites are below these threshold levels and are considered functionally impaired with respect to habitat needed for nesting success.

1.6.5.5 WCS 4: This subunit contains about 379,130 acres in Lane and Douglas Counties, Oregon. All acres are on Federal lands managed by the Willamette National Forest except for 76 acres managed by the Eugene BLM. WCS 4 contains 240 spotted owl territories of which 82% are at or above suitable habitat threshold levels for functional home ranges, accounting for past consultation on harm.

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