Biological Opinion
Regarding the Effects of Habitat Modification Activities
within Oregon
under the Safe Harbor Agreement for the
Northern Spotted Owl (*Strix occidentalis caurina*)

(FWS Reference Number 13420-2010-F-0155)

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

Paul Henson

Paul Henson, State Supervisor

7/26/10

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 activities described below that are proposed for implementation within the range of the northern spotted owl (*Strix occidentalis caurina*) (spotted owl) in Oregon, and their effects on the spotted owl , and spotted owl critical habitats (CH). 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.*).

This BO is based on the following major sources of information: the Programmatic Safe Harbor Agreement for the Northern Spotted Owl (Agreement); 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 BO on the NWFP (USFWS 1994); Status and Trends in Demography of Northern Spotted Owls, 1985-2003 (Anthony et al. 2006a); Scientific Evaluation of the Status of the Northern Spotted Owl (Courtney et al. 2004); Recovery Plan for the Northern Spotted Owl (USFWS 2008a); our files; and informal consultation between the USDA Natural Resources Conservation Service NRCS), and Service staff.

CONSULTATION HISTORY

For the programs of activities included in this consultation we estimated the number of actions, and the potential impacts of those actions, anticipated for completion in years 2010 - 2060. These estimates of potential impacts were based on currently identified projects, discussions with planners, and through assessments of projects completed in previous years. Proposed actions will be tracked yearly to monitor actions that modify spotted owl habitat. These monitoring reports are due to the Service yearly by December 31.

The Service, the Oregon Department of Forestry (ODF) and the NRCS prepared the proposed Agreement which was submitted as part of an enhancement of survival permit application on July 20, 2009. Formal consultation was officially initiated by this office on November 10, 2009. NRCS requested formal consultation for the HFRP's potential impacts on the spotted owl in Oregon on June 17, 2010.

BIOLOGICAL OPINION

1.0 DESCRIPTION OF THE PROPOSED ACTION

ODF applied to the Service for an enhancement of survival permit (permit) pursuant to the Endangered Species Act of 1973, as amended. The permit application includes a proposed programmatic safe harbor agreement (Agreement) between ODF, the NRCS, and the Service. The proposed term of the permit and Agreement is 50 years. The requested permit would authorize ODF to extend incidental take coverage with assurances through issuance of

Certificates of Inclusion to eligible landowners who are willing to carry out habitat management measures that would benefit the northern spotted owl (*Strix occidentalis caurina*), which is federally listed as threatened. The covered area or geographic scope of this Agreement includes non-federal forest lands within the range of the spotted owl in Oregon, which is estimated at about 9 million acres. However, we have set a limit of 50,000 acres (total) to be covered under this Agreement. State of Oregon statutes give ODF the authority to enter into Stewardship Agreements with landowners who wish to voluntarily improve fish and wildlife habitat and water quality. Stewardship Agreements provide regulatory certainty to landowners in complying with State forest practice requirements. The proposed Agreement is intended to compliment ODF's Stewardship Agreement program. All landowner's enrolled by ODF under the Agreement will have a site-specific Stewardship Agreement.

NRCS is a party to the Agreement in order to incorporate landowners participating in their Healthy Forest Reserve Program (HFRP). The HFRP is a new voluntary program established for the purpose of financing the restoration and enhancement forest ecosystems. The HFRP has been offered to landowners interested in promoting the recovery of threatened and endangered species, improving biodiversity, and enhancing carbon sequestration. There are two enrollment options with the HFRP: a 10-year restoration agreement and a permanent easement. Under a restoration agreement, participants can receive 50 percent of the cost of selected conservation practices. With a permanent easement, the HFRP pays 100 percent of the easement value and 100 percent of the cost of selected activities. Landowners continue to manage the land for timber production while maintaining habitat for spotted owls under the permanent easement. The HFRP is incorporated into the Agreement to provide an additional financial incentive for landowners to become a party to the Agreement. HFRP funds can be made available on an annual basis through a competitive process with states and landowners. However, the future availability of funding for the HFRP and the duration of this program will depend upon Congressional appropriations.

Since designated critical habitat for the spotted owl only includes Federal lands, the proposed action, covering only non-federal lands will have no effect on those lands. The proposed action includes all interrelated actions needed to plan, evaluate, survey, prepare and complete activities including, but not limited to, felling, bucking, hauling, post-harvest burning, and replanting.

1.1 **Definitions**

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

1.1.1 *Spotted Owls*

1.1.1.1 *Suitable habitat*: Consists of stands with sufficient structure (large trees, snags, and downed wood) to provide opportunities for spotted owl nesting, roosting, and foraging. Generally, these conditions are associated with conifer-dominated stands, 80 years old or older, multi-storied in structure, have trees greater than or equal to 18 inches diameter at breast height (dbh), and the canopy closure generally exceeds 60 percent. Stands are defined at a larger scale (i.e. province) as suitable based just on age or size (i.e. 80 years, >18") alone. The local biologist evaluates all project areas to make a final determination of habitat type based on the structural complexity associated with functioning nesting, roosting, and foraging habitat.

1.1.1.2 *Dispersal habitat*: Conifer and mixed mature conifer-alder (conifer <50%) stands with a canopy cover greater than or equal to 40 percent and trees greater than or equal to 11 inches average diameter at breast height dbh. Stands provide protection from avian predators and at least minimal foraging opportunities during dispersal. Dispersal habitat complexity may range from simplified managed stands with little or no structural diversity to more complex stands that contain some or all the habitat characteristics of suitable habitat.

1.1.1.3 *Breeding Period*: the breeding period for northern spotted owls is March 1 through September 30. The critical breeding period is March 1 through July 7.

1.1.1.4 *Known owl site*: A site that was or is occupied by a pair or resident single (1990 to present) as defined by the 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.

1.1.1.5 *Predicted spotted owl site*: An area able to support resident spotted owls (i.e. a potential breeding pair) as determined by the interagency occupancy template (USFWS et al. 2008). This is used for determining potential effects to spotted owls on Federal lands where survey data are insufficient and can be adapted for use on non-federal lands.

1.1.1.6 *Nest Patch (or stand)*: 300 meter radius circle around a point (known or predicted owl site), where a spotted owl would be likely to select a nesting tree (USFWS et al. 2008).

1.1.1.7 *Core area*: 0.5 mile radius circle around a known or predicted owl site, which delineates the area most heavily used during the nesting season (USFWS et al. 2008).

1.1.1.8 *Home Range*: An estimated area for habitat use of a spotted owl pair. For the Oregon Coast, the Oregon Cascades, and the Klamath Province, this estimate is a 1.5 mile radius circle, 1.2 mile circle, and 1.3 mile circle, respectively, around a known or predicted owl site (Thomas et al. 1990 and USFWS et al. 2008).

1.1.3 <u>*Disturbance/Disruption Distances*</u>
1.1.3.1 *Disturbance distance*: consists of the distance from the project boundary outward that would potentially cause a spotted owl, if one was present, to be distracted from its normal activity. Disturbance distances may increase or decrease according to the best available scientific information and site-specific conditions.

1.1.3.2 *Disruption distance*: consists of the distance from the project boundary outward that would potentially cause a spotted owl, if one was present, to be distracted from its normal activity to such an extent to significantly impact its normal behavior and create the likelihood of injury (harass). The disruption distance is a subset of the disturbance distance (Table 1).

Table 1. Disturbance and disruption distances for northern spotted owls during the breeding period (March 1 – September 30). Distances are measured from the edge of the 200 meter radius circle around the activity center to take into account alternate nest locations.

DISTURBANCE SOURCE	DISTURBANCE DISTANCES DURING THE BREEDING PERIOD (MAR 1 – SEP 30)	DISRUPTION DISTANCES DURING THE CRITICAL BREEDING PERIOD (MAR 1 – JUL 7)	DISRUPTION DISTANCES DURING THE LATE BREEDING PERIOD (JUL 8 – SEP 30)
Road brushing and maintenance on all roads	440 yards (0.25 mile)	0 yards	0 yards
Hauling on open roads	440 yards (0.25 mile)	0 yards	0 yards
Use of chainsaws	440 yards (0.25 mile)	65 yards	0 yards
Heavy equipment	440 yards (0.25 mile)	35 yards	0 yards
Tree climbing	440 yards (0.25 mile)	35 yards	0 yards
Burning	440 yards (0.25 mile)	440 yards (0.25 mile)	0 yards
Use of Type I helicopter [2]	880 yards (0.5 mile)	440 yards (0.25 mile)	440 yards (0.25 mile)
Use of Type II, III or IV helicopter [3]	440 yards (0.25 mile)	120 yards	0 yards
Use of fixed-wing aircraft	440 yards (0.25 mile)	120 yards	0 yards
Pile driving	440 yards (0.25 mile)	60 yards	0 yards
Rock crushing	440 yards (0.25 mile)	180 yards	0 yards

[1] Noise disturbance distances were developed from a threshold of 92 dB (USFWS 2003a). Smoke disturbance distances are based on a FWS white paper (USFWS 2007b).

[2] Type I helicopters seat at least 16 people and have a minimum capacity of 5,000 lbs. Both a CH-47 (Chinook) and UH-60 (Blackhawk) are Type I helicopters. Kmax helicopters are considered "other" for the purposes of disturbance. Sound readings from Kmax helicopter logging on the Olympic NF registered 86 dB at 150 yards (Piper 2006).

[3] All other helicopters (including Kmax).

If a known site is surveyed to protocol and it is determined that owls are not nesting at the site, ODF may determine that no disturbance or disruption would occur as a result of the proposed activities, and lift the associated restrictions on activities within disruption distances during the year of survey.

1.1.4 *Habitat Modification*

1.1.4.1 *Habitat maintained*: Refers to silvicultural activities that alter forest stand characteristics but maintain the components of spotted owl habitat within the stand such that spotted owls can continue to have their life history requirements supported (i.e., the functionality of the habitat remains intact post silvicultural activity).

For spotted owl suitable habitat a canopy cover of >40 percent along with other habitat elements (e.g. including snags, down wood, dominated by large overstory trees, tree-height class-diversity,

and older hardwoods) will be maintained post silvicultural activity to allow for management flexibility in improving future habitat quality and to provide for spotted owl nesting, roosting, and foraging within the stand in the short term.

Available scientific literature provides support for the finding that forest stands can be altered in a manner that is not necessarily expected to change the habitat function for spotted owls (e.g., Forsman et al. 1984, USFWS 2007). Examples of silvicultural activities that may fall into this category are light to moderate thinning, down salvage, individual tree removal, and prescribed burning.

1.1.4.2 *Habitat downgraded*: Refers to silvicultural activities that change spotted owl suitable habitat to dispersal habitat. Their post-treatment habitat either continues to support its original nesting/roosting function [*Maintain*] or it does not [*Remove*].

1.1.4.3 *Habitat Removal*: Alter spotted owl suitable or dispersal habitat so that it no longer supports nesting, roosting, foraging, or dispersal.

1.2 General Standards Applicable to the Proposed Activities

The proposed action includes all interrelated actions needed to plan, evaluate, survey, prepare and complete activities including, but not limited to, felling, bucking, hauling, post-harvest burning, and firewood sales. Descriptions of potential treatment types are described in Table 2. Additionally, the general standards listed below were used to design and evaluate the proposed activities. Together, these actions and standards constitute the proposed action.

1.2.1 *General Standards*

1) A forester and/or biologist would participate in the planning and design of all projects.
2) At the end of each calendar year, ODF will complete project implementation and monitoring forms to show actual levels of effects. These forms are to be forwarded to the Fish and Wildlife Service to fulfill the regulatory requirements of the ESA by documenting the actual effects to the subject species.
3) Monitoring will ensure that actual levels of effects do not exceed the levels anticipated by this assessment. If incidental take or adverse effects are anticipated to exceed authorized levels of take, ODF or NRCS shall inform the Service and the Service will evaluate the need to reinitiate formal consultation.

1.2.2 *Spotted Owl*

Except in the case of danger tree removal, the activity type *Individual Tree Removal* does not include the removal of (1) individual trees with owl nesting structure from areas where, in the opinion of the unit biologist, the loss of such a tree would limit nesting by owls or (2) known owl nest trees. In the case of danger tree removal, a known nest tree may be removed only when it is an immediate danger *and* when the tree is not currently being used by nesting owls or their young.

Table 2. Description of range of potential treatments associated with the proposed activities.

	DESCRIPTION
Regeneration Harvest	Regeneration harvest (including associated road construction, or creation of coarse woody debris and snags) is any cable, ground based, horse or helicopter operation that reduces the average stand canopy cover of a treatment unit to less than 40% in suitable owl habitat and less than 30% in dispersal habitat. Once completed, only seed trees, green-tree retention, snags, or coarse wood debris recruitment trees would likely remain standing. Habitat characteristics including canopy cover, roosting and nesting trees, foraging areas, and/or some large down woody material may be removed. This type of harvest may also be described as clear-cut, seed tree retention, shelter-wood cut or selective cut. *Unit of measure is acres harvested.*
Thinning	Heavy thinning harvest (including associated road construction, or creation of gaps, coarse woody debris and snags) is any cable, ground based, horse or helicopter operation that partially removes the over-story canopy cover. This type of activity maintains a minimum average canopy cover of 40 to 60% in suitable owl habitat and 30 to 40% in dispersal habitat throughout the treatment unit, and is intended to improve forest health or facilitate the development of structural characteristics of a stand.. See definition above). Heavy thinning may also be described as density management, selective cut, partial cut or mortality (standing) salvage. Light to moderate thinning maintains current habitat functionality after treatment (e.g. suitable habitat retains nesting, roosting, and foraging habitat components). Light to moderate thinning harvest (including associated road construction, or creation of gaps, coarse woody debris and snags) is any cable, ground based, horse or helicopter operation that partially removes the over-story canopy cover. Light to moderate thinning actions may also be described as commercial thinning, density management, selective cut, partial cut, or mortality (standing) salvage. *Unit of measure is acres thinned.*
Down Salvage	Salvage harvest is any cable, ground based, horse, or helicopter operation that removes large downed woody material. Salvage of landings and stems within the road prism is not considered habitat loss. *Unit of measure is acres salvaged.*
* Includes road construction, loading, yarding, hauling, and site preparation of burning or brushing, piling, and scarification, coarse woody debris and snag creation within timber sale units, any of which might take place over multiple years.	

1.3 **Action Area**

The action area is defined by 50 CFR 402 to mean "all areas to be affected directly or indirectly by the federal action and not merely the immediate area involved in the action." The action area includes those portions of forested private lands in Oregon within the known range of the spotted owl and extends from the Oregon Coast to the eastern portion of the Cascade mountains. The action area occurs within the Oregon counties of Clatsop, Columbia, Multnomah, Hood, Tillamook, Washington, Clackamas, Hood, Yamhill, Polk, Lincoln, Marion, Wasco, Jefferson, Benton, Linn, Lane, Deschutes, Coos, Douglas, Curry, Josephine, Jackson, and Klamath. We estimate this area to be about 11.8 million acres (USFWS 1992c), which includes non-forest areas.

2.0 **FRAMEWORK FOR JEOPARDY ANALYSES**

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 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.

3.0 STATUS OF THE NORTHERN SPOTTED OWL

3.1 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 (USFWS 1990a). The Service recovery priority number for the spotted owl is 6C, on a scale of 1C (highest) to 18 (lowest) (USFWS 1983a, 1983b, 2004a). This number reflects a high degree of threat, a low potential for recovery, and the owl's taxonomic status as a subspecies. The "C" reflects conflict with development, construction, or other economic activity. The spotted owl was originally listed with a recovery priority number of 3C, but that number was changed to 6C in 2004 during the 5-year review of the species (USFWS 2004a).

3.2 Life History

3.2.1 *Taxonomy*

The 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, Barrowclough et al. 1999, Haig et al. 2004), morphological (Gutiérrez et al. 1995), and biogeographic information (Barrowclough and Gutiérrez 1990). 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). Recent studies analyzing mitochondrial DNA sequences (Haig et al. 2004, Chi et al. 2004, Barrowclough et al. 2005) and microsatellites (Henke et al., unpubl. data) 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 Nevadas, appears to be stable (Barrowclough et al. 2005).

3.2.2 *Physical Description*

The spotted owl is a medium-sized owl and is the largest of the three subspecies of spotted owls (Gutiérrez et al. 1995). 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 USFWS 2008a). The 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). The spotted owl superficially resembles the barred owl (*Strix varia*), a species with which it occasionally hybridizes (Kelly and Forsman 2004). Hybrids exhibit physical and vocal characteristics of both species (Hamer et al. 1994).

3.2.3 *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 (USFWS 1990a). The range of the spotted owl is partitioned into 12 physiographic provinces (see Figure 1) based on recognized landscape subdivisions exhibiting different physical and environmental features (Thomas et al. 1993). 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 Mountains
- Three provinces in California: California Coast, California Klamath, California Cascades

The spotted owl is extirpated or uncommon in certain areas such as southwestern Washington and British Columbia. Timber harvest activities have eliminated, reduced or fragmented spotted owl habitat sufficiently to decrease overall population densities across its range, particularly within the coastal provinces where habitat reduction has been concentrated (Thomas and Raphael 1993).

3.2.4 *Behavior*

Spotted owls are territorial. However, home ranges of adjacent pairs overlap (Forsman et al. 1984, Solis and Gutiérrez 1990) suggesting that the area defended is smaller than the area used for foraging. 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). 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). Little is known about floaters other than that they exist and typically do not respond to calls as vigorously as territorial birds (Gutiérrez 1996).

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).

3.2.5 *Habitat Relationships*

3.2.5.1 *Home Range*. Home-range sizes vary geographically, generally increasing from south to north, which is likely a response to differences in habitat quality (USFWS 1990a). 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)) vary by province and range from 2,955 acres in the Oregon Cascades (Thomas et al. 1990) to 14,211 acres on the Olympic Peninsula (USFWS 1994b). Zabel et al. (1995) 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, Solis and Gutiérrez 1990), 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 (~20% of the home-range), often referred to as the core area (Bingham and Noon 1997). 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). 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, Sisco 1990).

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, Bart 1995).

3.2.5.2 *Habitat Use*. Forsman et al. (1984) 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, Forsman et al. 1984).

Roost sites selected by spotted owls have more complex vegetation structure than forests generally available to them (Barrows and Barrows 1978, Forsman et al. 1984, Solis and Gutiérrez 1990). These habitats are usually multi-layered forests having high canopy closure and large diameter trees in the overstory.

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, Hershey et al. 1998). 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, Buchanan et al. 1995, Hershey et al. 1998).

Foraging habitat is the most variable of all habitats used by territorial spotted owls (Thomas et al. 1990). Descriptions of foraging habitat have ranged from complex structure (Solis and Gutiérrez 1990) to forests with lower canopy closure and smaller trees than forests containing nests or roosts (Gutiérrez 1996).

3.2.5.3 *Habitat Selection.* 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). Forested stands with high canopy closure also provide thermal cover (Weathers et al. 2001) and protection from predators.

While spotted owls nest almost exclusively in trees, foraging habitat generally has attributes similar to those of nesting and roosting habitat, but such habitat may not always support successfully nesting pairs (USFWS 1992b). 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 (USFWS 1992b). Although Forsman et al. (2002) found that spotted owls could disperse through highly fragmented forest landscapes, the stand-level and landscape-level attributes of forests needed to facilitate successful dispersal have not been thoroughly evaluated (Buchanan 2004).

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, Diller and Thome 1999). 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). 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).

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).

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, Carey et al. 1990, Carey et al. 1992, Thomas et al. 1990). Glenn et al. (2004) 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) 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) 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, Franklin et al. 2000, Meyer et al. 1998). In Oregon Klamath Mountains and Western Oregon Cascade provinces, Dugger et al. (2005) 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). 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) 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. (2006a). Olson et al. (2004) 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) 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.

3.2.6 *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). 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, Franklin 1992, Forsman et al. 2002). 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 (USFWS 1990b, Forsman et al. 1984, Anthony et al. 2006a), and renesting after a failed nesting attempt is rare (Gutiérrez 1996). 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).

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). 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 (USFWS 1990a, Forsman et al. 1984). 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). Telemetry and genetic studies indicate that close inbreeding between siblings or parents and their offspring is rare (Haig et al. 2001, Forsman et al. 2002).

3.2.7 *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). Natal dispersal occurs in stages, with juveniles settling in temporary home ranges between bouts of dispersal (Miller et al. 1997, Forsman et al. 2002). The median natal dispersal distance is about 10 miles for males and 15.5 miles for females (Forsman et al. 2002). Dispersing juvenile spotted owls experience high mortality rates, exceeding 70 percent in some studies (USFWS 1990a, Miller 1989). Known or suspected causes of mortality during dispersal include starvation, predation, and accidents (Miller 1989, USFWS 1990a, Forsman et al. 2002). Parasitic infection may contribute to these causes of mortality, but the relationship between parasite loads and survival is poorly understood (Hoberg et al. 1989, Gutiérrez 1989, Forsman et al. 2002). 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).

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). 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). 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).

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). Breeding dispersal distances were shorter than natal dispersal distances and also are apparently random in direction (Forsman et al. 2002).

3.2.8 *Food Habits*

Spotted owls are mostly nocturnal, although they also forage opportunistically during the day (Forsman et al. 1984, Sovern et al. 1994). 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) in Washington and Oregon, while dusky-footed wood rats

(*Neotoma fuscipes*) are a major part of the diet in the Oregon Klamath Mountains, California Klamath, and California Coastal provinces (Forsman et al. 1984, 2001, 2004, Ward et al. 1998, Hamer et al. 2001). 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, 2004, Ward et al. 1998, Hamer et al. 2001).

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). For example, Rosenberg et al. (2003) 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). Ward (1990) 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. 1984, 2001, 2004).

3.2.9 *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). 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).

Annual variation in population parameters for spotted owls has been linked to environmental influences at various life history stages (Franklin et al. 2000). 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), 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). Annual variation in breeding may be related to weather (i.e., temperature and precipitation) (Wagner et al. 1996 and Zabel et al. 1996 *In*: Forsman et al. 1996) and fluctuation in prey abundance (Zabel et al. 1996).

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). Specifically, weather could have increased negative effects on spotted owl fitness for those owls occurring in relatively lower quality habitat (Franklin et al. 2000). 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).

Olson et al. (2005) 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.

3.3 **Threats**

3.3.1 *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" (USFWS 1990a: 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 (USFWS 1992b). These threats were characterized for each province as severe, moderate, low or unknown (USFWS 1992b) (The range of the spotted owl is divided into 12 provinces from Canada to northern California and from the Pacific Coast to the eastern Cascades; see Figure 1). 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). However, great horned owls (*Bubo virginianus*), an effective predator on spotted owls, are closely associated with fragmented forests, openings, and clearcuts (Johnson 1992, Laidig and Dobkin 1995). As mature forests are harvested, great horned owls may colonize fragmented forests, thereby increasing spotted owl vulnerability to predation.

3.3.2 *New Threats*

The Service conducted a 5-year review of the spotted owl in 2004 (USFWS 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 2004:11-7)
- "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% of the range-wide habitat base over a 10-year period)." (Courtney and Gutiérrez 2004:11-8)
- "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 2004:11-8)

3.3.2.1 *Barred Owls*. With its recent expansion to as far south as Marin County, California (Gutiérrez et al. 2004), the barred owl's range now completely overlaps that of the spotted owl. Barred owls may be competing with spotted owls for prey (Hamer et al. 2001) or habitat (Hamer et al. 1989, Dunbar et al. 1991, Herter and Hicks 2000, Pearson and Livezey 2003). In addition, barred owls physically attack spotted owls (Pearson and Livezey 2003), and circumstantial evidence strongly indicated that a barred owl killed a spotted owl (Leskiw and Gutiérrez 1998). 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, Pearson and Livezey 2003, Olson et al. 2005). It is widely believed, but not conclusively confirmed, that the two species of owls are competing for resources. 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 quantitatively evaluate 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 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 1988, Iverson 1993). However, recent studies conducted in the Pacific Northwest show that barred owls frequently use mature and old-growth forests (Pearson and Livezey 2003, Gremel 2005, Schmidt 2006). 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).

The only study comparing spotted owl and barred owl food habits in the Pacific Northwest indicated that barred owl diets overlap strongly (76 percent) with spotted owl diets (Hamer et al. 2001). However, barred owl diets are more diverse than spotted owl diets and include species associated with riparian and other moist habitats, along with more terrestrial and diurnal species (Hamer et al. 2001).

The presence of barred owls has been reported to reduce spotted owl detectability, site occupancy, reproduction, and survival. Olson et al. (2005) 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. 2003:51). Pearson and Livezey (2003) 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) 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) 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.

Olson et al. (2004) 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) was unfounded because of small sample sizes (Livezey 2005). 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 USFWS 2008a). Anthony et al. (2006a) 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.

In a recent analysis of more than 9,000 banded spotted owls throughout their range, only 47 hybrids were detected (Kelly and Forsman 2004). 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 2004:808).

The preponderance of 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, Olson et al. 2005). 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 spotted owls have been already fully realized" (Gutiérrez et al. 2004:7-38).

3.3.2.2 *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. Bond et al. (2002) 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). In a preliminary study conducted by Anthony and Andrews (2004) in the Oregon Klamath Mountains 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). 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. 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). 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 further understand the relationship between fire and spotted owl habitat use.

At the time of listing there was recognition that large-scale wildfire posed a threat to the spotted owl and its habitat (USFWS 1990a). 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) 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). 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). 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).

3.3.2.3 *West Nile Virus.* West Nile virus (WNV) has killed millions of wild birds in North America since it arrived in 1999 (McLean et al. 2001, Caffrey 2003, Marra et al. 2004). 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, Komar et al. 2001). Recent tests of tree squirrels from Los Angeles County, California, found over 70 percent were positive for WNV (R. Carney, pers. comm., cited in USFWS 2004). 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), but it is unknown how WNV will ultimately affect spotted owl populations. Susceptibility to infection and mortality rates of infected individuals vary among bird species, even within groups (Courtney et al. 2004). Owls appear to be quite susceptible. For example, breeding Eastern screech owls (*Megascops asio*) in Ohio experienced 100 percent mortality (T. Grubb, pers. comm., cited in Courtney et al. 2004). Barred owls, in contrast, showed lower susceptibility (B. Hunter, pers. comm., cited in Courtney et al. 2004). 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.

Courtney et al. (2004) offer competing propositions for the likely outcome of spotted owl populations being infected by WNV. One proposition 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 proposition 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, spotted owls has been recorded; however, WNV is a potential threat of uncertain magnitude and effect (Courtney et al. 2004).

3.3.2.4 *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. 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). 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). It has been found in several different forest types and at elevations from sea level to over 800 m. 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).

3.3.2.5 *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, Haig et al. 2004, Henke et al. unpublished). However, in Canada, the breeding population is estimated to be less than 33 pairs and annual population decline may be as high as 35 percent (Harestad 2004). It is possible (but not necessarily the case) that the 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). 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.

3.3.2.6 *Climate Change.* Climate change, a potential additional threat to spotted owl populations, is not explicitly addressed in the NWFP. Climate change could have direct and indirect impacts on spotted owls and their prey. However, the emphasis on maintenance of seral stage complexity and related organismal diversity in the Matrix under the NWFP should contribute to the resiliency of the Federal forest landscape to the impacts of climate change (Courtney et al. 2004). There is no indication in the literature regarding the direction (positive or negative) of the threat.

Based upon a global meta-analysis, Parmesan and Yohe (2003) discussed several potential implications of global climate change to biological systems, including terrestrial flora and fauna. Results indicated that 62 percent of species exhibited trends indicative of advancement of spring conditions. In bird species, trends were manifested in earlier nesting activities. Because the spotted owl exhibits a limited tolerance to heat relative to other bird species (Weathers et al. 2001), subtle changes in climate have the potential to affect this. However, the specific impacts to the species are unknown.

3.3.2.7 *Disturbance-Related Effects.* 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 Skagen 1988). 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.

Although 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) and helicopter overflights can reduce prey delivery rates to nests (Delaney et al. 1999). 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, Andersen et al. 1989, McGarigal et al. 1991).

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). 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, Saplosky et al. 2000). In avian species, the secretion of corticosterone is the primary non-specific stress response (Carsia and Harvey 2000). The quantity of this hormone in feces can be used as a measure of physiological stress (Wasser et al. 1997). Recent studies of fecal corticosterone levels of spotted owls indicate that low intensity noise of short duration and minimal repetition does not elicit a physiological stress response (Tempel and Gutiérrez 2003, Tempel and Gutiérrez 2004). However, prolonged activities, such as those associated with timber harvest, may increase fecal corticosterone levels depending on their proximity to spotted owl core areas (see Wasser et al. 1997, Tempel and Gutiérrez 2004).

Post-harvest fuels treatments may also create above-ambient smoke or heat. Although it has not been conclusively demonstrated, it is anticipated that nesting spotted owls may be disturbed by heat and smoke intrusion into the nest grove.

3.4 **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:

3.4.1 *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 distributed across a variety of ecological conditions within the spotted owl's range to reduce risk of local or widespread extirpation;

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

3. 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

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

3.4.2 *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 better understand 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.

3.4.3 *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 (USFWS 1992b), the Draft Recovery Plan (USFWS 1992c), 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 and USDI 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.

3.4.4 *Federal Contribution to Recovery – NWFP (Conservation Strategy for the spotted owl).*
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 and USDI 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 was designed around reserve/connectivity functions that are expected to be achieved through a variety of land use allocations (LUAs). Each LUA has a distinct set of Standards and Guidelines that established goals and directs management actions that are consistent with NWFP expectations for ensuring appropriate management of reserves (large blocks) of late-successional and old-growth forest habitat to support multiple pairs of nesting owls and for connectivity between reserves in the intervening matrix. LUAs in the plan that are designed to support or contribute to supporting population clusters are: 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 may, in the short-term, contribute demographic support but is

designed 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 and USDI 1994a, USFWS 1994a)) which would persist into future managed timber stands.

The NWFP with its range-wide system of LSRs was based on work completed by three previous studies (Thomas et al. 2006): the 1990 Interagency Scientific Committee (ISC) Report (Thomas et al. 1990), the 1991 report for the Conservation of Late-successional Forests and Aquatic Ecosystems (Johnson et al. 1991), and the 1993 report of the Scientific Assessment Team (Thomas et al. 1993). In addition, the 1992 Draft Recovery Plan for the Northern Spotted Owl (USFWS 1992c) 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, USDA and USDI 1994a, 1994b). Based on the results of the first decade of monitoring, Lint (2005) 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, Noon and Blakesley 2006). Bigley and Franklin (2004) 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).

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. 2006a) 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, Lint 2005). Even with the population decline, Courtney et al. (2004) 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 spotted owl population declines, indicates that the spotted owl continues to meet the definition of a threatened species (USFWS 2004). 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.

3.4.5 *Northern Spotted Owl Recovery Plan.*
In May, 2008, the Service published the 2008 Final Recovery Plan for the Northern Spotted Owl (USFWS 2008a). The recovery plan identifies that competition with barred owls, ongoing loss of suitable habitat as a result of timber harvest and catastrophic fire, and loss of amount and distribution of suitable habitat as a result of past activities and disturbances are the most important range-wide threats to the spotted owl (USFWS 2008a). To address these threats, the present recovery strategy has the following three essential elements: barred owl control, dry-forest landscape management strategy, and managed owl conservation areas (MOCAs) (USFWS 2008a). The recovery plan lists recovery actions that address research of the competition between spotted and barred owls, experimental control of barred owls to better understand the impact the species is having on spotted owls, and, if recommended by research, management of barred owls (USFWS 2008a). The foundation of the plan for managing forest habitat in the non-fire-prone western Provinces of Washington and Oregon is the MOCA network on Federal lands, which are intended to support stable and well-distributed populations of spotted owls over time and allow for movement of spotted owls across the network (USFWS 2008a).

On the fire-dominated east side of the Cascade Mountains in Washington and Oregon, and the California Cascades, the dry-forest habitat management strategy is intended to maintain spotted owl habitat in an environment of frequent natural disturbances (USFWS 2008a). Additionally, the recovery plan identifies Conservation Support Areas (CSAs) in Washington, the west side of the Cascades in Oregon, and in California. These CSAs are located on private, State, and Federal lands and are expected to support the MOCA network and the dry-forest landscape management approach (USFWS 2008a). In addition, the recovery plan recommends a research and monitoring program be implemented to track progress toward recovery, inform changes in recovery strategy by a process of adaptive management, and ultimately determine when delisting is appropriate (USFWS 2008a). The three primary elements of this program include 1) the monitoring of spotted owl population trends, 2) an inventory of spotted owl distribution, and 3) a comprehensive program of barred owl research and monitoring (USFWS 2008a). The recovery plan estimates that recovery of the spotted owl could be achieved in approximately 30 years (USFWS 2008a).

3.4.6 *The effect of barred owls on NWFP Implementation.*
The Service believes that the NWFP and the Spotted Owl Recovery Plan provides the backbone of the federal contribution to spotted owl recovery even with the uncertainty surrounding the effect of barred owls on spotted owls.

3.4.6.1 *Reserve Network.* The most important aspect of NWFP and the Recovery Plan for spotted owls are the substantial forest reserves and related management standards. These reserves are separated by matrix habitat (suitable for dispersal and some breeding) and non-federal lands (which also have some roles as breeding and dispersal habitats). Invasion of protected reserves (such as the Olympic National Park area) by barred owls may lead to the loss of some conservation function of the reserve network. For example, Schmidt (2003) reported a decline of spotted owls in one such reserve in northern California. Pearson and Livezey (2003)

established that the density of barred owls was highest in Gifford Pinchot National Forest LSRs and other reserve areas and lower in areas subject to harvest. Annual reports by Anthony et al. (2006b, 2006c) in both the central and southern Oregon Cascades show continued annual declines in spotted owl pair occupancy in the major land-use allocations of LSR, Adaptive Management Areas (AMA) and Matrix, while barred owl frequency is increasing, although the latter information is not presented by land-use allocation. No information is provided in terms of spotted owl survival by land-use allocation.

The inability of a reserve strategy, which comprises 80 percent of the NWFP Federal land base (USDA and USDI 1994b), to deal with invasive species such as the barred owl is a concern. If late-successional reserves fail to protect breeding populations of spotted owls, then the overall conservation strategy for the species is could be based on an untenable premise and may be questionable. The above data suggests that reserves are insufficient protection against invasive owls, and other habitat management options, such as increased habitat protection (although see habitat discussion below) outside reserves may not have an additive affect helping spotted owl populations against barred owls. It is recognized however, that the NWFP has made important conservation contributions, and without the plan the situation of spotted owls would be far bleaker.

3.4.6.2 *Dispersal-Matrix Habitat.* The NWFP provision of dispersal habitat in the matrix is an important component of long-term spotted owl conservation. Management of matrix habitat (15 percent of the NWFP federal land base) has been of lower impact on spotted owls than anticipated (Courtney et al. 2004, Lint 2005), yet decline in spotted owl populations are occurring in some areas. The NWFP provided for some protection of spotted owl nesting and foraging habitat within the matrix (e.g., reserves around know nest sites) as well as maintenance of general conditions within the matrix that would facilitate dispersal of spotted owls and recovery of spotted owl habitat following logging (e.g., variable retention harvesting). For these reasons, spotted owls are likely using matrix habitat more than anticipated as a consequence of lack of harvest activity in the matrix. However, the long-term suitability of matrix areas under a fully-implemented NWFP is impossible to assess at this point (Courtney et al. 2004) and dispersal remains a difficult topic to study (Buchanan 2004).

Because dispersal habitat in the matrix is important for spotted owl conservation and if barred owls now occupy matrix habitat, one suggestion is that such areas may be less suitable for dispersal of young spotted owls, due to both direct antagonism (and possibly predation) and indirect inhibition (Courtney et al. 2004). An alternative view, and tenable under the current understanding of dispersal dynamics of spotted owls (Forsman et al. 2002), is that barred owl presence in matrix habitat may promote a more rapid dispersal of juvenile spotted owls through lower quality habitat. If barred owls exclude spotted owls, then spotted owls will likely spend less time in matrix habitat occupied by barred owls. If this were accomplished without reduced survivorship of spotted owls, there might be few or no negative consequences of barred owls occupying matrix habitat (Courtney et al. 2004).

Barred owls are known to use a wide variety of forest types, including early successional habitats, and some authors have suggested that timber harvest activities may favor the species (Hamer 1988, Iverson 1993, Pearson and Livezey 2003). For instance, fragmentation of forest

habitat may have created favorable conditions for survival and reproduction. By contrast, spotted owls appear to be more generally associated with old growth forest or forests that are structurally complex over a greater part of the species' range (Courtney et al. 2004). Under such conditions, timber harvest may have increased interpolation and contact of the two species' preferred and potential habitats, leading to increased competition between the species. Hicks et al. (2001) have attempted to examine this hypothesis in the northern part of the range by determining the amounts of different habitat types surrounding spotted owl territories that both have and have not been invaded by barred owls. Their results (Hicks et al. 2001) detected no effect of surrounding habitat on the probability of replacement. Also, under the Plum Creek HCP, harvest was deferred for areas of nesting, roosting and foraging habitat around 30 productive spotted owl sites. After six years, only 10 sites had any spotted owl presence – this rate of decline is very similar to that seen at other areas where timber harvest occurred. These results suggest something other than timber harvest is influencing occupancy in this location, although, overall, it is unclear if forest management affects the outcome of the interaction between the two species (Courtney et al. 2004, Chapter 8).

It is also clear that, in some portions of the spotted owl's range, barred owls are increasing and spotted owls are declining to some degree independently of forest management history in the area. For example, the population of spotted owls has decreased on both the Plum Creek Cascades HCP area (with extensive harvest) and nearby reserve areas without harvest (Courtney et al. 2004). Similarly, barred owls are increasing while spotted owls are declining throughout the Olympic peninsula in both industrial and national forest land, but also in the unharvested areas of the National Park (Anthony et al. 2006a). On the Gifford Pinchot National Forest in Washington, the density and impact of barred owls appears higher in areas without timber harvest (Pearson and Livezey 2003). Although there is a strong overall correlation between barred owl increases and spotted owl declines, many historical spotted owl sites are not currently known to be occupied by either species (Wiedemeier and Horton 2000, Herter and Hicks 2000). Large numbers of truly vacant sites are not to be expected if the main cause of spotted owl decline is barred owl invasion and pre-emption of suitable sites (Courtney et al. 2004). Habitat loss to timber harvest is often postulated to be a major factor in spotted owl decline, but habitat is still present in the study areas (indeed some areas where spotted owls are in the worst decline, such as Olympic National Park, have never been harvested). Further, these results are not inconsistent with other factors that are known to negatively affect spotted owls. For example, Franklin et al. (2000) predicted, based on past weather data that there could be long periods of decline in a spotted owl population due solely to weather effects.

The Reserve and Matrix strategy of the NWFP has been successful in that spotted owl populations are persisting, and (largely) performing as predicted (Courtney et al. 2004). Continued cutting of spotted owl suitable habitat, in absence of a NWFP, might have accelerated the decline of the species and, possibly, facilitated more rapid displacement or occupation of vacated habitat by barred owls. However, the provision of suitable habitat for spotted owls was an essential contribution of the NWFP but has not protected it from competition from the invasive and highly competitive barred owl. At present, based on the habitat use patterns of both species and what little is known of interspecific competition, it is unclear whether additional habitat protection would improve conditions from the spotted owl.

3.4.6.3 *Spotted Owl Population Declines and NWFP.* Anthony et al. (2006a) noted precipitous declines in adult spotted owl populations on all four study areas in Washington. In northern Oregon, spotted owl population declines were noted in all three of the study areas, although the declines were generally less than those in Washington (Anthony et al. 2006a). The spotted owl has continued to decline in the northern portion of its range, despite the presence of a high proportion of protected habitat on Federal lands in that area. Although Courtney et al. (2004) indicate that the population decline of the spotted owl over the last 14 years was expected, they conclude that the greater than expected downward trends in certain study areas in Washington where little timber harvest was taking place suggest that something other than timber harvest is responsible for the recent decline. Anthony et al. (2006a) stated that determining the cause of this decline was beyond the scope of their study, and that they could only speculate among the numerous possibilities including: competition from barred owls, loss of habitat from wildfire, timber harvest including lag effects from prior harvest, poor weather conditions, and defoliation from insect infestations. Not unexpectedly, considering the fact that the spotted owl is a predator species, Anthony et al. (2006a) also noted the complexities of the relationships of prey abundance on predator populations, and identified declines in prey abundance as another possible reason for declines in apparent survival of spotted owls.

In southern Oregon and northern California, spotted owl populations are more stationary than in Washington (Anthony et al. 2006a) despite the fact that more timber harvest is taking place in these areas than in areas experiencing greater than expected declines. The fact that spotted owl populations in some portions of the range were stationary was not expected within the first ten years, given the general prediction of continued declines in the population over the first several decades of NWFP implementation (Lint 2005). The cause of the better demographic performance on the southern Oregon and northern California study areas, and the cause of declines in the Washington study areas are both unknown (Anthony et al. 2006a). Although population declines in the Washington demographic areas exceeded anticipated levels, Courtney et al. (2004) noted that a range-wide decline in the spotted owl population was not unexpected during the first decade, and that the observed range-wide population change during this period was not a reason to doubt the effectiveness of the core NWFP conservation strategy. It is clear that there is no simple correlation with timber harvest patterns (AFRC 2004), and barred owl invasion is certainly a viable hypothesis for this regional pattern (Courtney et al. 2004).

The synergistic effects of past threats and new threats are unknown. Although, the science behind the NWFP appears valid, new threats from barred owls, and potential threats from West Nile Virus and Sudden Oak Death may result in spotted owl populations in reserves falling to lower levels (and potentially at a faster rate) than originally anticipated, which would further retard spotted owl recovery (Courtney et al. 2004). According to the USFWS (2004), the current scientific information, including that showing the declines in Washington and northern Oregon, and Canada, indicate that the spotted owl continues to meet the definition of a threatened species. Populations are still relatively numerous over most of the species' historic range, which suggests that the threat of extinction is not imminent, and that the subspecies is not endangered even in the northern part of its range where greater than expected population declines were documented (USFWS 2004). The USFWS (2004) did not consider the increased risk to spotted owl populations due to the uncertainties surrounding barred owls and other factors sufficient to reclassify the species to as endangered at this time. However, a problem in assessing this decline

is that we lack a strong benchmark to know whether this decline is greater or less than that predicted under NWFP (Courtney et al. 2004).

A complication noted by some biologists in studying spotted owls is their belief that spotted owls are silent in the presence of barred owls (Olson et al. 2005, Crozier et al. 2006). Hence, an area may be recorded as vacated by spotted owls, when in fact the birds are merely unresponsive to surveyors' calls. Evidence contradictory to this hypothesis comes from the meta-analysis, where, if this scenario were true, we would expect to observe a decline in recapture rates for banded spotted owls in areas where barred owls are increasing, but this does not seem to be the case for any study area (Anthony et al. 2006a).

Given the observed inverse correlations of some barred owl and spotted owl population trends, it is important to evaluate the relative effects of interspecific competition as a cause of spotted owl decline, as compared to other factors such as habitat loss. Historically, much of the observed loss of old-growth habitat occurred well before barred owls arrived in the region. Hence, there must have been substantial effects of habitat loss on spotted owl populations prior to the period 1965 to 1980 (when the barred owl arrived in western states). However, the arrival of the barred owl has introduced a new threat.

Previous estimates of spotted owl demographic parameters in 1994 (Burnham et al. 1994) and 1998 (Franklin et al. 1999) have produced substantial evidence that some populations at least are in decline. Of particular concern was the 1994 meta-analysis result that there was an accelerating rate of adult female mortality over the period study for the various demographic study areas. This trend was not apparent in the 1998 meta-analysis although some populations apparently were declining. Although habitat loss is one plausible explanation for such population trends, an alternative explanation is that barred owl invasion has been depressing spotted owl survival and reproduction. Recent studies have shown strong effects (Franklin et al. 2000) and relatively weak effects (Olsen et al. 2005) of some habitat conditions on spotted owl survival and reproduction. In demographic study areas where barred owls have been present the longest, and have been increasing through time, Anthony et al. (2006a) noted strong evidence for negative effect of barred owl on survival on the Olympic and Wenatchee, weak evidence for a barred owl effect on survival on the Cle Elum, but no effect of barred owls on fecundity on any demographic study population. Even a low level of competition may contribute to depressed demographic parameters.

Demographic data collected over 15 years document declining populations across the species range with the most pronounced declines in British Columbia, Washington, and northern Oregon. This area of pronounced decline constitutes approximately 50 percent of the geographic range of the spotted owl, but supports about 25 percent of all known spotted owl activity centers, and contains approximately 25 percent of all spotted owl habitat, greater than 90 percent of which is federally managed. These declines in Washington and northern Oregon demographic study areas, as well as Canada, indicate the spotted owl meets the definition of a threatened species. However, populations are still relatively numerous over most of the species historic range, suggesting the threat of extinction is not imminent, and the subspecies in not "endangered" even in the northern part of the range where the demographic results are least promising (USFWS 2004, p. 54)

In summary, a decline of spotted owl populations under the NWFP during the past decade was anticipated; however, Anthony et al. (2006a) and Courtney et al. (2004) identified greater than expected spotted owl population declines in Washington and northern portions of Oregon, and more stationary populations in southern Oregon and northern California. These reports did not find a direct correlation between habitat conditions and changes in spotted owl populations, and they were inconclusive as to the cause of the declines. Lag effects from prior harvest of suitable habitat, competition with barred owls, and habitat loss due to wildfire were identified as current threats. Complex interactions are likely among the various factors. The status of the spotted owl population, and increased risk to spotted owl populations due to uncertainties surrounding barred owls were reported as not sufficient to reclassify the species to endangered at this time. Similarly, the reports did not identify cause for changing the basic conservation strategy in the NWFP.

3.4.7 *Conservation Efforts on Non-federal Lands.*
In the report from the Interagency Scientific Committee (Thomas et al. 1990), the draft recovery plan (USFWS 1992c), and the report from the Forest Ecosystem Management Assessment Team (Thomas and Raphael 1993), 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 (USFWS 2008a, page 55). 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 or completed Habitat Conservation Plans (HCPs) that have incidental take permits issued for spotted owls—eight in Washington, three in Oregon, and four in California. The HCPs range in size from 40 acres to more than 1.6 million acres, although not all acres are included in the mitigation for spotted owls. In total, the HCPs cover approximately 2.9 million acres (9.1 percent) of the 32 million acres of non-federal forest lands in the range of the spotted owl. The period of time that the HCPs will be in place ranges from 5 to 100 years; however, most of the HCPs are of fairly long duration. While each HCP 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 suitable habitat
- Forest management that maintains or develops dispersal habitat
- Deferral of harvest near specific sites

3.4.7.1 *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, Buchanan et al. 1994). 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). Spotted owl-related HCPs in Washington generally were intended to provide demographic or connectivity support (USFWS 1992c).

3.4.7.2 *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). 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.

3.4.7.3 *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). 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). 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 authorizing take of spotted owls have been approved; these HCPs cover more than 669,000 acres of non-Federal lands. Implementation of these plans is intended to provide for spotted owl demographic and connectivity support to NWFP lands.

3.5 **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 (USFWS and USDC NMFS 1998).

3.5.1 *Range-wide Habitat and Population Trends.*

3.5.1.1 *Habitat Baseline.* The 1992 Draft Spotted Owl Recovery Plan estimated approximately 8.3 million acres of spotted owl habitat remained range-wide (USFWS 1992c). Reliable habitat baseline information for non-federal lands has been lacking (Courtney et al. 2004). Raphael (2006) most recently reported that there are approximately 7 million acres of higher suitability spotted owl habitat in Washington, Oregon, and California. Oregon had about 2.6 million acres of this total. The Service has used information provided by the Forest Service, Bureau of Land Management, and National Park Service to update the habitat baseline conditions on Federal lands for spotted owls on several occasions since the spotted owl was listed in 1990. The estimate of 7.4 million acres used for the NWFP in 1994 (USDA and USDI 1994a) was believed to be representative of the general amount of spotted owl habitat on these lands. This baseline has been used to track relative changes over time in subsequent analyses on Federal lands.

In 2005 a new map depicting suitable spotted owl habitat throughout the range of the spotted owl was produced as a result of the NWFP's effectiveness monitoring program (Lint 2005). However, the spatial resolution of this new habitat map currently makes it unsuitable for tracking habitat effects at the scale of individual projects. The Service is evaluating the map for future use in tracking habitat trends. Additionally, there continues to be no reliable estimates of spotted owl habitat on non-federal lands; consequently, consulted-on acres can be tracked, but not evaluated in the context of change with respect to a reference condition on non-federal lands. The production of the monitoring program habitat map does, however, provide an opportunity for future evaluations of trends in non-federal habitat.

3.5.1.2 *NWFP Lands Analysis 1994 – 2001.* In 2001, the Service conducted an assessment of habitat baseline conditions, the first since implementation of the NWFP (USFWS 2001). This range-wide evaluation of habitat, compared to the FSEIS, was necessary to determine if the rate of potential change to spotted owl habitat was consistent with the change anticipated in the NWFP. In particular, the Service considered habitat effects that were documented through the section 7 consultation process since 1994. In general, the analytical framework of these consultations focused 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 spotted owl habitat within those land-use allocations. The Service determined that actions and effects were consistent with the expectations for implementation of the NWFP from 1994 to June, 2001 (USFWS 2001).

3.5.1.3 *Range-wide Analysis from 1994 to June 24, 2010.* This section updates the information considered in USFWS (2001), relying particularly on information in documents the Service produced pursuant to section 7 of the Act and information provided by NWFP agencies on habitat loss resulting from natural events (e.g., fires, windthrow, insect outbreaks, and disease). To track impacts to spotted owl habitat, the Service designed the Consultation Effects Tracking System database which records impacts to spotted owls and their habitat at a variety of spatial and temporal scales. Data are entered into the database under various categories including, land management agency, land-use allocation, physiographic province, and type of habitat affected.

In 1994, about 7.4 million acres of suitable spotted owl habitat were estimated to exist on Federal lands managed under the NWFP. As of June 24, 2010, the Service had consulted on the proposed removal and had natural events resulting in the loss of approximately 394,749 acres (Table 3) or 5.36 percent of 7.4 million acres of spotted owl suitable habitat on Federal lands. Of the total Federal acres consulted on for removal, approximately 238,352 acres[1] (Table 4) or 3.22 percent of 7.4 million acres of spotted owl habitat were removed as a result of timber harvest. These changes in suitable spotted owl habitat are consistent with the expectations for implementation of the NWFP (USDA and USDI 1994a).

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

[1] Due to the query type and combination of data categories in the NWFP and Section 7 Consultation Effects Tracker system, the NWFP subtotal for removed/downgraded in Table 3 is 11,497 acres greater than the NWFP land use allocation removed/downgraded totals (Reserves and Non-reserves) in Table 3.

management activities and natural events are not provided here, but can be calculated using the Service's Consultation Effects Tracking system.

Habitat loss from Federal lands due to management activities has varied among the individual provinces with most of the impacts concentrated within the Non-Reserve relative to the Reserve land-use allocations (Table 3). When habitat loss is evaluated as a proportion of the affected acres range-wide, the most pronounced losses have occurred within Oregon (84.24%), especially within its Klamath (49.99%) and Western Cascades (24.07%) Provinces (Table 3), followed by much smaller habitat losses in Washington (7.51%) and California (8.25%) (Table 3). When habitat loss is evaluated as a proportion of provincial baselines, the Oregon Klamath Mountains (25.10%), Oregon Eastern Cascades (7.99%), and the California Cascades (5.45%) all have proportional losses greater than the range-wide mean (5.36%)(Table 3).

From 1994 through June 24, 2010, habitat lost due to natural events was estimated at approximately 167,894 acres (range-wide)(Table 3). About two-thirds of this loss was attributed to the Biscuit Fire that burned over 500,000 acres in southwest Oregon (Rogue River basin) and northern California in 2002. This fire resulted in a loss of approximately 113,451 acres of spotted owl habitat, including habitat within five LSRs. Approximately 18,630 acres of spotted owl habitat were lost due to the B&B Complex and Davis Fires in the Oregon Eastern Cascades Province.

Because there is no comprehensive spotted owl habitat baseline for non-federal lands that has been tracked over time, there is little available information regarding spotted owl habitat trends on non-Federal lands. Yet, we do know that internal Service consultations conducted since 1992, have documented the eventual loss of 420,485 acres (Table 4) of habitat on non-federal lands. Most of these losses have yet to be realized because they are part of large-scale, long-term HCPs. Combining effects on Federal and non-federal lands, the Service had consulted on the proposed removal of approximately 659,120 acres of spotted owl habitat range-wide, resulting from all management activities, from 1994 to June 24, 2010 (Table 4).

3.5.1.4 *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

Table 3. Acres of northern spotted owl suitable (NRF[1]) habitat loss on Federal lands from 1994 to June 24, 2010, from proposed management activities and natural events: baseline and summary of effects by State, physiographic province and land use function.

Physiographic Province[4]		Evaluation Baseline[2]			Habitat Removed/Downgraded[3]				% Provincial Baseline Affected	% of Range-wide Effects
		Reserves[5]	Non-reserves[6]	Total	Reserves[5]	Non-reserves[6]	Habitat loss to natural events[7]	Total		
WA	Olympic Peninsula	548,483	11,734	560,217	867	24	299	1,190	0.21	0.30
	Eastern Cascades	506,340	200,509	706,849	4,028	6,082	5,754	15,864	2.24	4.02
	Western Cascades	864,683	247,797	1,112,480	1,681	10,924	0	12,605	1.13	3.19
	Western Lowlands	0	0	0	0	0	0	0	0.00	0.00
OR	Coast Range	422,387	94,190	516,577	734	3,938	66	4,738	0.92	1.20
	Klamath Mountains	448,509	337,789	786,298	23,402	72,245	101,676[8]	197,323	25.10	49.99
	Eastern Cascades	247,624	196,035	443,659	2,472	13,448	19,547[9]	35,467	7.99	8.98
	Western Cascades	1,012,426	1,033,337	2,015,763	4,020	66,397	24,583	95,000	4.71	24.07
	Willamette Valley	593	5,065	5,658	0	0	0	0	0.00	0.00
CA	Coast Range	47,566	3,928	51,494	455	65	100	620	1.20	0.16
	Cascades	61,852	26,385	88,237	0	4,809	0	4,809	5.45	1.22
	Klamath	734,103	345,763	1,079,866	1,545	9,719	15,869	27,133	2.51	6.87
Total		4,894,566	2,502,532	7,397,098	39,204	187,651	167,894	394,749	5.36	100.00

[1] Nesting, roosting, foraging habitat. In California, suitable habitat is divided into two components; nesting – roosting (NR) habitat, and foraging (F) habitat. The NR component most closely resembles NRF habitat in Oregon and Washington. Due to differences in reporting methods, effects to suitable habitat compiled in this, and all subsequent tables include effects for nesting, roosting, and foraging (NRF) for 1994-6/26/2001. After 6/26/2001, suitable habitat includes NRF for Washington and Oregon but only nesting and roosting (NR) for California.

[2] 1994 FSEIS baseline (USDA and USDI 1994b).

[3] Includes consulted-on effects reported by USFWS (2001) and subsequent effects compiled in the Northern Spotted Owl Consultation Effects Tracking System database.

[4] Defined by the NWFP as the twelve physiographic provinces, as presented in Figure 3&4-1 on page 3&4-16 of the FSEIS.

[5] Land-use allocations intended to provide large blocks of habitat to support clusters of breeding pairs

[6] Land-use allocations intended to provide habitat to support movement of spotted owls among reserves.

[7] Acres for all physiographic provinces, except the Oregon Klamath Mountains and Oregon Eastern Cascades, are from the Scientific Evaluation of the Status of the Northern Spotted Owl (Courtney et al. 2004).

[8] Acres are from the biological assessment entitled: Fiscal year 2006-2008 programmatic consultation: re-initiation on activities that may affect listed species in the Rogue-River/South Coast Basin, Medford BLM, and Rogue-Siskiyou National Forest.

[9] Acres are from the Scientific Evaluation of the Status of the Northern Spotted Owl (Courtney et al. 2004) and data in the Northern Spotted Owl Consultation Effects Tracking Database.

Table 4. Changes to northern spotted owl suitable[1] habitat acres from activities addressed in section 7 consultations (both formal and informal) and other causes, range-wide from 1994 to June 24, 2010.

Northwest Forest Plan (NWFP) Group /Ownership		Consulted On Habitat Changes[2]		Other Habitat Changes[3]	
		Removed/ Downgraded	Degraded	Removed/ Downgraded	Degraded
Federal - Northwest Forest Plan	Bureau of Land Management	101,186	56,166	760	0
	Forest Service	117,869	472,821	36,911	5,481
	National Park Service	3,916	5,286	3	0
	Multi-agency[4]	15,381	23,314	130,220	0
	NWFP Subtotal	238,352	557,587	167,894	5,481
Other Management and Conservation Plans (OMCP)	Bureau of Indian Affairs and Tribes	110,123	28,398	2,398	0
	Habitat Conservation Plans	295,889	14,430	0	0
	OMCP Subtotal	406,012	42,828	2,398	0
Other Federal Agencies & Lands[5]		283	466	28	70
Other Public & Private Lands[6]		14,473	880	30,240	20,949
TOTAL Changes		659,120	601,761	200,560	26,500

[1] Nesting, roosting, foraging habitat. In California, suitable habitat is divided into two components; nesting – roosting (NR) habitat, and foraging (F) habitat. The NR component most closely resembles NRF habitat in Oregon and Washington. Due to differences in reporting methods, effects to suitable habitat compiled in this, and all subsequent tables include effects for nesting, roosting, and foraging (NRF) for 1994-6/26/2001. After 6/26/2001, suitable habitat includes NRF for Washington and Oregon but only nesting and roosting (NR) for California.

[2] Includes both effects reported by USFWS (2001) and subsequent effects compiled in the Spotted Owl Consultation Effects Tracker (web application and database).

[3] Includes effects to NRF habitat (as documented through technical assistance) 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.

[4] The 'Multi-agency' grouping is used to lump a variety of NWFP mixed agency or admin unit consultations that were reported together prior to 6/26/2001, and cannot be split out.

[5] Includes lands that are owned or managed by other federal agencies not included in the NWFP.

[6] Includes lands not covered by Habitat Conservation Plans that are owned or managed by states, counties, municipalities, and private entities. Effects that occurred on private lands from right-of-way permits across Forest Service and BLM lands are included here.

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 et al. (2005) also evaluated suitable habitat levels in 450 spotted owl management circles (based on the provincial annual median spotted owl home range). Across their study area, they found that owl circles averaged about 26 percent suitable habitat in the circle across all landscapes. Values in the study ranged from an average of 7

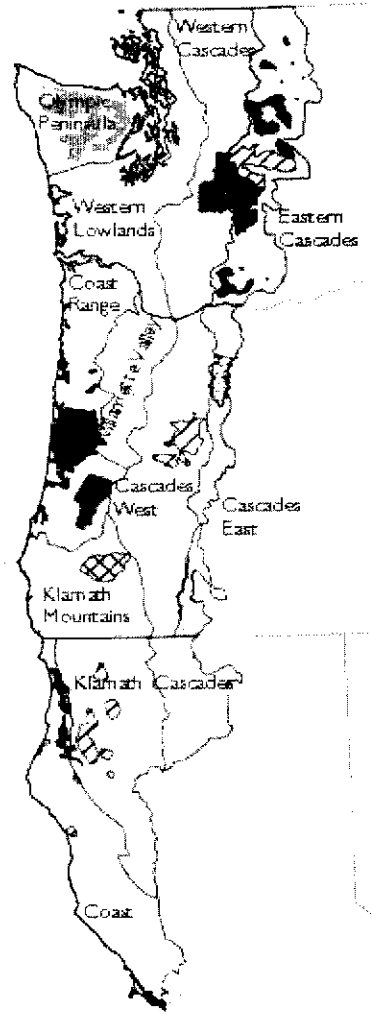
percent in southwest Washington to an average of 31 percent in the east Cascades, suggesting that many owl territories in Washington are significantly below the 40 percent suitable habitat threshold used by the State as a viability indicator for spotted owl territories (Pierce et al. 2005).

Moeur et al. (2005) estimated an increase of approximately 1.25 to 1.5 million acres of medium and large older forest (greater than 20 inches dbh, single and multi-storied canopies) on Federal lands in the NWFP area between 1994 and 2003. The increase occurred primarily in the lower end of the diameter range for older forest. The net forest area in the greater than 30 inch dbh size class increased by only an estimated 102,000 to 127,000 acres. 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 in-growth. 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 spotted owl habitat, the significance of these acres to spotted owl conservation remains unknown.

3.5.1.5 *Spotted Owl Numbers, Distribution, and Reproduction Trends.* There are no estimates of the size of the spotted owl population prior to settlement by Europeans. Spotted owls are believed to have inhabited most old-growth forests or stands throughout the Pacific Northwest, including northwestern California, prior to the beginning of modern settlement in the mid-1800s (USFWS 1989). According to the final rule listing the spotted owl as threatened (USFWS 1990a), approximately 90 percent of the roughly 2,000 known spotted owl breeding pairs were located on federally-managed lands, 1.4 percent on State lands, and 6.2 percent on private lands; the percent of spotted owls on private lands in northern California was slightly higher (Forsman et al. 1984, USFWS 1989, Thomas et al. 1990).

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 (USFWS 1990a). 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 (Thomas et al. 1993). 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 (USFWS 1995). By June 2004, the number of territorial spotted owl sites recognized by Washington Department of Fish and Wildlife was 1,044 (Buchanan and Swedeen 2005). The actual number of currently occupied spotted owl locations across the range is unknown because many areas remain unsurveyed (USFWS 1992b, Thomas et al. 1993). In addition, historical sites may no longer be 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 in USFWS (1995) represent the cumulative number of locations recorded in the three states, not population estimates.



Demographic Study Area	Land Ownership	# Owls Banded	Fecundity	Apparent Survival	$\lambda_{m.s}$	Population Trend Based on $\Delta\lambda$
Washington						
Wenatchee (WEN)	Mixed	1,200	Declining	Declining	0.917	Declining
Rainer (RAI)	Mixed	217	Stable	Declining	0.896	Declining
Olympic (OLY)	Federal	985	Stable	Declining	0.956	Declining
Cle Elum (CLE)	Mixed	724	Declining[1]	Declining?[2]	0.938	Declining
Oregon						
Oregon Coast Range (COA)	Mixed	1,025	Declining?[1]	Stable	0.968	Declining
Tyee (TYE)	Mixed	1,032	Increasing	Stable	1.005	Stationary
South Oregon Cascades (CAS)	Federal	881	Declining	Stable	0.974	Stationary
H.J. Andrews (HJA)	Federal	1,095	Stable?[3]	Stable	0.978	Declining
Klamath (KLA)	Mixed	1,147	Stable	Stable	0.997	Stationary
Warm Springs (WSR)	Tribal	381	Stable	Stable	0.908	Declining
California						
Marin (MAR)	Federal	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)	Federal	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. 2006a)

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, Burnham et al. 1994: Forsman et al. 1996, Anthony et al. 2006a) to estimate trends in the populations of the spotted owl.

In January 2004, two meta-analyses modeled rates of population change for up to 18 years using the re-parameterized Jolly-Seber method (λ_{RJS}). One meta-analysis modeled all 13 long-term study areas excluding the Marin study area (Table 5), while the other modeled the eight study areas that are part of the effectiveness monitoring program of the NWFP (Anthony et al. 2006a). Data were analyzed separately for individual study areas, as well as across all study areas in a meta-analysis.

Point estimates of λ_{RJS} ranged from 0.896 to 1.005 for the 13 long-term study areas, and in all study areas but one—the Tyee study area—these estimates were less than 1.0 (Anthony et al. 2006a). There was strong evidence that populations in the Wenatchee, Cle Elum, Warm Springs, and Simpson study areas decreased during the period of study. There also was evidence that populations in the Rainier, Olympic, Oregon Coast Range, and HJ Andrews study areas were decreasing. The precision of the λ_{RJS} estimates for Rainier and Olympic study areas was poor and not sufficient to detect a statistically significant difference from 1.00; however, the estimate of λ_{RJS} for the Rainier study area (0.896) was the lowest of all of the areas. Populations in the Tyee, Klamath, South Oregon Cascades, Northwest California, and Hoopa study areas appeared to be stationary during the study, but there was some evidence that the spotted owl population in the Northwest California study area was decreasing (λ_{RJS} = 0.959 to 1.011).

The weighted mean λ_{RJS} for all of the study areas was 0.963 (standard error [SE] = 0.009, 95 percent confidence interval [CI] = 0.945 to 0.981), suggesting that populations over all of the study areas decreased by about 3.7 percent per year from 1985 to 2003. Anthony et al. (2006a) explains that the indication populations were declining was based on the fact that the 95 percent confidence intervals around the estimate of the mean lambda did not overlap 1.0 (stable) or barely included 1.0. The number of populations that declined and the rate at which they have declined are noteworthy, particularly the precipitous declines in the Wenatchee, Cle Elum, and Rainier study areas in Washington and the Warm Springs study area in Oregon. Estimates of population declines in these areas ranged from 40 to 60 percent during the study period of 1990 to 2003 (Anthony et al. 2006a). Decreases in apparent adult survival rates were an important factor contributing to decreasing population trends. Survival rates decreased over time in five of the 14 study areas: four study areas in Washington, which showed the sharpest declines, and one study area in the California Klamath Province of northwest California (Anthony et al. 2006a). In Oregon, there were no time trends in apparent survival for four of six study areas, and remaining

Table 5. Spotted owl demographic parameters from demographic study areas (adapted from Anthony et al. 2006a).

Study Area	Fecundity	Adult Survival	[1]RJS	Population Change
Wenatchee	Declining	Declining	0.917	Declining
Cle Elum	Declining	Declining?	0.938	Declining
Rainier	Stable	Declining	0.896	Declining
Olympic	Stable	Declining	0.956	Declining
Coast Ranges	Declining?	Stable	0.968	Declining
HJ Andrews	Stable?	Stable	0.978	Declining
Warm Springs	Stable	Stable	0.908	Declining
Tyee	Increasing	Stable	1.005	Stationary
Klamath	Stable	Stable	0.997	Stationary
S. Cascades	Declining	Stable	0.974	Stationary
NW California	Declining	Declining	0.985	Declining?
Hoopa	Increasing	Stable	0.98	Stationary
Simpson	Declining	Stable	0.97	Declining
Marin	Stable	Stable	NA	NA

areas had weak, non-linear trends. In California, three study areas showed no trend and one showed a significant linear decrease (Anthony et al. 2006a). Like the trends in annual rate of population change, trends in the rate of adult survival showed clear decreases in some areas but not in others.

There are few spotted owls remaining in British Columbia. Chutter et al. (2004) suggested immediate action was required to improve the likelihood of recovering the spotted owl population in British Columbia. So, in 2007, personnel in British Columbia captured and brought into captivity the remaining 16 known wild spotted owls. Prior to initiating the captive-breeding program, the population of spotted owls in Canada was declining by as much as 35 percent per year (Chutter et al. 2004). The amount of previous interaction between spotted owls in Canada and the United States is unknown (Chutter et al. 2004).

4.0 ENVIRONMENTAL BASELINE

The environmental baseline is defined as "the past and present impacts of all Federal, state or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of State and private actions which are contemporaneous with the consultation in process [50 CFR 402.02]."

4.1 Spotted Owl

4.1.1 *Action Area.*

The action area is within the range of the spotted owl on non-federal forest lands in Oregon. We have estimated this to be about 8.9 million acres (based on GIS data from Davis and Lint 2005). Although site specific information is lacking for activities, the action area contains about 2.6 million acres of potentially suitable habitat (Raphael 2006).

Very few current spotted owls have been conducted in the action area and observed owl use can be sporadic. For example, Forsman (2008, pages 2 and 3) reported that in the Oregon Coast Ranges there is a 50 percent annual occupancy of territories by spotted owls and of these 64 percent contained pairs, but an additional 7 percent did not have a residence status established. In order to address the potential large area of coverage projected spotted owl use was determined by using landscape-scale observed densities. There have been few studies that have documented spotted owl densities, but there are a few that are relevant to this analysis. Thomas et al., App. G (1990) reported that in old growth study areas across northern California, Oregon, and Washington containing 19-73 percent of forests with trees greater than 160 years of age, there was a range of 2 to 36 owl pair sites per 100 square miles (64,000 acres) and a mean of 12.75 pairs. Specific to Oregon, the Tyee Density Study Area northwest of Roseburg, provides a reasonable example of the forested landscape because it includes a mixture of Federal lands interspersed with private lands. The total size of the area is approximately 253,280 acres and it has been monitored since 1985 (Forsman et al. 2009). In 2009, there were 44 pairs and 28 singles documented (Forsman et al. 2009) in this study area covering about 396 square miles.

The quality of a spotted owl site is related to the amount of available habitat used for nesting, roosting and foraging which is referred to as NRF or suitable habitat. The Service recommends that a spotted owl site be above 50 percent suitable habitat within the core (0.5 mile radius area around the activity center) and 40 percent suitable habitat throughout the home range (1.5 miles radius area around the activity center) to provide a functional home range in relation to reproductive success and survival of the pair (USFWS et al. 2007). This is also known as the "take" threshold for evaluating adverse affects and incidental take.

4.1.2 *Oregon Coast Ranges Study Area.*

The Oregon Coast Ranges Demographic Study Area that is within the Siuslaw National Forest, Salem and Eugene Districts of the BLM, and non-federal lands overlaps with part of the action area. The Oregon Coast Ranges Demographic Study Area was set up to provide spotted owl demographic information for the Oregon Coast Range Physiographic Province. Therefore, spotted owl demographic information collected in this study area has been used to characterize the spotted owl population trend within the action area.

In 2007, site occupancy was the lowest number since the study was initiated in 1990, with the percent of occupied sites gradually decreasing from a high of 88 percent in 1991 to a low of 50 percent in 2007 (Forsman 2008, pages 3-4). Fecundity in 2007 (0.28 female young/adult female, SE = 0.05) was slightly above the overall average (mean fecundity/year = 0.25) (Forsman 2008, page 5).

Relative to the thirteen other spotted owl study areas represented in the 2004 meta-analysis, the demographic parameters estimated for the spotted owl population in the Oregon Coast Range Study Area were at intermediate levels (Anthony et al. 2006a, page 25-29). The greatest population declines were reported for the Warm Springs Reservation and for all Washington demographic study areas. In contrast, the Tyee, Klamath, South Cascades, and Hoopa Reservation study areas have spotted owl populations that appeared to be relatively stable. It is not possible to differentiate among the effects of habitat loss (land use practices, and wildfires), climate, and abundance of barred owls on the demography of the spotted owls. Therefore, it is

not possible to determine what caused the patterns in population trends (Anthony et al. 2006a, page 35).

4.1.3 *Area of Concerns.*

4.1.3.1 *The South Willamette-North Umpqua Area of Concern.* This area is a region with limited federal ownership within the BLM Eugene and Roseburg district boundaries. It is an area "of concern" because (1) habitat conditions on non federal lands appear to limit owl movement and survival in this area and (2) the risk that management activities on federally-administered lands within this area could add to nonfederal habitat conditions to create a regional barrier, or strong filter, to owl movement and demographic interchange between the Coast Range and West Cascades physiographic provinces. Although the AOC never has been formally delineated, the portion of the areas of concern within the action area contains approximately 75,000 acres of BLM Eugene Matrix and Connectivity lands (excluding the large LSRs designated in the NWFP). Approximately 19,000 acres (25%) of these BLM-administered lands are in OMOCA 11.

4.1.4 *Physiographic Provinces.*
The action area is located within the Oregon Coast Physiographic Province, the Oregon Cascades East and West Physiographic Provinces, the Klamath Province, and the Oregon Willamette Valley Physiographic Province.

4.1.4.1 *Oregon Coast Range Physiographic Province.* This province is located on the Oregon coast and provides links with the Oregon Western Cascades, and Klamath Mountains Physiographic Provinces. Washington Western Lowlands are to the north of this province, but due to the relative low amounts of suitable habitat, low number of owls, and low amount of Federal ownership in the Northern portion of this Province the Columbia River may provide a barrier of possible dispersal of spotted owls to the Washington Western Lowlands Physiographic Province.

The 1994 FSEIS baseline (USDA and USDI 1994b) was 516,577 acres of suitable spotted owl habitat on Federal lands within this province. As of June 24, 2010, proposed management activities and natural events have resulted in the baseline being reduced by 4,738 acres of suitable spotted owl habitat resulting in a decrease of 0.92 percent of the 1994 provincial baseline (**Error! Reference source not found.**).

4.1.4.2 *Oregon Willamette Valley Physiographic Province.* This province is located in the Willamette valley and does not significantly contribute to the spotted owl population nor does it provide a link to other Physiographic Provinces due to the lack of habitat. This area does contribute to spotted owl habitat on the edges adjacent to the Oregon Coast Range and Oregon Western Cascades Physiographic Provinces, and with non-federal habitat does support spotted owls.

The 1994 FSEIS baseline (USDA and USDI 1994b) was 593 acres of suitable spotted owl habitat on Federal lands within this province. As of June 24, 2010, proposed management activities and natural events have resulted in the baseline being reduced by zero acres of suitable spotted owl habitat.

4.1.4.3 *Eastern Oregon Cascades Physiographic Province.* The Eastern Oregon Cascades Province is a narrow band of habitat along the east side of the Cascade crest from the Columbia River to the California border. Conservation objectives for this province include: maintaining existing connectivity within the province and with the Western Oregon Cascades Physiographic Province; providing connectivity with in the vicinity of the Columbia River Gorge; improving connectivity into northern California from the Eastern Oregon Cascades Physiographic Province.

The 1994 FSEIS baseline (USDA and USDI 1994b) was 138,684 acres of suitable spotted owl habitat on Federal lands within this province. As of June 24, 2010, proposed management activities and natural events have resulted in the baseline being reduced by 35,467 acres of suitable spotted owl habitat resulting in a decrease of 7.99 percent of the 1994 provincial baseline (Table 6).

4.1.4.4 *Western Oregon Cascades Physiographic Province.* The Western Oregon Cascades Province is located along the western slope of the Cascade crest from the Columbia River to the California border. This province is located in the geographic center of the spotted owl's range and provides links with the Washington Cascades, Oregon Coast Range, and Klamath Mountains Physiographic Provinces.

The 1994 FSEIS baseline (USDA and USDI 1994b) was 2,015,763 acres of suitable spotted owl habitat on Federal lands within this province. As of June 24, 2010, proposed management activities and natural events have resulted in the baseline being reduced by 95,000 acres of suitable spotted owl habitat resulting in a decrease of 4.71 percent of the 1994 provincial baseline.

4.1.4.5 *Oregon Klamath Physiographic Province.* This province is located west of the Cascade crest, starting at the southern border of the Oregon Coast Range Province, and extending down to the California border.

The 1994 FSEIS baseline (USDA and USDI 1994b) was 786,298 acres of suitable spotted owl habitat on Federal lands within this province. As of June 24, 2010, proposed management activities and natural events have resulted in the baseline being reduced by 197,323 acres of suitable spotted owl habitat resulting in a decrease of 25.1 percent of the 1994 provincial baseline.

4.1.5 *Relationship among the NWFP, Critical Habitat, and Recovery Plan.*
On the Forest Service Lands on the west side of the Cascades, MOCAs delineated as part of the Northern Spotted Owl Recovery Plan are contained within LSRs and Congressionally Reserved areas. On BLM lands MOCAs are contained within any land use allocation. The critical habitat units are congruent with the MOCAs on the west side, except that critical habitat units do not contain Congressionally Reserved areas (i.e. a subset of MOCAs). Therefore, on the west side of the Cascades all critical habitat acres are also MOCAs, but not all MOCAs are CHUs. On the eastside of the Cascades, no MOCAs were delineated; however, critical habitat was.

4.1.6 *NWFP.*
The action area surrounds the Federal land areas in Oregon managed under the direction of the NWFP, which established a conservation strategy for the spotted owl on Federal lands in Washington, Oregon, and California. It is designed around the conservation needs of the spotted

owl and based on the designation of a variety of land-use allocations whose objectives are either to provide for spotted owl population clusters (i.e., demographic support) or to maintain connectivity between population clusters. Several land-use allocations are intended to contribute primarily to supporting population clusters: LSRs, Managed Late-Successional Areas (MLSAs), Congressionally Reserved Areas (CRAs), Managed Pair Areas and Reserve Pair Areas. The remaining land-use allocations [Matrix, Adaptive Management Area (AMAs), Riparian Reserves (RRs), Connectivity Blocks, and Administratively Withdrawn Areas (AWAs)] provide connectivity between habitat blocks intended for demographic support.

The range-wide system of LSRs set up under the NWFP captures the variety of ecological conditions within the 12 different physiographic provinces to which spotted owls are adapted. This design reduces the potential for extinction due to large catastrophic events in a single province. Multiple, large LSRs in each province reduce the potential that spotted owls will be extirpated in any individual province and reduce the potential that large wildfires or other events will eliminate all habitat within a LSR. In addition, LSRs are generally arranged and spaced so that spotted owls may disperse to two or more adjacent LSRs and/or Wilderness complexes. This network of reserves reduces the likelihood that catastrophic events will impact habitat connectivity and population dynamics within and between provinces.

It has been fourteen years since the adoption of the NWFP in 1994. Thomas et al. (1990) argued that the spotted owl population trend should stabilize at a lower equilibrium sometime within the next 100 years. During the interim, there was an expectation that the rate of decline would slowly decrease as habitat loss was arrested and new habitat regenerated in the habitat conservation areas. The NWFP predicted a continuing decline of spotted owls until such time as new habitat developed (over the course of decades) (Appendix J of FSEIS) (Courtney et al. 2004). Lint (2005) concluded that during the first ten years of the NWFP, the spotted owl habitat prognosis is seemingly correct. Anthony et al. (2006, page 23) stated that spotted owl populations appeared to be stationary in several study areas. While the habitat provision of the NWFP is a necessary condition for spotted owls, it may not be a wholly sufficient provision (Courtney et al. 2004), given the spotted owl population declines observed in Washington (Anthony et al. 2006, page 29). Information collected during the first decade of the NWFP, affirms that protecting habitat is very important to the survival and recovery of the spotted owl, and that the reserve network prescribed under the NWFP has been effective in maintaining and restoring spotted owl habitat (Lint 2005).

4.1.7 *Late Successional Reserves (LSR).*
There is an expectation that owl populations would be self-sustaining where the land area (assumed to be habitat-capable land area) in individual LSRs is at least 60 percent suitable spotted owl habitat (Lint et al.1999).

4.1.8 *Recovery Plan for the Northern Spotted Owl.*
The Recovery Plan for the Northern Spotted Owl relies on Federal lands to provide the major contribution for spotted owl recovery; however it does recommend actions pertinent to the proposed project. Recovery Action 13 encourages the development of safe harbor agreements that are consistent with the Recovery Plan. Recovery Action 14 calls for the establishment of incentive programs to develop creative opportunities for non-federal landowners to engage in management strategies consistent with recovery objectives. Recovery Action 15 calls for streamlining the process of a landowner gaining approval of a safe harbor agreement. Recovery

Action 18 calls for encouraging development of dispersal habitat for spotted owl demographic support in CSAs. Recovery Action 27 calls for expediting experimental removal of barred owls. Recovery Action 31 calls for development of easily implementable safe harbor agreements that could support barred owl management. Recovery Action 32 calls for encouraging maintenance of structurally complex habitat outside of MOCAs on non-federal lands.

4.1.9 *Role of the Action Area in the Survival and Recovery of the Spotted Owl.*
Under the conservation strategy set forth in the NWFP and the Spotted Owl Recovery Plan, the action area is primarily intended to provide for spotted owl dispersal between habitat blocks reserved for breeding spotted owls, but the benefit's of having additional nesting habitat on private lands have been identified as being a valuable contribution to recovery. The proposed project lies only within non-federal lands, many of which may border Federal lands.

The NWFP conservation strategy for the spotted owl does not rely on nesting pairs and nesting habitat outside of reserved habitat blocks to maintain and recover the spotted owl population. As discussed above under the *Status of the Species* section, it was assumed under the NWFP that about 2.5 percent of Matrix lands would be subject to timber harvest per decade. At that rate, a large area of Matrix is expected to continue to support nesting spotted owls and the overall species' population while additional spotted owl NRF habitat is developing within the LSR system. In the first decade of the NWFP, timber harvest in the Matrix LUA was consistent with that assumption. As discussed in the *Status of the Species* section, the NWFP along with the strategy outlined in the Spotted Owl Recovery Plan is the basis for the Federal contribution to spotted owl recovery, even in light of spotted owl population declines and threats from such things as barred owls and West Nile virus. While non-federal land occurs adjacent to large blocks of Federal lands, the non-federal land likely plays a minor role in currently supporting spotted owls within the action area due to its average younger age and smaller contiguous stand size.

5.0 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.

This section is organized in the following manner. First, there are general discussions of how the proposed actions affect spotted owls as a result of disturbance and habitat modification. Second, there is specific discussion on the effects of each activity type as it relates to disturbance and habitat modification issues for the spotted owl.

6.0 EFFECTS TO SPECIES

6.1 Spotted Owl

6.1.1 *Disturbance Effects (Background Information).*
The Service has concluded that noise, smoke and human presence 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 (i.e., incidental take in the form of harassment). 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 1, USFWS 2003, 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 Oregon Western Cascades Physiographic 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 7. This is based on fledge data (Loschl 1996) and includes an additional two weeks to allow for development of flight skills. After July 7, it is estimated that most fledgling spotted owls are capable of sustained flight and can move away from most harmful disturbances.

However, disturbances associated with the use of Type I helicopters[2] and blasting are considered to have a greater impact than other activities, due to the intensity of the noise. Thus, these activities would require fledglings to move over greater distances and potentially increasing 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 1).

Log-hauling on open roads is not expected to have adverse affects 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 diluting the disruption noise from hauling trucks.

A general summary of effect determinations for disturbance-related actions are listed in Table 6.

Although the Service has assumed disruption distances based on interpretation of best available information, the exact distances where different disturbances disrupt breeding are difficult to

[2] Incident Command System definitions: A Type I helicopter seats at least 16 people and has a minimum capacity of 5,000 lbs. **Kmax** helicopters are considered Type I helicopters according to the ICS definition but are considered other for the purposes of disturbance.

predict and can be influenced by a multitude of factors. Site-specific information (e.g., topographic features, project length/duration or frequency of disturbance to an area) would also influence the degree of the effects to spotted owls. The potential for noise producing activities creating the likelihood of injury to spotted owls is also dependent on the background or baseline levels in the environment. In areas that are continually exposed to higher ambient noise levels (e.g. areas near well-traveled roads, campgrounds), spotted owls are probably less susceptible to small increases in disturbances because they are accustomed to such activities. Some spotted owls occur in areas near human activities and may habituate to certain levels of noise.

6.1.2 *Habitat Effects (Background Information).*
The decline of the spotted owl throughout its range is in part linked to 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 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 other harvest prescriptions 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 post-harvest operations than during the pre-harvest period. The cause of the reduced 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

Table 6. Summary of potential effects to spotted owls from disturbance associated with habitat modification activities near an active nest site.

SOURCE OF DISTURBANCE	DISTANCE FROM ACTIVE NEST SITES			TIME PERIOD
Use of a Type I helicopter[1]	≤ 440 yards	440 – 880 yards	> 880 yards	
	May affect, and is likely to adversely affect (MA-LAA)	May affect, but is not likely to adversely affect (MA-NLAA)	No Effect (NE)	March 1 – July 7
	MA-LAA	MA-NLAA	NE	July 16 – September 30
	NE	NE	NE	October 1 – February 28
Blasting	≤ 440 yards	440 yards – 1 mile	> 1 mile	
	MA-LAA	MA-LAA	NE	March 1 – July 7
	MA-LAA	MA-NLAA	NE	July 16 – September 30
	NE	NE	NE	October 1 – February 28
Use of Type II-IV helicopters	≤ 120 yards	120 – 440 yards	> 440 yards	
	MA-LAA	MA-NLAA	NE	March 1 – July 7
	MA-NLAA	MA-NLAA	NE	July 16 – September 30
	NE	NE	NE	October 1 – February 28
Use of chainsaws	≤ 65 yards	65 – 440 yards	> 440 yards	
	MA-LAA	MA-NLAA	NE	March 1 – July 7
	MA-NLAA	MA-NLAA	NE	July 16 – September 30
	NE	NE	NE	October 1 – February 28
Use of heavy equipment	≤ 35 yards	36 – 440 yards	> 440 yards	
	MA-LAA	MA-NLAA	NE	March 1 – July 7
	MA-NLAA	MA-NLAA	NE	July 16 – September 30
	NE	NE	NE	October 1 – February 28
Prescribed burning	≤ 440 yards		> 440 yards	
	MA-LAA		NE	March 1 – July 7
	MA-NLAA		NE	July 16 – September 30
	NE		NE	October 1 – February 28
Hauling		≤ 440 yards	> 440 yards	
		MA-NLAA	NE	March 1 – September 30
		NE	NE	October 1 – February 29

[1] Kmax helicopters are considered Type I helicopters for the ICS definition but will be considered Type II for the purposes of disturbance. Sound readings from Kmax helicopter logging on the Olympic NF registered 86 dB at 150 yards (Piper 2006).

owls naturally tend to avoid because they are more exposed 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 (i.e. nest patches) 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. As noted above, silvicultural prescriptions that

promote multi-aged and multi-storied stands, such as those promoted in the Agreement, may retain the suitability of habitat within affected stands for spotted owls and may increase the quality of that habitat over time (USFWS 2007).

6.1.3 *Effects of Habitat Modification that Cause Take of the Spotted Owl.*
The Service has used a "40% rule" at the scale of a spotted owl home range to determine if incidental take of the spotted owl is likely to occur when suitable habitat is removed by a timber harvest action. If a proposed action will reduce the amount spotted owl suitable habitat within a provincial home range to less than 40 percent, incidental take of the spotted owl(s) occupying that home range is considered to be likely. Best available information and the professional judgment of spotted owl experts support a finding that under those conditions the nesting, foraging, or roosting behavior of affected spotted owls is likely to be disrupted to the degree that injury or death of the affected owls is likely (USFWS et al. 2008). For similar reasons, the Service has used a "50% rule" at the scale of a spotted owl core area (500 acres - .5 mile radius circle around nest tree) to determine if timber harvest actions are likely to cause take of the spotted owl (USFWS et al. 2008). If the amount of suitable habitat is less than 250 acres (post harvest), take of spotted owls is likely to occur. Any habitat removal at or in the immediate vicinity of a spotted owl nest site (nest patch – about 70 acres) is also considered by the USFWS et al. (2008) to cause take of the spotted owl.

7.0 EFFECTS OF THE PROPOSED PROJECT ON THE SPOTTED OWL

Proposed activities are expected to increase and/or maintain the amount of habitat available to spotted owls by up to 50,000 acres. Some harvest will result in habitat removal but most forest management activities under the Agreement are intended to maintain, enhance, or increase the amount and quality of spotted owl habitat. The Agreement allows for a return to baseline conditions. Some properties may enroll above baseline habitat that will be counted towards the 50,000 acres. Baseline habitat will be maintained through the enrollment term. Some baseline habitat may be managed, provided the baseline acreage is maintained. It is anticipated that a gradual return to baseline conditions is likely to occur beginning approximately ten years from the end of the Agreement (40 years from the present). Many of the enrolled properties will not be returned to baseline conditions because of requirements imposed by permanent conservation easements under the HFRP, and because some landowners will voluntarily maintain spotted owl habitat conditions for personal reasons.

The effects described herein are conservative in estimating the benefits to spotted owls and likely provide an overestimate of the potential adverse effects. This was done in order to address the levels of uncertainty in a way that minimizes the risks to the species and assures a likelihood of achieving the desired beneficial outcome.

For the purposes of this analysis in order to project changing conditions over time, we will assume that one third of the enrolled forests in any given year will be an average of 60 years old, one third will be 45 years old, and one third will be 30 years old. These ages should reflect a sufficient range of stand ages for which landowners are interested in enrolling under the Agreement. At that rate, within 20 years time, the 60 year old forests will become 80 years old and start resembling spotted owl nesting habitat. It will take an additional 15 years for the first enrolled 45 year old forest to reach a similar age when enrolled at the same time. The 30 year old forest will only have just begun to reach 80 years of age at the end of the Agreement. We

will also assume that all the 50,000 acres will be enrolled by year 40 of the Agreement. If we evenly distribute that over that time, the average enrolled per year will be 1,250 acres. Under this scenario at year 30 under the Agreement, there could be about 4170 acres of 80 year old forest enrolled that would continue to provide habitat for spotted owls for another 20 years, minus some removal for continued forest harvest operations such as patch cutting and selective harvest as the Agreement comes to an end. At year 35, the 45 year old forest would begin contributing to the acreage of 80 year old forest. By year 40, there could be about 10,800 acres of 80 year old forest, minus some removal for harvest activities. We would expect there to be increased levels of harvest at this point in the Agreement in order to space harvest activities out prior to the end of the Agreement. Due to the nature of this voluntary Agreement, we also assume that not all enrolled landowners will return their properties to their baseline conditions due to their desire to manage for older forest conditions for environmental or otherwise aesthetic reasons. We assume this, along with landowners enrolled with existing baseline conditions, could result in as much as 25 percent of the enrolled properties containing suitable spotted owl habitat after the Agreement expires. If this were distributed equally over all the anticipated enrollments indicated above, that would mean that up to 12,500 acres addressed under the Agreement could remain beyond the 50 year timeline. Approximately 8,333 acres of this total would be greater than 80 years of age and the remainder would be less than 80 years of age.

Therefore, we will assume that up to 37,500 acres of forested area generated under the Agreement could be lost through timber harvest by the end of the Agreement, of which 25,000 acres could be 80 years old or greater in age. All other treatments will maintain suitable or remove dispersal habitat, and will maintain dispersal opportunities post harvest. The activities are also expected to generate above ambient noise levels due to use of chainsaws, heavy equipment and helicopter work, and generate smoke from burning post harvest.

7.1 **Regeneration Harvest**

This activity is expected to remove suitable and dispersal habitat, produce smoke from post harvest burning and generate above ambient noise levels due to use of chainsaws, helicopters and heavy equipment.

7.1.1 *Disturbance*. Above ambient noise levels caused by this activity could adversely affect and potentially significantly disrupt the breeding behavior of spotted owls during their critical breeding period if the activity is implemented at or in proximity to an active nest site.

Some activities will take place within the critical nesting season, but they will either be beyond the disruption distance of an actively nesting spotted owl pair, or not be within suitable habitat. Timing restrictions are in place for regeneration harvest of suitable habitat during the nesting season. Therefore, the proposed regeneration harvest *may affect, but is not likely to adversely affect* spotted owls through disturbance.

7.1.2 *Habitat Modification*. Regeneration harvest of 37,500 acres will likely remove spotted owl habitat, especially those acres greater than 80 years of age. Therefore, regeneration harvest *may affect, and is likely to adversely affect* spotted owls due to the potential impairment of breeding and feeding of any resident spotted owls that may be present. Even though some structural components (snags, clumps of large trees, down wood) will be retained to meet existing Oregon Forest Practice Act requirements and the additional management objectives under the Agreement, the overall affect to suitable spotted owl habitat is that it will be set back for 20-40

years before it provides stand conditions suitable for owl dispersal and over 80 years before it functions once more as suitable spotted owl habitat. Therefore, the removal of suitable spotted owl habitat may affect the success of spotted owls to raise young, because 1) if a nest tree is removed, the pair will not be able to produce young until a suitable replacement nest has been established, and 2) if foraging habitat is limited near a nest tree and more foraging habitat is removed, the spotted owl pair may not be able to obtain enough food to successfully fledge their young and potentially may cause the pair to relocate to a nest site with sufficient foraging to support nesting.

Some of the regeneration harvest of within the 37,500 acres will be dispersal habitat Harvest of dispersal habitat *may affect, but is not likely to adversely affect* dispersing spotted owls because, even though dispersal habitat would be eliminated on these acres, sufficient habitat would remain in the area to facilitate owl dispersal.

The reduction of spotted owl dispersal habitat will occur through small scale harvests on smaller ownerships within areas that have additional dispersal habitat to allow for continued dispersal; therefore, the survival and recovery of the spotted owl should not be significantly affected.

7.2 **Thinning**

This activity is expected to temporarily degrade suitable habitat, remove dispersal habitat, produce smoke from post harvest burning and generate above ambient noise levels due to use of chainsaws, helicopters and heavy equipment

7.2.1. *Disturbance.* Above ambient noise levels caused by this activity could adversely affect and potentially significantly disrupt the breeding behavior of spotted owls during their critical breeding period if the activity is implemented at or in proximity to an active nest site. Therefore, the proposed thinning projects *may affect, and are likely to adversely affect* spotted owls.

7.2.2 *Habitat Modifications*. Thinning activities within up to 37,500 acres of habitat will likely remove some occupied spotted owl habitat, and therefore *may affect, and are likely to adversely affect* spotted owls due to the impairment of breeding and/or feeding. Even though the stands will still be able to function as dispersal habitat, foraging and roosting structure will likely be reduced or eliminated in the area and the quality of foraging and roosting structure within the stand will be temporarily diminished. After the initial impact of the timber harvest (about 6 months to one year), the understory habitat conditions for prey would increase over the next few years, until shrubs and residual trees close the canopy of the stand. This may affect the success of spotted owls to raise young, because 1) if too much structure near a nest tree is removed, the pair will not be able to produce young until a suitable replacement nest has been established, and 2) if foraging habitat is limited near a nest tree, and more foraging habitat is removed the spotted owl pair will not be able to obtain enough food to successfully fledge their young and potentially may cause the pair to relocate to a nest site with sufficient foraging to support nesting. The same acres that are thinned may also eventually be regeneration harvested by the end of the Agreement.

Even though dispersal habitat would be harvested on these acres, sufficient habitat would remain in the area to facilitate owl dispersal. Suitable habitat will only be treated to promote older forest

conditions; therefore, survival and recovery of the spotted owl should not be significantly affected.

7.3 **Down Salvage**

This activity is expected to affect non-habitat, produce smoke from post harvest burning and prescribed burning, and generate above ambient noise levels due to use of chainsaws, helicopters and heavy equipment.

7.3.1 *Disturbance.* Above ambient noise levels caused by this activity could adversely affect and potentially significantly disrupt the breeding behavior of spotted owls during their critical breeding period if the activity is implemented at or in proximity to an active nest site, but the project does not disrupt an active nest site or predictive nest patch. Therefore, down salvage that occurs near a nest site during the breeding season *may affect, and is likely to adversely affect* spotted owls due to disturbance. Salvage events are impossible to predict and may not be able to be deferred to outside of the breeding season in order to address forest health and safety. We will assume up to 500 acres of down salvage may occur that may adversely impact spotted owls through disturbance.

7.3.2 *Habitat Modifications*. We have determined that this activity within non-habitat will have *no effect* on spotted owls.

7.4 **Summary of Adverse Effects**

7.4.1 *Disturbance*. Most projects will avoid disrupting nesting spotted owls. Thinning will harass nesting spotted owls. Thinning *may affect and is likely to adversely affect* spotted owls due to disruptions of breeding and feeding. Down salvage on up to 500 acres that occurs near spotted owl nest sites may affect and is likely to adversely affect spotted owls through disturbance of breeding and feeding.

7.4.2 *Habitat Modifications*. The regeneration harvest and/or thinning of up to 37,500 acres of suitable and dispersal habitat within nesting territories *may affect, and are likely to adversely affect* spotted owls.

8.0 **COMBINED ADVERSE EFFECTS TO THE SPOTTED OWL POPULATION**

Although harassment of breeding spotted owls is of a short duration, especially when compared to growing suitable habitat, it will result in adverse effects and contribute to adverse effects from habitat changes.

Adult spotted owls are expected to continue to survive with reduced reproduction or to move to a new territory. The moving and searching for a new territory will potentially cause the adults to be exposed to a greater predation risk then they previously had as a territorial owl. Predation on spotted owls has not been directly observed, but is suspected by northern goshawks (*Accipiter gentiles*), Cooper's hawks (*Accipiter cooperi*), red-tailed hawks, great horned owls (*Bubo virginianus*), and barred owls (*Strix varia*) (Courtney et al., page 2-8).

The potential impact to the population is from the loss of reproduction from nesting spotted owls. The impact can not be measured since pre-project reproduction levels are not available for these sites. The impact is expected to be small due to the marginal pre-project habitat. All units should develop high quality habitat quicker then if left un-thinned.

The temporary loss of habitat at territories will impact the survival and recovery of the spotted owl within the project area. However, at the larger provincial and range wide scales these impacts will not appreciably reduce the likelihood of survival or recovery for the spotted owl population.

9.0 **CUMULATIVE EFFECTS**

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

We are not aware of any future actions that are likely to occur on non-federal lands that might affect spotted owls and that have not already been consulted upon.

10.0 **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 its habitats, 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.

The Service reached these conclusions because the proposed action is not likely to appreciably diminish the effectiveness of the range-wide conservation program established under the Recovery Plan for the Northern Spotted Owl to protect the spotted owl and its habitat on Federal lands within its range including designated spotted owl critical habitat. Additionally, no known cumulative impacts changed the determinations made under the effects of the proposed action.

The Service reached these conclusions for the following reasons:

1. The conservation needs of the spotted owl will continue to be met at the provincial and range-wide scale because the proposed action will conform to the guidance of the Recovery Plan for the Northern Spotted Owl as currently interpreted, which provides for large blocks of interconnected breeding habitat (MOCAs) throughout the range of the spotted owl. On Forest Service lands MOCAs overlap LSRs.

2. The proposed project will not appreciably reduce the likelihood of survival or recovery for the spotted owl population.

3. The conservation needs of the spotted owl will not be reduced at the unit, provincial and range-wide scale because the proposed action will not impact any spotted owl CH, which also provides for large blocks of breeding habitat (CHUs) throughout the range 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 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. We have a continuing duty to regulate the activities covered by this Incidental Take Statement. If we fail to assume and implement the terms and conditions or (2) fail to require cooperators to adhere to the terms and conditions of the Incidental Take Statement through enforceable terms that are added to the permit, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, we must report the progress of the action and its impact on the species as specified in this Incidental Take Statement. [50 CFR §402.14(i)(3)]

11.0 AMOUNT OR EXTENT OF TAKE

The estimation of the number of spotted owls affected by this project relied on data on the number, distribution, and density of owl locations from demographic study areas and other agency owl survey data sets. These data, when combined with information on landscape habitat configurations, facilitated the projection of likely spotted owl occurrence patterns across the landscape. The estimation process used landscape level spotted owl locations as the basis for the assessment and supplemented the known locations with the average known densities derived from demographic studies. Additional field surveys were not considered prudent due to the unknown precise location of properties to be enrolled and the distribution of habitat surrounding those properties. Most properties will not have any initial associations with known spotted owls sites due to lack of suitable habitat on the properties.

Any adverse impacts to spotted owls under the terms of the Agreement would generally not otherwise occur but for the development of suitable habitat conditions that is promoted by the Agreement and created by the voluntary actions of landowners. Incidental take is likely to occur as a result of timber harvest activities associated with occupied suitable spotted owl habitat. Not all habitat that is created under the Agreement will be utilized by spotted owls such that its removal would result in adverse impacts that would constitute incidental take. It is unlikely that many of the enrollee's properties will create new nesting opportunities due to the ages of stands that are likely to be enrolled and the duration of the Agreement. The created forest conditions

will more likely serve in a support role as foraging and roosting habitat associated with existing nesting habitat nearby.

Due to the large geographic area to be covered and the unknown number of acres and their exact locations to be enrolled under the Agreement, it is not possible to precisely determine the amount of incidental take of spotted owls that may occur over the term of the Agreement. We can determine a range of possible impacts to spotted owls, and provide a take estimate using that range for reference.

The Agreement has an enrollment limit of 50,000 acres and a duration of 50 years. For the purposes of this take assessment we will assume that: 50,000 acres will be enrolled; the majority of the initially enrolled 50,000 acres will be comprised of non-habitat, with much but not all likely developing into habitat at some point in time over the 50 years; a small percentage will be considered habitat at the time of enrollment and there may be some habitat enhancement that can occur in it; some but not all enrolled lands will be returned to baseline conditions primarily through timber harvest; and, regeneration harvest to return to baseline conditions may occur with spotted owl territories. These assumptions will describe the greatest number of spotted owls that are likely to be impacted and is likely an over-estimate.

We will assume that a landowners with as little as 200 acres of forest land will enroll under the Agreement based upon interest expressed during the first NRCS Healthy Forest Reserve Program request for proposals in Oregon in 2009. The Agreement is intended for non-industrial forest landowners, meaning those that own less and 5,000 acres. Therefore we can expect up to a couple hundred enrollees with various acreages ranging from about 200 to 5,000 acres. We will assume that these properties will be scattered across the forested landscape within the range of the spotted owl.

In order to place the potential 50,000 acres of enrolled lands in a landscape setting, we will assume an affected area of 200,000 acres to account for the fact that the 50,000 acres will not be enrolled as a single block of contiguous land. Using the above studies to provide a rough density estimate we get approximately 80 individual spotted owls per 200,000 acres using the mean from Thomas et al., App. G (1990) and about 92 individual owls per 200,000 acres from the Forsman et al. (2009).

Another habitat assessment tool that can be used is a software program called Biomapper. Using Biomapper to delineate higher quality spotted owl habitat on non-federal land in Oregon, a figure of 764,158 acres was derived (P. Bridges, pers.comm. 2010). If known spotted owl sites are projected on those habitat acres and additional sites are added in-between known sites to account for areas lacking surveys but containing suitable habitat, then it's estimated that up to 375 owl sites may occur on those non-federal lands (P. Bridges, pers.comm. 2010). If we project this density of spotted owls across the potential 50,000 acres under this Agreement, the number of owl sites distributed across this acreage would be about 24 sites. If each 'site' is assumed to be a pair, then the number of owls comes out to 48. However, this number does not adequately account for spotted owls potentially located on adjacent Federal lands for which the non-federal lands contribute to their habitat requirements within their home ranges. This figure of 48 could be potentially doubled depending upon how closely the Federal and non-federal lands are co-mingled. Based upon this information, we will assume the higher value of 92 owls from the above approximation that could be impacted, acknowledging that this could be an overestimate.

We need to make an adjustment to this figure to account for the quality of habitat likely to be generated under the Agreement. Based upon the maximum 50 year term and the likelihood of the majority of properties being enrolled will having stand ages from 30 to 60 years of age, we can see that most stands under the Agreement will not reach more than 110 years of age. Lower quality nesting habitat will generally not occur until stands are about 80 to 120 years of age with at least a scattering of trees greater than about 160 to 200 years of age along with some larger dead and downed trees. Therefore, much of the habitat to be created under this Agreement will not function as nesting habitat and attract owls to occupy new territories, but will more likely serve to support existing or dispersing owls. As previously stated, we assumed that at age 40 of the Agreement, there may be almost 11,000 acres of forest stands greater than 80 years of age that could begin to support spotted owl nesting provided some older forest remnants are also present. This is close to 25 percent of the land. For the purposes of this analysis, we will conservatively assume that up to 25 percent of the habitat will not support nesting owls but will provide benefits to dispersing owls through foraging and roosting opportunities, although in reality, the percentage could be much greater. We will also assume that at least 25 percent of the enrolled lands will not be returned to baseline conditions at the end of their Agreement term because: 1) those participating in the NRCS Healthy Forest Reserve Program won't be able to do so under the restrictions placed on those properties through conservation easements or fee title acquisitions; and, 2) some landowners are interested in creating and maintaining a older forested landscape with only partial cutting and thinning to provide some economic return.

For the reasons set forth above under the "Effects of the Action" section of this document and with the above conservative assumptions in place, we estimate that up to 46 individual spotted owls over 25,000 acres of suitable habitat may be incidentally taken in the future beginning in 10 to 20 years through thinning and patch cutting in developing habitat as a result of this Agreement in the action area. This is likely an overestimate of the likely amount of incidental take and addresses what may be considered a 'worse-case' scenario. The proposed activities will remove up to 25,000 acres of suitable spotted owl habitat, and maintain and/or create up to 25,000 acres of dispersal or higher quality habitat. Take will be in the form of harm resulting from post-harvest habitat conditions that further reduce the levels of suitable habitat within potential nesting territories.

12.0 REASONABLE AND PRUDENT MEASURES

The *General Standards* (section 1.2) that are part of the proposed action serve as the basis for the reasonable and prudent measures below. They were developed as part of the proposed action, which includes measures to minimize incidental take, including monitoring of projects.

1) Projects will be consistent with the Stewardship Agreement and the Safe Harbor Agreement.
2) A wildlife biologist and/or forester will participate in the planning and design of all projects.
3) At the end of each calendar year, the Service will review project implementation and monitoring forms to show actual levels of effects. These forms will fulfill the regulatory requirements of the ESA by documenting the actual effects to the subject species.

4) Monitoring will ensure that actual levels of effects do not exceed the levels anticipated by this assessment. If incidental take or adverse affects are anticipated to exceed authorized levels of take, the Service shall reinitiate formal consultation.

Except in the case of danger tree removal, the activity type *Individual Tree Removal* does not include the removal of (1) individual trees with owl nesting structure from areas where the loss of such a tree would limit nesting by owls or (2) known owl nest trees. In the case of danger tree removal, a known nest tree may be removed only when it is an immediate danger *and* when the tree is not currently being used by nesting owls or their young.

13.0 TERMS AND CONDITIONS

If a dead, injured, or sick endangered or threatened species specimen is located, initial notification must be made to the nearest Service Law Enforcement Office, located at 9025 SW Hillman Court, Suite 3134, Wilsonville, Oregon 97070; phone: 503-682-6131. Care should be taken in handling sick or injured specimens to ensure effective treatment or the handling of dead specimens to preserve biological material in the best possible state for later analysis of cause of death. In conjunction with the care of sick or injured endangered and threatened species or preservation of biological materials from a dead animal, the finder has the responsibility to carry out instructions provided by Law Enforcement to ensure that evidence intrinsic to the specimen is not unnecessarily disturbed.

14.0 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 critical habitat, 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.

15.0 REINITIATION NOTICE

This concludes formal consultation on the actions outlined in the Agreement. 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 critical habitat 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 critical habitat that was not considered in this BO; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending re-initiation of formal consultation.

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