Umpqua National Forest-North Umpqua Ranger District-Calf-Copeland Restoration Project
Biological Assessment

Subject: Formal consultation on the Calf Copeland Project.

At issue are the effects of the proposed action (or Project) on the threatened northern spotted owl (*Strix occidentalis caurina*) (spotted owl) and designated spotted owl critical habitat. As well as the threatened gray wolf *(Canis lupus)*.

The proposed action has also been planned in a manner which incorporates recommendations of the Spotted Owl Revised Recovery Plan's Recovery Actions 6, 10 and 32 (USDI FWS 2011a).

The proposed action includes habitat modification on approximately 5,475 acres of designated spotted owl critical habitat (2,384 acres of Primary Constituent Element 4 – dispersal-only habitat, and 2,796 acres of Primary Constituent Element 2 and 3 – nesting/roosting and foraging habitat).

The Assessment includes a finding that it may take several years to fully complete the activities included in the proposed action.

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INTRODUCTION

The purpose of this Biological Assessment (BA) is to evaluate the effects of the **Calf Copeland Project** on the northern spotted owl (*Strix occidentalis caurina*) and it's designated Critical Habitat. The Northern spotted owl is listed as threatened under the Endangered Species Act (ESA). This assessment describes and evaluates the potential effects of specific activities that ***may affect and are likely to adversely affect (LAA)*** the spotted owl, its habitat or designated critical habitat by modifying or removing spotted owl habitat. Additionally, this assessment presents information and requests to conference on one species proposed for listing, the fisher (*Pekania pennanti*) West Coast Distinct Population

Habitat in the project area does exist for gray wolf. However, no known active wolf den or rendezvous sites are within the project area. If such sites were to become known during implementation of this project, project design criteria (as described in letter of concurrence # 01EOFW00-2019-I-0406) would need to be adhered to in order to comply with the Program of Activities Proposed by the Umpqua National Forest and Roseburg District of the Bureau of Land Management affecting the Gray Wolf).

CONSULTATION HISTORY

Pursuant to implementing interagency guidance on streamlining section 7 ESA consultation (USDC/USDI 1999), Forest staff and staff from the Service's Roseburg Field Office comprise an interagency team (Level 1 Team]) tasked with developing biological assessments and providing a conduit for input into Forest timber sale planning efforts. As part of the Team, the Service was involved early (2015) with the development of some of the proposed projects in an IDT meeting. Continued communication occurred August 30 and August 31st of 2018 with the review of mapped RA-32. Also in 2018 (6/28), attended agency and public field trip, reviewing project proposals and harvest units. The Service's recommendations made during all of the early planning efforts (and subsequently) were pursuant to avoiding and minimizing impacts to spotted owls (as provided for in Section 7 of the ESA) along with implementing recommendations in the spotted owl revised recovery plan (USDI FWS 2011a) and both draft and final revised critical habitat rules (USDI FWS 2012a). The project areas continued to be refined as additional data became available through field review, and the Forest continued to inform and involve Service staff. Throughout this process Service input was incorporated into the project design criteria.

Action Area

The action area is defined as "all areas to be affected directly or indirectly by the federal action and not merely the immediate area involved in the action." (50 CFR 402). Utilizing GIS, stand exam data, satellite imagery and personnel field verification, this Assessment defines the Action Area as all land within 1.2 miles (the mean Oregon West Cascade Province northern spotted owl home range radius) of all individual parts of the proposed action and the entire home ranges of all Northern Spotted Owl activity centers within the first 1.2 miles. The combined area is shown in Figure 1. Northern spotted owl habitat determinations were based on the stand exam information available for federal lands. The Action Area encompasses approximately 66,828

acres; 99 percent, or 66,252 acres, are managed by the Umpqua National Forest, of which 56,681 acres or 62 percent is in some form of "reserved" allocation (NWFP 1990) (Table 5, pg. 19).

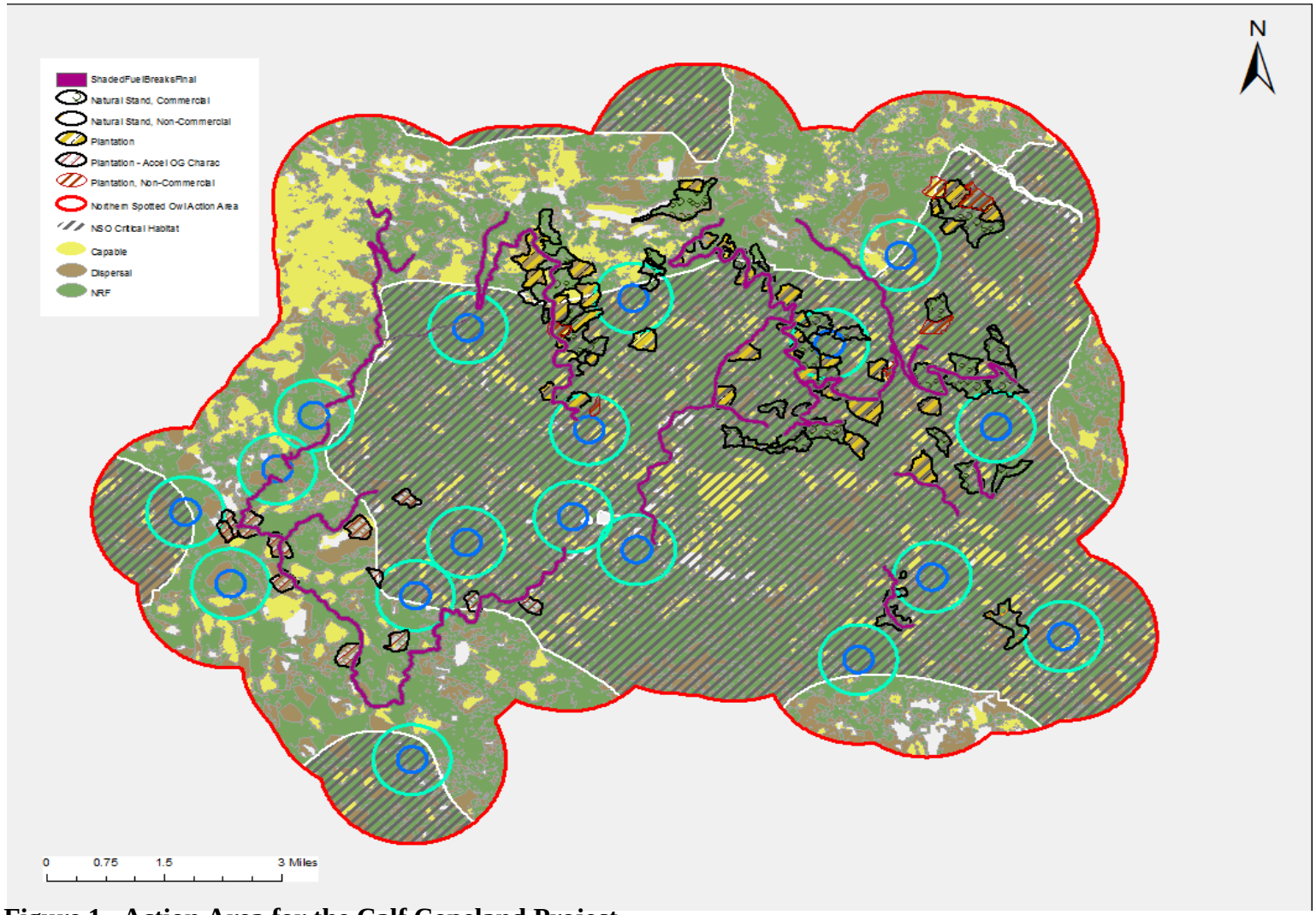


Figure 1. Action Area for the Calf Copeland Project

DESCRIPTION OF THE PROPOSED ACTION

The proposed Projects are planned for implementation (NEPA Decision Notice signed) during Fiscal Year 2020, however, project completion (for example timber harvesting) may not occur for another 3 to 5 (or more) years. These actions were identified and are accounted for in this analysis.

The proposed projects encompass approximately 5,475 acres on the North Umpqua and Diamond Lake Ranger Districts in Middle North Umpqua 5th field watersheds in Douglas County, Oregon.

The proposed actions are planned within the Late-successional Reserve (LSR) land use allocations (LUA) of the Northwest Forest Plan (NWFP) and Northern Spotted owl critical habitat, excluding associated riparian reserves (USDA FS and USDI BLM 1994).

Table 1. Summary of spotted owl habitat within the Calf Copeland Project for the U.S Forest Service.

		Habitat Types within Proposed Actions[1]*(acres)*			
		Northern Spotted Owl			
Proposed Activities (Mapped by Specific District GIS Polygons)	**Action Total (acres)**	**NRF**	**Dispersal-only**	**Capable**	**Non-Capable**
Commercial Thinning Natural Stand	1,759	1,611	146	2	0
Plantation	1,661	0	1,661	0	0
Non Commercial Thinning Natural Stands	282	234	48	0	0
Plantation	194	0	174	20	0
Shaded Fuel Break creation	1,426	871	324	220	12
Prescribed fire Maintenance Burn	141	82	26	30	3
Temp Road Construction (OUTSIDE OF HARVEST UNITS)	12 acres	2	2	3	5
Totals	5,475	2,796	2,384	275	20

Values may not sum to "Sub-Total" or "Total" due to rounding.

[1] **Habitat Definitions** – The categories of northern spotted owl

Northern Spotted Owl

NRF: nesting, roosting, and foraging habitat (stand age ≥ 80 years).

Dispersal-only: dispersal quality habitat (stand age between 40-79 years).

Capable: forest stands that are capable of developing into dispersal and NRF habitat but currently are not functioning as spotted owl habitat (FOI stand age ≤ 39 years).

Non-capable: lands not capable of developing into dispersal or NRF habitat in the foreseeable future because they are non-forested ground (e.g. rocky bluffs, cliffs, grassland, etc.) or are existing roads.

Thinning

For simplicity, herein the single term "thinning" is used to categorize timber harvests in that an average canopy cover that includes both treated and untreated areas will be maintained at or above a minimum stand averages of 40 percent, typical for dispersal quality habitat or 60 percent in nesting, roosting, foraging [NRF] habitat or more at the individual stand level. Stand as defined by Oliver is a spatially continuous group of trees and associated vegetation having similar structures and growing under similar soil and climatic conditions. And harvest unit is defined as a man defined boundary in which a single cutting prescription will be applied (person comm, Kaberly 2019), portions of riparian reserves are included in harvest units (see below in stream buffers). Post-harvest a combination of the treatments described below will be applied to the proposed thinning projects, producing a range of variable density outcomes at the stand level which is defined as a spatially continuous group of trees and associated vegetation having similar structure and growing under similar soil and climatic conditions (Oliver and Larson, pg 1); and landscape levels.

Commercial thinning would occur on 3,409 acres of previously managed and natural stands. The managed stands had been clearcut between 1956 and 1975 and planted to predominately Douglas-fir. Currently, the plantation range in canopy cover 50-85% with 81->300 trees per acre (TPA) greater than 7 inch dbh with an average height of 56-102 feet. The natural stands range in canopy cover from 40 to 85% with 50-270 TPA greater than 7 inch dbh and an average height of 70-130 feet. The commercial thinning would be thinned to 20 to55 percent canopy cover and small gaps of up to 2.5 acres would be created and planted with rust resistant sugar pine or ponderosa pine. Gaps for pine restoration would total no more than 10 percent of the area of each stand with an estimated 82 acres of total gap creation across the project area for this purpose. Gaps where all, or nearly all overstory trees are harvested for the projects addressed herein will be one-half to two acres in size. Such gaps may contain one or more "trees with unique characteristics" e.g. wolf-trees, larger than average trees, etc. However, skips are reserved from harvest, i.e. "no harvest" zones. These areas may be linear features such as "no cut" riparian buffers or may be of other various sizes and shapes. At the stand level the canopy cover will maintain 40-60 percent cover. Depending on harvest operability, yarding corridors may be established through designated skips.

Levels of snag and coarse woody material (CWM) retention will be determined by the management direction for the specific land use allocations (USDA 1994). The residual trees will also provide a pool of candidate trees for future snag and CWM recruitment. Snags and CWM may be created incidentally through the harvest operations, e.g. damage such as broken tops or individual tree mortality or through weather damage such as wind and snow break. Generally, existing large CWM in decay classes 3, 4 and 5 (i.e., more deteriorated wood) will also be reserved under contract provisions on all land use allocations.

Retention components will reflect the existing species composition and range of tree sizes within each stand. Retention of older remnant (legacy) trees will be emphasized to the extent practicable. Cutting of remnant trees will generally be limited to clearing road right-of-ways, landings, and providing for safe operations.

Aggregate retention areas may be established around concentrations of snags, and trees adjacent to individual snags may be retained to help protect them from damage during harvesting operations. It is likely that additional snags will be created from retention trees due

to yarding damage, wind breakage, and mortality caused by burning. Additional snags will be created subsequently where post-harvest assessments indicate a deficit in desired snag numbers. Within the Matrix LUA, a minimum of 120 linear feet per acre of large down wood in decay classes 1 and 2 will be provided as pieces greater than or equal to 16 inches in diameter and 16 feet long. Existing large down wood in decay classes 3, 4 and 5 will also be reserved under contract provisions. Within harvest units there are a total of 3,409 acres. Of this total, 481 acres are within 'no-cut' riparian buffers leaving a total harvested area of 2,928 thinned acres post-harvest canopy cover will be within the range of 30% - 70%. Of the thinned acres, 0 acres are Matrix and Riparian Reserve, 2,928 acres are LSR.

Sugar and Ponderosa Pine Restoration

Sugar pine trees are susceptible to the mountain pine beetle and are at a greater risk when competing with surrounding trees. There is management direction to maintain the health, integrity, and longevity of 5 needle pine restoration within the watershed (U.S Forest Service 2001, pg 14-15) in addition a goal of forest management on federal lands is to maintain biological diversity associated with natives species and ecosystems (USDA 1994, pg B-1)and the development of old-growth forest characteristics including snags, logs on the forest floor, large trees and canopy gaps that enable establishment of multiple layers tree layers and diverse species composition (USDA 1994, pg B-5). Thinning treatments around large sugar pines have been shown to contribute to increased growth, decrease the likelihood of bark beetle infestation, and promote sugar pine regeneration (Goheen 2011). In response to a current infestation in the Calf Copeland project, the proposal is to mimic the Wolfpine Project, which is in the adjacent watershed to Calf-Copeland (Goheen 2011). Preliminary results of this study demonstrated that clearing of all trees less than 25 inches diameter at breast height within 25 feet of the dripline of sugar pine was more beneficial than clearing of trees within ten feet of the dripline. Interestingly, leaving the larger diameter trees (25 inches diameter at breast height or greater) near sugar pine provided improved survival and growth compared to treatments where all trees were removed. Based on these results, the Calf-Copeland prescriptions would use the extended clearing size but leave all large diameter trees regardless of proximity to pines.

The action proposed by the Forest Service to meet the purpose and need to restore mixed-conifer stands with sugar pine or ponderosa pine would occur on 1,759 acres. Treatment would consist of density reductions through stand-level thinning and radial thinning around individual pine trees. All conifers under 24 inches diameter breast height (DBH) within 25 feet of the dripline of all healthy pine over 20 inches DBH will be removed. Although larger trees up to 24 inches DBH may be cut and left within 20 feet of the dripline of large pines. In some cases trees up to 24 inches DBH could also be girdled in the vicinity of large pines rather than felled. Overall canopy cover in the treated portions of the stands would be reduced to 40-60 percent. No trees over 24 inches DBH would be removed. Trees greater than 8 inches DBH that are felled will be removed with mechanical equipment to reduce fuel loading and insect outbreaks within the area. Merchantable material will be sold to fund the project.

As a result of the pine restoration treatments, openings of a ½ acre or larger in size are a likely outcome. However, openings of this size are not uncommon in older forests characterized by

natural disturbance regimes in the affected province (Larson and Churchill 2012; U.S. Forest Service 2012)

The Calf-Copeland planning area is 62 percent within late-successional reserve (LSR) and in addition 38 percent of the planning area are Inventoried Roadless Areas (Figure 4). In addition about two thirds of the planning area is designated critical habitat (CHU) for the northern spotted owl. Because so much of the adjacent watersheds have burned severely, the Calf-Copeland area has become an even more important refuge for late-successional and old-growth forest. Prudent measures that could reduce the risk of further stand-replacement fire within Northern spotted owl habitat while still maintaining the planning area as functional owl habitat are indicated. Moreover, measures that can begin the process of restoring fire-resilient patches within the landscape where they historically occurred, could reduce the risk of uncharacteristic fire behavior by breaking up the unnaturally homogeneous fuel conditions that currently exist. In addition, thinning around the remaining sugar and ponderosa pine while there is still time to save the remaining legacy trees and preserve the old-growth nature of these highly evolved diverse plant communities. There is an equally urgent need to create gaps to allow for regeneration of pine seedlings so that there will be old-growth pines for future generations. This need is particularly imperative within the overstocked Douglas-fir dominated plantations.

Stream Buffers

Riparian Reserves that were previously harvested and are not meeting aquatic needs (high density small diameter stands) have been proposed for thinning to provide for future needs of the stream and meet the Aquatic Conservation Strategy (ACS).

Stream Classes 1: a “no-cut” buffer extending 180 feet (slope distance) on either side of the edge of the stream channel, as measured from the ordinary high water line, will exclude thinning immediately adjacent to streams. No trees will be removed within the “no-cut” buffer.

Stream Class 2 and 3: A “no-cut” buffer extending 85 feet (slope distance) on either side from the edge of the stream channel, as measured from the ordinary high water line for class 2 and 3 streams

Stream Class 4: A “no cut” buffer extending variable width 25-50 feet (slope distance) on either side of the stream channel, as measured from the ordinary high water line, will exclude thinning immediately adjacent to streams, No trees will be removed within the “no-cut” buffer.

No harvest will occur around streams within the natural stands, Riparian Reserves were determined to be fully functional and no-cut buffers were established that extended the full width of Riparian Reserves. Class 1 streams would receive a 360 foot buffer on either side, Class 2 and 3 streams would receive a 180 foot buffer and Class 4 streams would receive a 25-50 foot.

Legacy Tree and Snag retention

Some of the proposed thinning harvest units may have older remnant trees and large snags that are not the focus of the proposed harvest treatments. Older remnant trees and large snags will be retained to the greatest degree practicable while providing for safe operations (e.g. adjusting unit configuration and/or yarding and road placement).

Existing snags may be protected by establishing aggregate retention around concentrations of snags and clumping trees around individual scattered snags. If necessary, however, additional snags could be created by mechanical means where post-harvest assessment indicates an insufficient numbers of snags.

Non-commercial Thinning of Plantations

Non-commercial thinning, girdling or burning would occur on 474 acres. Non-commercial thinning would be comprised of predominately conifers under 7 inches DBH, although larger trees up to 24 inches DBH may be cut and left within 20 feet of the dripline of large pines. In some cases trees up to 24 inches DBH could also be girdled in the vicinity of large pines rather than felled.

Non-Commercial Fuel Breaks (See Appendix C)

Approximately 1,420 acres of shaded fuel breaks along major/strategic road systems will be created to help aid in future management of fire. These fuel breaks will extend 150 feet on either side of the road and will remove brush and trees up to 7" dbh within the project area to reduce the amount of fuel loading, break up canopy continuity, and improve ingress and egress for future wildland fire personnel, which will aid in managing future wildfires.

These shaded fuel breaks will consist of non-commercial treatments along FS roads 4750, 4770, 4720.2800. 2801-100 2801-340, 2800-589, and 2715-530

Within the non-commercial thinning treatment areas, this will involve removing brush and trees ≤7 inches in diameter material, which will be hand-piled and burned onsite. Within the Riparian Reserve, no treatment will occur within the primary shade zones (PSZ), (variable widths, see stream buffers, pg. 8). Treatment outside of the PSZ will be limited to tree limbing to raise the canopy base height and scattering of limbs for fuels treatment.

Prescribed Fire (see Appendix C-Map)

Approximately 1,218 acres would receive maintenance prescribed fire subsequent to all harvest and timber activity fuel management. These maintenance burns should occur within 10 to 15 years of cessation of timber management activities and may include multiple entries. No riparian buffers would be used for prescribed burning, however minimal spread and consumption is expected in these areas under the weather and fuel moisture conditions we plan to burn.

Activity Fuels

Fuels treatments within the acres planned for commercial and non-commercial thinning may consist of pile and burning or broadcast burning or both.
Prior to burning the activity-generated fuels, we will offer the material for firewood, biochar, biomass or other utilization methods

Road Actions

For this analysis, two categories of proposed road actions were used to describe the range of actions: road maintenance and temporary road construction. These road actions are associated with individually proposed timber sales described previously for thinning actions. For analytical purposes, road activities are 50 feet in width. The proposed action includes 12 acres of temporary road construction outside of harvest units (Table 1, pg. 5).

Road Construction:

Road construction includes road work to build a road where a designed road did not exist previously. Road work on a "jeep road" will be considered road construction since there is no previous design specification for such roads.

Typical activities that will be associated with road construction:

- brushing,
- ditch cleaning,
- surface grading,
- installing/replacing drainage structures, and/or
- adding additional rock surfacing where needed (i.e. spot rock) where rock was included in the original design.
- clearing/grubbing

There are approximately 12 acres of road construction OUTSIDE OF HARVEST UNITS identified in the project (Table 1, pg. 5). Road construction will occur within .4 acres of NRF habitat, 2.3 acres of dispersal habitat, and 3 acres of capable habitat. The remaining acres will occur within non-capable habitat (Table 1, pg. 5). These activities are accounted for in the Effects section.

Temporary Road Construction outside Harvest Units

Approximately 3.5 miles of new temporary road or reconstructed non-system road will be needed to complete the project. All temporary roads and reconstructed non-system roads will be removed after use. Reconstructed Maintenance Level 1 roads will be left in a hydrologically stable condition, blocked, and placed into storage as Maintenance Level 1 roads. No temporary road construction activities will occur within recovery action 32 stands

Activity-generated Fuels Management within harvest units (Table 2)**:**

Fuels management (burning ground-based machine piles, landings and hand piles) will occur during the late autumn and early winter when soil and duff moisture is high (fuels specialist report-Calf Copeland EIS) to protect soils (Busse et al 2014) but prior to persistent rain. In some of the harvest areas, ground-based machine piles will be burned when the fuels are dry enough to burn within the piles and potentially carry between piles at a low intensity, commonly referred to as jackpot burning. Jackpot burning in ground-based areas will be allowed to back into Riparian Reserves. Piles in cable yarding areas will be burned under wet conditions when fire will not

carry outside of the piles. If necessary, logging slash in portions of some units will be broadcast burned to reduce fire risk and prepare for planting.

Light to moderate burn intensity will be prescribed to minimize consumption of duff and large woody material. Broadcast burning by hand ignition will occur in the fall, winter, or spring depending on conditions conducive to achieving burn objectives and when soil and duff moisture is high and moisture content of large fuels is high (Busse et al 2014, Busse et al. 2013; Busse et al 2010) . There will be no ignition within the Riparian Reserves to avoid potential fuel spills therein, but if operationally possible, fire will be allowed to back into the Riparian Reserves to enhance biological diversity.

Table 2. Activity-generated Fuels within the Calf Copeland Project.

Activity	Acres
Landing and Grapple pile	1,661
Under-burning	1,759

Project Design Criteria/Features of the Proposed Action

Project Design Criteria

Project Design Criteria (PDC) associated with the proposed Project are defined as measures incorporated into the proposed action to minimize potential adverse effects to the spotted owl and its habitat (Assessment Appendix B). The Forest uses PDC to the extent practicable in keeping with Forest policy and regulation. The PDC apply to all proposed actions described in this assessment.

Physical impacts to habitat and disturbances to individuals can be reduced or avoided with PDC. Listed below are species-specific PDC for the proposed actions. These PDC have been separated into those that reduce or avoid habitat impacts and those that reduce or avoid disturbance impacts. The Effects of the Action analysis in this Opinion relies on the full implementation of the PDC described below.

If spotted owls are located during surveys at sites not included in this analysis, the Forest will review PDC and affirm whether the effects analysis in this Opinion remains valid (see Project Monitoring below). If new information on spotted owl site occupancy becomes available, the Forest will affirm consistency of the new information with this Opinion and will reinitiate consultation or make modifications to the proposed action, as appropriate. To the extent possible existing down woody material and snags will be left undisturbed, if snags are felled, within the LSR and left on site.

The following standards are common to all proposed actions:

- A wildlife biologist shall participate in the planning and design of all activities affecting listed species.

- The Project Design Criteria described below (Tables 3 and 4) will be implemented unless surveys indicate either non-occupancy or non-nesting of target species.

- Occupied and known historic spotted owl nest trees will not be removed.

- Year-end monitoring will ensure that actual levels of adverse effect and incidental take resulting from implementation of the proposed actions do not exceed the levels anticipated in the Biological Opinion associated with this document, whether from habitat modification, or impacts to Critical Habitat. The Forest shall inform the Interagency Level 1 Team and re-initiate formal consultation with the Service before exceeding an anticipated level of incidental take or adverse effect.

- The Forest will complete a Project Implementation and Monitoring Form (Appendix B) by December 31st of each year for all actions that are likely to adversely affect a listed species or or downgrade NRF, dispersal, or Critical Habitat. This form will be forwarded to the Service.

- Interim monitoring reports provided for timber harvest operations will qualitatively reflect the proportion of the project completed (e.g. ¼, ½, or ¾ complete) and the acres actually sold and awarded until harvest is completed. Upon completion of the project (i.e. after harvest), monitoring reports will indicate the actual number of acres treated and any observed effects to listed species.

Reinitiation

Page 4-60 of the Consultation Handbook (USDI FWS/USDC NMFS 1998) lists four situations that trigger the need to reinitiate consultation on a proposed project:

- The amount or extent of incidental take is exceeded.
- New information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in the Biological Opinion.
- The agency action is subsequently modified in a manner that causes an effect to listed species or critical habitat not considered in the Biological Opinion.
- A new species is listed or critical habitat designated that may be affected by the action.

The unit biologist should review those provisions and inform the authorized officer of any requirement to reinitiate consultation. The Level I Team also is available to help the unit wildlife biologist, as requested, apply this assessment and review site-specific situations.

The Forest retains discretion to halt and modify all projects, anywhere in the process, should new information regarding effects to proposed and listed threatened or endangered species, or their critical habitat, arise. Minimization of impacts would then, at the least, include the application of an appropriate seasonal restriction to minimize disruption impacts; and could include clumping of retention trees around nest trees, establishment of buffers, dropping unit(s) or portions of units, or dropping entire projects.

Additional circumstances where reinitiation may be required:

- As surveys are conducted as part of an on-going project that overlaps the Action Area to assess spotted owls in the project area and those surveys detect owls in a different area than originally consulted upon, re-initiation may be required. Contact Level I Team representative(s) to review site-specific situations.
- Timber sales are administered by an Authorized Contracting Officer. Other aspects of the contract are typically administered at the local level by Contracting Officer Representative (COR) throughout implementation until the project work is completed, or implemented by Forest staff. Timber sales also have a contract clause that authorizes a stop work order when threatened or endangered species or sites are found within the timber sale or to comply with court orders. When (and if) a spotted owl (or other listed species) is found in the project area, the Forest is authorized to stop the work until the issue is evaluated further. If a spotted owl or other listed species site is found, biologists will review PDCs and the appropriate consultation document to confirm the ESA analysis remains valid.

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

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

Disturbance/Disruption Distances

A **disruption distance** is the distance within which the effects to listed species from noise, or mechanical movement associated with an action will be expected to exceed the level of discountable or insignificant. Thus, within the disruption distance, actions will be expected to adversely affect listed species. Unit wildlife biologists may increase, ***but may not decrease***, these disruption distances and still comply with the standards of this consultation. Within the disruption distance, activities (Table 3) occurring during the critical breeding period could significantly disrupt the normal behavior pattern of individual animals or breeding pairs and could create a likelihood of injury (USDI FWS 2003).

A **disturbance distance** is the distance within which the effects to listed species from noise, human intrusion, and mechanical movement associated with an action will be expected to be discountable or insignificant and incidental "take" will not be expected. Effects are expected to be "insignificant" or "discountable" beyond the disruption distance and up to the disturbance distance. Thus, between the disruption distance threshold and disturbance distance threshold,

effects will be expected to not adversely affect listed species. To correctly apply the standards of this assessment to individual animals or breeding pairs, the unit wildlife biologist may increase or decrease these disturbance distances based on the best available scientific information and site-specific conditions. Beyond the disturbance distance threshold, no effects to listed species are expected.

During the critical breeding period, activities occurring within the disruption distances from occupied spotted owl sites, shown in Tables 3 and 4. In unsurveyed spotted owl NRF habitat suitable habitat could cause injury by significantly disrupting the normal behavior pattern of individual animals or breeding pairs. Use of these threshold distances with the project design criteria listed below will minimize effects to listed species from disruption.

Table 3. Disturbance and Disruption Distances for the spotted owl for the Calf Copeland Project

Project Activity	No Effect	NLAA "may affect" disturbance distance	LAA early nesting season disruption distance (Mar 1–Jul 15)	LAA late nesting season disruption distance (Jul 16–Sep 30)	LAA direct injury and/or mortality (Mar 1 – Sept. 30)
Light maintenance (e.g., road brushing and grading) at campgrounds, administrative facilities, and heavily-used roads	>0.25 mile*	≤ 0.25 mile	NA[1]	NA	NA
Log hauling on heavily-used roads	>0.25 mile	≤ 0.25 mile	NA[1]	NA	NA
Chainsaws (includes felling hazard/danger trees)	>0.25 mile	66 yards to 0.25 mile	≤ 65 yards[2]	NA	NA
Heavy equipment for road construction, road repairs, bridge construction, culvert replacements, etc.	>0.25 mile	66 yards to 0.25 mile	≤ 65 yards[2]	NA	NA
Pile-driving (steel H piles, pipe piles) Rock Crushing and Screening Equipment	>0.25 mile	120 yards to 0.25 mile	≤ 120 yards[3]	NA	≤ 5 yards(injury)[3]

Project Activity	No Effect	NLAA "may affect" disturbance distance	LAA early nesting season disruption distance (Mar 1–Jul 15)	LAA late nesting season disruption distance (Jul 16–Sep 30)	LAA direct injury and/or mortality (Mar 1 – Sept. 30)
Blasting	>1 mile	0.25 mile to 1 mile	≤ 0.25 mile[4]	NA	≤ 100 yards (injury)[4]
Helicopter: Chinook 47d	>0.5 mile	266 yards to 0.5 mile	≤ 265 yards[5]	≤ 100 yards[6] (hovering only)	NA
Helicopter: Boeing Vertol 107, Sikorsky S-64 (SkyCrane)	>0.25 mile	151 yards to 0.25 mile	≤ 150 yards[7]	≤ 50 yards[6] (hovering only)	NA
Helicopters: K-MAX, Bell 206 L4, Hughes 500	>0.25 mile	111 yards to 0.25 mile	≤ 110 yards[8]	≤ 50 yards[6] (hovering only)	NA
Small fixed-wing aircraft (Cessna 185, etc.)	>0.25 mile	111 yards to 0.25 mile	≤ 110 yards	NA	NA
Tree Climbing	>66 yards	26 yards to 65 yards	≤ 25 yards[9]	NA	NA
Burning (prescribed fires, pile burning)	>1 mile	0.25 mile to 1 mile	≤ 0.25 mile[10]	NA	NA

*Distances are to a known occupied spotted owl nest tree or fledging locations, but if no current survey information is available then distances are from the edge of the most recent nest patch.

1. NA = not applicable. Based on information presented in Temple and Guttiérez (2003, p. 700), Delaney et al. (1999, page 69), and Kerns and Allwardt (1992, page 9), we anticipate that spotted owls that select nest sites in close proximity to open roads either are undisturbed by or habituate to the normal range of sounds and activities associated with these roads.
2. Based on Delaney et al. (1999, page 67) which indicates that spotted owl flush responses to above-ambient equipment sound levels and associated activities are most likely to occur at a distance of 65 yards (60 meters) or less.
3. Impulsive sound associated with pile-driving is highly variable and potentially injurious at close distances. A review compiled by Dooling and Popper (2007, page 25) indicates that birds exposed to multiple impulses (e.g., pile driving) of sound at 125 decibels (dBA) or greater are likely to suffer hearing damage. We have conservatively chosen a distance threshold of 120 yards for impact pile-driving to avoid potential effects to hearing and to account for significant behavioral responses (e.g., flushing) from exposure to loud, impulsive sounds. Based on an average maximum sound level of 110 dBA at 50 feet for pile-driving, exposure to injurious sound levels would only occur at extremely close distances (e.g., ≤ 5 yards).
4. Impulsive sound associated with blasts is highly variable and potentially injurious at close distances. We selected a 0.25-mile radius around blast sites as a disruption distance based on observed prairie falcon flush responses to blasting noise at distances of 0.3 – 0.6 miles from blast sites (Holthuijzen et al. 1990, page 273). Exposure to peak sound levels that are >140 dBA are likely to cause injury in the form of hearing loss in birds (Dooling and Popper 2007, pgs. 23-24). We have conservatively selected 100 yards as an injury threshold distance based on sound levels from experimental blasts reported by Holthuijzen et al. (1990, page 272), which documented peak sound levels from small blasts at 138 – 146 dBA at a distance of 100 meters (110 yards).

5. Based on an estimated 92 dBA sound-contour (approximately 265 yards) from sound data for the Chinook 47d presented in Newman et al. (1984, Table D.1).
6. Rotor-wash from large helicopters is expected to be disruptive at any time during the nesting season due the potential for flying debris and shaking of trees located directly under a hovering helicopter. The hovering rotor-wash distance for the Chinook 47d is based on a 300-foot radius rotor-wash zone for large helicopters hovering at < 500 above ground level (from WCB 2005, page 2 – logging safety guidelines). We reduced the hovering helicopter rotor-wash zone to a 50-yard radius for all other helicopters based on the smaller rotor-span for all other ships.
7. Based on an estimated 92 dBA sound contour from sound data for the Boeing Vertol 107 the presented in the San Dimas Helicopter Logging Noise Report (USFS 2008, chapters 5, 6).
8. The estimated 92 dBA sound contours for these helicopters is less than 110 yards (e.g., K-MAX (100 feet) (USFS 2008, chapters 5, 6), and Bell 206 (85-89 dBA at 100 meters)(Grubb et al. 2010, page 1277).
9. Based on Swarthout and Steidl (2001, page 312) who found that 95 percent of flush responses by spotted owls due to the presence of hikers on trails occurred within a distance of 24 meters.
10. Based on recommendations presented in Smoke Effects to Northern Spotted Owls (USDI FWS 2008, page 4).

The Forest retains discretion to halt and modify all projects, anywhere in the process, should new information regarding effects to proposed and listed threatened or endangered species, or their critical habitat, arise (page 14).

The seasonal or daily restrictions listed in Tables 3 may be waived at the discretion of the decision maker if necessary to protect public safety or property, as in the case of emergency road repairs or hazard tree removal. In such cases, Emergency consultation will be initiated with the Service (Page 14).

Table 4. Spotted Owl Project Design Criteria for Disruption and Disturbance

Northern Spotted Owl
Actions: Road Maintenance
These projects will not be seasonally restricted for disruption to spotted owls because projects typically last less than a day on any quarter-mile section of road; and these areas receive baseline noise levels because they are spatially limited to the vicinity of existing roads. Thus, any spotted owls within applicable disruption threshold distances will likely be acclimated to noise disturbance.
Actions: *Thinning, Wetland Treatments, Road Activities,*
Projects will not occur within the appropriate disruption threshold distance of any **unsurveyed NRF habitat or known site** from March 1- July 15. This seasonal restriction may be waived until March 1 of the following year if current calendar year surveys indicate: 1) spotted owls not detected, 2) spotted owls present, but not attempting to nest, or 3) spotted owls present, but nesting attempt has failed.
Any action involving blasting will not occur within the appropriate disruption threshold distance of any unsurveyed NRF habitat, known site, or estimated site from March 1 - July 15.
All Actions
For projects that remove NRF habitat, work activities such as tree felling, yarding, etc., will not occur within 0.25 miles of any **unsurveyed NRF habitat or known site** from March 1- September 30. This seasonal restriction may be waived until March 1 of the following year if current calendar year surveys indicate: 1) spotted owls not detected, 2) spotted owls present, but not attempting to nest, or 3) spotted owls present, but nesting attempt has failed.

Project Monitoring

According to the Forest (page 14), timber sales are administered by an Authorized Officer and Contract Administrator. All other contracts are administered at the local level by Contracting Officer Representatives (CORs) and Project Inspectors (PI) throughout implementation until the project work is completed, or implemented by Forest staff. Timber sales also have a contract clause (E-4) that authorizes stop work when threatened or endangered species or sites are found within the timber sale or to comply with court orders. When (and if) a spotted owl or other listed species) is found in the project area, the Forest is authorized to stop the work until the issue is evaluated further. If a spotted owl or other listed species site is found, biologists will review PDCs and the appropriate consultation document to confirm the ESA analysis remains valid.

If the spotted owl (or other listed species) was not analyzed in the Biological Assessment, if the project area changes from what was originally analyzed in the Biological Assessment, if a site has moved, or other information is inconsistent with what is authorized, the Forest coordinates with project proponents, contractors, managers, local biologists and the Level 1 Team to ensure the project impacts remain consistent with the Biological Assessment and the responding consultation document (biological opinion or letter of concurrence). If further impact minimization is deemed necessary, minimization of impacts would then, at the least, include the application of an appropriate seasonal restriction to minimize disruption impacts; and could include clumping of retention trees around nest trees, establishment of buffers, dropping unit(s) or portions of units, or dropping entire projects. If not, the project will remain stopped until the Forest implements one or more of the following:

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

DESCRIPTION OF THE ACTION AREA

For the purposes of this analysis, spotted owl habitat composition and population distribution within the median provincial spotted owl pair home range radius for the Oregon Coast Ranges (1.2 miles) of the habitat impact footprint was used to delineate the action area because the project area lies entirely within the West Cascades province providence (Figure 2).

The Forest utilized multiple information sources and habitat data (pg. 3) to characterize spotted owl habitat within the delineated action area.

Range-wide Status of the Spotted Owl – See Appendix A

ENVIRONMENTAL BASELINE WITHIN THE ACTION AREA FOR THE SPOTTED OWL AND ITS HABITAT

62 percent of the Action Area is characterized as spotted owl NRF habitat. Approximately 61 percent of this NRF habitat in the action area (41,056 acres) occurs on Umpqua National Forest-administered lands (Table 5). Of the 66,252 acres of Umpqua Forest-administered lands in the

action area, 20 percent (13,518 acres) is dispersal-only habitat. Total spotted owl habitat on Forest-administered land in the Action Area, which includes both NRF and dispersal-only habitat accounts for approximately 82 percent (54,574 acres) (Table 5) of the Forest-administered land in the Action Area.

The 66, 828 acre Action Area overlaps approximately 39,406 acres of spotted owl critical habitat of which approximately 26,622 acres is considered NRF habitat. The environmental baseline used herein accounts for recent fire events (through 2018).

The Action Area (66,828 acres) is 99 percent Umpqua National Forest-administered lands. Of the 66,252 Forest-administered acres in the Action Area, there are 1,252 acres reserved as known spotted owl activity centers and approximately 56,681 acres are within Riparian Reserves, LSR4's and LSR. Approximately 41,056 acres provide spotted owl NRF habitat on the Forest-administered lands in the Action Area (Table 5).

Table 5. Environmental Baseline of spotted owl habitat in the Action Area for the Calf Copeland Project.

	Total Acres	NRF[1] (acres)	NRF[1] Previously Thinned (acres)	Post fire forage	Dispersal-only[1] (acres)	Dispersal[1] Previously Thinned (acres)	Capable[1] (acres)	Capable[1] Previously Thinned (acres)	Non-Capable[1] (acres)
All Ownerships (total)	66,828	41,224	651	2,330	13,759	810	10,007	655	2,000
Private (total)	577	168	Unknown	5	79	Unknown	130	Unknown	200
Umpqua National Forest (total)	66,252	41,056	651	2325	13,518	810	9,877	655	1,800
Known Owl Activity Centers (total)	1,252	1,002	0	40	155	0	95	0	0
Riparian Reserves (Matrix and AMA acres only) (total)	2,590	1,360	144	747	584	103	491	0	155
Reserved (total)	54,091	35,294	0	2228	10,566	0	7,665	0	566
Matrix/Adaptive Management Areas (total)	11,510	5,291	507	86	2,894	707	3,325	655	1,079
West Cascades South 5 CHU	38,000	25,664	435	1675	7,212	667	3,745	603	1,800
Klamath East 1 CHU	1,406	958	72	0	362	40	86	52	0

Values may not sum to "Total" due to rounding.

[1] **Habitat Definitions** – The categories of northern spotted owl habitat displayed in this table are mutually exclusive (i.e. based on non-overlapping polygons in GIS

Northern Spotted Owl

NRF: nesting, roosting, and foraging habitat (FOI stand age $\geq$ 80 years).

Post Fire Forage: NRF habitat that has burned at a moderate to high severity.

Dispersal-only: dispersal quality habitat (FOI stand age between 40-79 years).

Capable: forest stands that are capable of developing into dispersal and NRF habitat but currently are not functioning as spotted owl habitat (FOI stand age $\leq$ 39 years).

Non-capable: lands not capable of developing into dispersal or NRF habitat in the foreseeable future because they are non-forested ground (e.g. rocky bluffs, cliffs, grassland, etc.) or are existing roads.

Status of Spotted Owl Critical Habitat in the Action Area

The Action Area contains two individual subunits, West Cascades South 5 and Klamath East 1 (Figure 2). The subunits are described in USDI FWS (2011a).

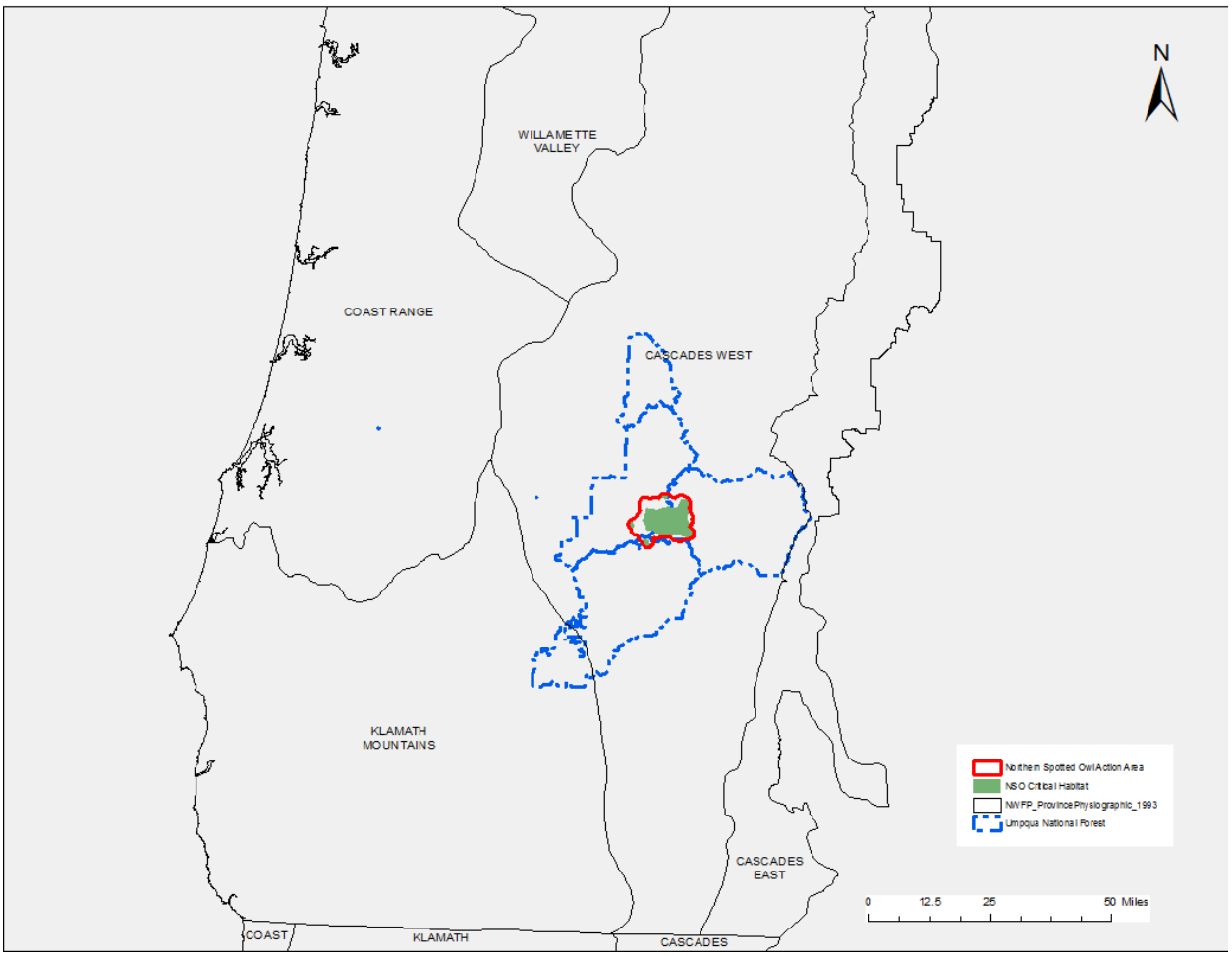


Figure 2. Vicinity of the Calf Copeland Restoration Project within the Physiographic Province and Spotted Owl Critical Habitat Subunit.

Table 6. Summary of northern spotted owl habitat available in northern spotted owl critical habitat subunits within the Action Area for the Calf Copeland Project.

Critical Habitat Sub-Units			Northern Spotted Owl Habitat[1] in Critical within the Action Area *(acres)*														
			Matrix[2]							Reserved[3]							
Sub-Unit	**Entire Sub-Unit[4] *(acres)***	**Within Action Area *(acres)***	**NRF**	**Thinned NRF**	**Post Fire Forage**	**Dispersal-only**	**Dispersal-only Previously Thinned**	**Capable**	**Non-Capable**	**NRF**	**NRF Previously Thinned**	**Post Fire Forage**	**Dispersal-only**	**Dispersal-only Previously Thinned**	**Capable**	**Non-Capable**	**State Lands**
West Cascades South 5	356,415	38,000	5,291	330	0	2,894	552	603	656	13,585	105	1,675	8,645	115	4,555	128	0
Klamath East 1	242,338	1,406	0	0	0	0	0	0	0	958	72	0	362	40	86	0	0
Total	598,753	39,406	5,291	330	0	2,894	552	603	656	14,543	177	1,675	9,007	155	4,641	128	0

Values may not sum to "Total CHU Acreage" or "Forest CHU Acreage" due to rounding.

[1] **Habitat Definitions** – See footnotes at Table 1.

[2] **Matrix** = lands within Adaptive Management Area (AMA), Connectivity/Diversity Block (C/D), or General Forest Management Area (GFMA) land use allocations.

[3] **Reserved** = lands within the Late Successional Reserve (LSR), Forest Designated Reserve (DDR), or Congressionally Designated Reserve (CGRR) land use allocations.

[4] Acreage of entire sub-units is from the Final Rule for Designation of Revised Critical Habitat for the Northern Spotted Owl (USDI FWS 2012).

Critical Habitat Unit (West Cascades South)

There are 2 subunit in the Oregon West Cascades South recovery unit affected by the proposed action: WSC-5 and KLE-1 (Figure 2).

Subunit WSC-5 consists of approximately 356,415 ac (144,236 ha) in Lane and Douglas Counties, Oregon, and comprises only Federal lands managed by the USFS under the NWFP (USDA and USDI 1994, entire). There are 169 historic (1990-2012) northern spotted owl sites in this unit. Special management considerations or protection are required in this subunit to address threats from current and past timber harvest and competition with barred owls. This subunit is expected to function primarily for demographic support to the overall population, as well as north-south and east-west connectivity between subunits and critical habitat units (USDI FWS 2011a).

Subunit KLE-1 consists of approximately 242,388 ac (41,255 ha) in Josephine and Douglas Counties, Oregon, and comprises Federal lands managed by the USFS and the BLM under the NWFP (USDA FS and USDI BLM 1994, entire). Special management considerations or protection are required in this subunit to address threats to the essential physical or biological features from current and past timber harvest, losses due to wildfire and the effects on vegetation from fire exclusion, and competition with barred owls. This subunit is expected to function primarily for east-west connectivity between subunits and critical habitat units, but also for demographic support. This subunit facilitates northern spotted owl movements between the western Cascades and coastal Oregon and the Klamath Mountains (USDI FWS 2011a).

Known Spotted Owls within the Action Area

There are currently 18 spotted owl sites within the Action Area. Based on surveys following the 2012 northern spotted owl survey protocol from 2014 through September 2018, 2 years of surveys were conducted at all sites and spot checks continue, none of the spotted owl sites are documented to be occupied by resident spotted owls. All 18 of the spotted owl sites occur within the Forest and have nest patches at least partially on Forest-administered lands. Barred owls have been detected across the Action Area, over the 4 years that surveys were conducted, 18 barred owl responses were heard**.**

Barred Owl Occurrence in the Action Area

While Appendix A summarizes information on the range-wide environmental baseline for spotted owls, additional information is provided in this section on the threat of barred owls relative to the action area.

The 2011 Revised Recovery Plan for the Northern Spotted Owl (USFWS 2011) identifies competition from the barred owl as an important threat to the spotted owl. Since barred owls are more aggressive and more habitat generalists but also use the same habitats and prey as spotted owls they are believed to be out competing spotted owls for habitat and food (USFWS 2011, Wiens 2012). Within the demographic study areas, there has been a steady increase in the

number of barred owls as measured by the proportion of spotted owl sites with barred owls detected, with as many as 60 percent of the spotted owl sites having barred owls detected (Dugger et al. 2016). Dugger et al. (2016) also found evidence that barred owl detections were important sources of variation and had negative effects on spotted owl apparent occupancy, survival and recruitment (Figure 3 & 4). In the Klamath Study Area since the recent Dugger (2016) meta-analysis, data continues to show trends where the numbers of barred owls continue to increase, while spotted owl occupancy and fecundity continue to decrease (Lesmeister 2018)

Figure 3. Annual proportion of Spotted Owl territories with Barred Owl detections (BO covariate) (Dugger et al. 2016)

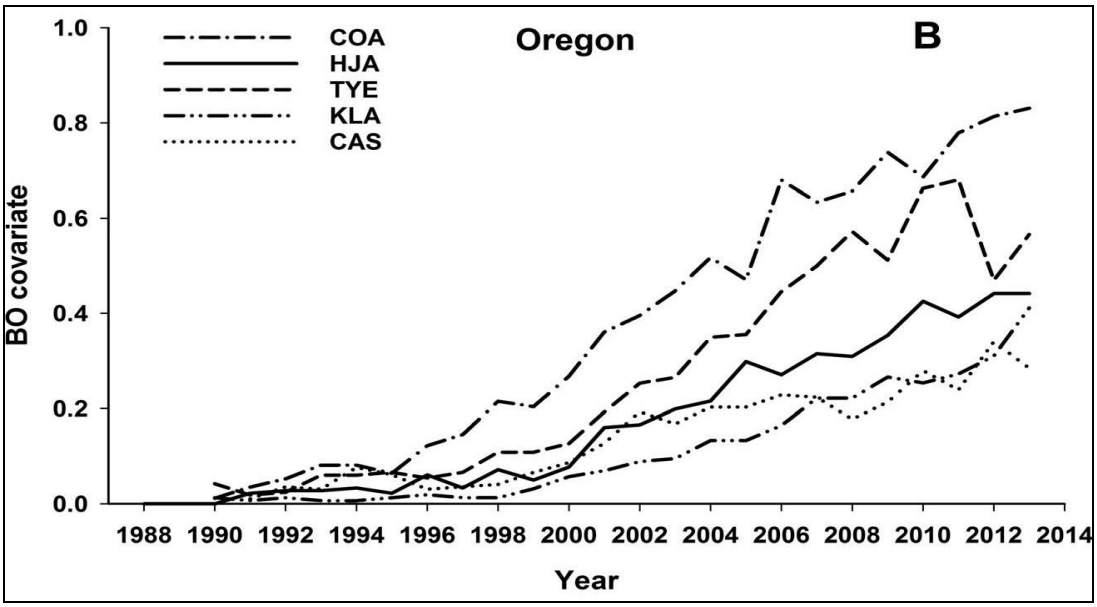
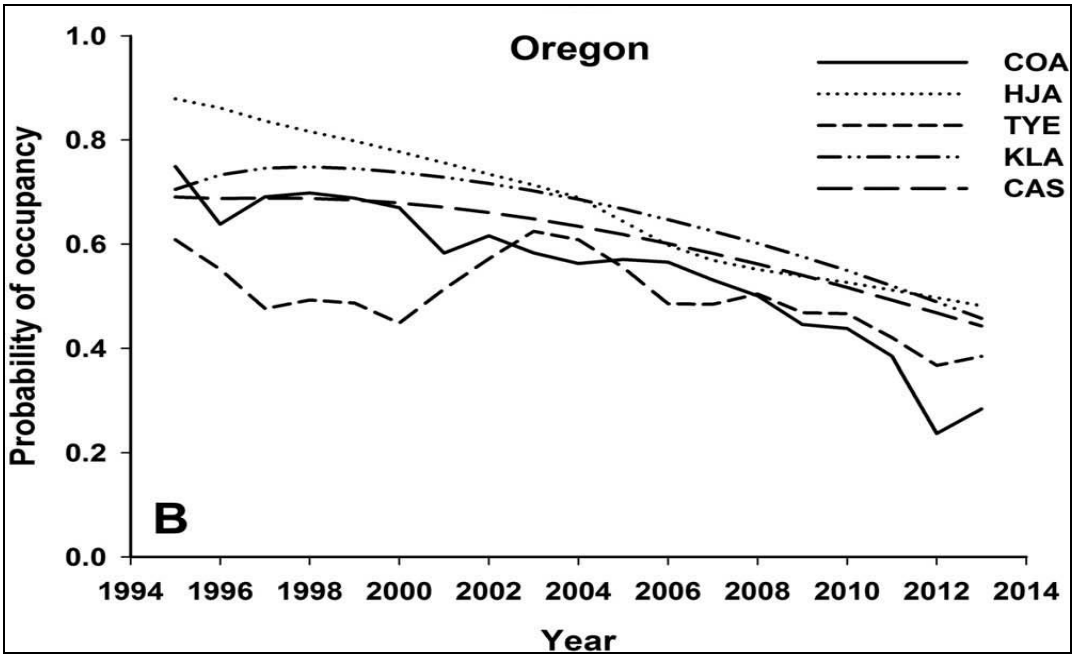


Figure 4. Probability of Spotted Owl Territory Occupancy (Dugger et al. 2016).



Dugger et al. (2016) modeled extinction and colonization rates for spotted owl pairs in the South Cascade Demographic Study area where barred owls were detected on some home ranges. They found that extinction rates for spotted owls increased with decreasing amounts of old forest in the core area, and that the effect was 2-3 times greater when barred owls were detected. They also found that colonization rates for spotted owls decreased as the distance between patches of old forest increased (i.e. increased habitat loss and fragmentation) and that barred owl presence similarly decreased the rate of colonization of spotted owl pairs. They concluded that conserving large blocks of contiguous old-forest habitat was important for reducing interference competition between the two owl species. Wiens (2012) also found that the relative probability of spotted owls selecting a location for reproduction was reduced if the location was in close proximity to the core-use area of a barred owl.

Some of the proposed activities would remove or degrade habitat conditions for spotted owls within the home range of known spotted owl sites. The likelihood of barred owls occurring within the home range of most sites in the action area is high, including multiple barred owl pairs residing within a single spotted owl site. Portions of the action area on the eastern edge, on the North Umpqua Ranger District have encountered barred owls (Copeland Creek Restoration Project) (personal communication, E. Trujillo) however surveys were not conducted in the entire Action Area, due to previous wildfire and fuels related work along Calf ridge. This area is now a proposed fuel break and will only be piling and removing stems less than 7 inches DBH to those portions of the action area that were previously burned. The Forest considers the risk of barred owls occurring in the area highly likely and they will most likely continue to persist.

Barred owls appear to be more tolerant of younger and lower quality forest conditions and seem to preferentially use forest stand types in proportion to their availability; while spotted owls are reliant on older forest (Weins 2014). When manipulation of habitat (e.g., timber harvest) alters habitat conditions for both barred owl and spotted owl, the relative effect on barred owls may be lesser because they do not appear as dependent on older forests as spotted owls.

Some spotted owls appear to be able to successfully defend territories and reproduce when barred owls are present (Weins 2014), but the mechanism that allows this is currently unknown and such behavior often does not occur. As mentioned above, when barred owls are present, the effect of habitat modification on northern spotted owl pair survival (estimated as the probability of extinction of a single territory) may be exacerbated by 2-3 times (Dugger et al. 2011). The relative effect of barred owls on site extinction probability increases as the proportion of older forest habitat at the core area scale decreases (Dugger et al 2011). Barred owl effects on spotted owl survival and colonization appear to be substantial and additive to the effects of reduction and fragmentation of habitat in spotted owl home range areas. Habitat loss accompanied by spotted owl exclusion from other habitat due to barred owl competition, has a disproportionate increase in the effects to spotted owls compared to habitat loss alone.

Spotted owls displaced by timber management are unlikely to successfully establish a new territory in areas where barred owls are present (Dugger et al. 2011, Yackulic et al. 2014). Displaced spotted owls may survive for some period, but if they are not able to establish a new territory and pair, their contribution to the population and its recovery is minimal. While the effects described above would vary in occurrence and intensity among individual spotted owl territories, they are overall, relevant assumptions used to assess typical effects of habitat modification combined with barred owl competition.

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

Approximately 54,091 acres of Reserved LUA and 39,406 acres of critical habitat are located within the Action Area – 53,433 acres are both LSR and NSO CH. These areas include riparian reserves, LSR4 and the larger South Cascades LSR 222 (NWFP), these land use allocations continue to allow connectivity through the landscape and owl persistence in and outside the Action Area.

The role of spotted owl critical habitat is:

- To ensure sufficient habitat to support stable, healthy populations of spotted owls across the range and within each of the 11 recovery units,
- To ensure distribution of northern spotted owl habitat across the range of habitat conditions used by the species, and
- Incorporate uncertainty, including potential effects of barred owls, climate change and wildfire-disturbance risk.

Critical habitat protections are also meant to work in concert with other recovery actions such as barred owl management (USFWS 2012a, p. 71879). Recovery actions include:

1. Conserve the older growth, high quality and occupied forest habitat as necessary to meet recovery goals. This includes conserving old growth trees and forests on Federal lands *wherever they are found*, and undertake appropriate restoration treatment in the threatened forest types.

2. Implement science-based, active vegetation management to restore forest health, especially in drier forests in the eastern and southern portions of the spotted owl's range. This includes managing NWFP forests as dynamic ecosystems that conserve all stages of forest development (e.g., old growth and early seral), and where tradeoffs between short-term and long-term risks are better balanced. The NWFP should be recognized as an integrated conservation strategy that contributes to all components of sustainability across Federal lands.

3. Encourage landscape-level planning and vegetation management that allows historical ecological processes, such as characteristic fire regimes and natural forest succession, to occur on these landscapes throughout the range of the spotted owl. This approach has the best chance of resulting in forests that are resilient to future changes that may arise due to climate change (USFWS 2012a, p. 71881).

EFFECTS OF THE ACTION ON THE SPOTTED OWL

Analytical Approach and Spotted Owl Occupancy

For the purposes of this effects analysis, the area within 1.2 miles of project sites will be used because the Action Area occurs in the Oregon Cascades Physiographic Province. This distance is based on the median home range size of a resident spotted owl pair in this province, and represents the best available approach to analyzing habitat modification impacts to spotted owls.

The Forest utilized habitat data based on the GIS data; satellite imagery; and field verification to assist in their characterization of spotted owl habitat within project sites and to inform the habitat-baseline at the Action Area scale (see page 3, this document).

Effects to Spotted Owl Habitat caused by the Proposed Action

Of the 54,574 acres characterized as spotted owl habitat (NRF plus dispersal-only) on Umpqua NF lands across the action area (Table 5 and 8, pgs. 22 and 39, respectively), the Forest proposes 5,475 acres of treatments, of which, the primary actions affecting spotted owls will be the commercial thinning (3,420 acres) and non-commercial (1,894) and prescribed fire in NRF and dispersal-only habitat. (Table 1, pg. 5).

<u>Thinning –</u>

Vertical and horizontal cover will be reduced within the proposed units through the reduction in overstory canopy cover with varying levels of residual tree density. However, 1,427 acres of NRF habitat proposed for thinning in harvest units (Table 8, pg. 39) are expected to be down-graded as well as 65 acres of NRF will be removed, this is due to mostly to the thinning around Ponderosa and Sugar Pine. 39,732 or (96%) acres of NRF habitat will be maintain at its current function within the Action Area. Dispersal habitat will increase by 1,227 acres because of the

down-grading of NRF habitat. In addition to the retention of other key features such as snags, downed-wood, (Davis et al. 2011 and USDI FWS 2011a). Most of the large remnant trees and dominant and co-dominant hardwoods will be reserved and snags and coarse wood will be protected to the greatest extent possible, maintaining or enhancing many habitat features necessary for the future development of late-seral characteristics.

Prescribed Burning

Our assumptions about the likely effects of fire, which are largely attributed to wildfires and not prescribed fire on spotted owls, are based on conditions and scenarios described in literature and then compared to the site-specific conditions for projects being evaluated. Studies have detected highly variable responses to fire-caused habitat changes with apparent habitat value declining with burn severity (Bond et al. 2009, Clark 2007, Clark et al. 2011, Clark et al. 2013, Gaines et al. 1995, and King et al. 1998).

Sites selected by spotted owls for nesting and roosting in post-fire landscapes generally experienced either no fire or low- to moderate- severity fire (Bond et al. 2009, Clark 2007, Clark et al. 2011, Clark et al. 2013, King et al. 1998). Additionally, where vegetation was measured, sites selected consistently had high canopy closure (Bond et al. 2009). High-severity burns were generally not used by spotted owls for nesting or roosting (Bond et al. 2009, Clark 2007, Clark et al. 2011, Clark et al. 2013, King et al. 1998) presumably because the live canopy is essentially consumed in the fire. This would suggest that low- to moderate-severity fires that retain adequate canopy can function for nesting or roosting and thus allow the continued use of spotted owl territories, while territories that burned at high-severity no longer supported nesting spotted owls. It is expected that within mixed severity burns, spotted owls will select the best available post-fire habitat and activity centers at these locations may persist into the future. The Calf Copeland project proposed prescribed fire is anticipated to have post-fire conditions similar to and/or less impact on forest-habitat conditions than a low severity wildfire. Therefore, the Forest does not anticipate that spotted owls will avoid or shift their home range use patterns due to the prescribed underburn.

Smoke

There is little scientific information available related to the effects of smoke on spotted owls. Although, smoke is probably of little consequence to terrestrial fauna, especially when managed to reduce impacts (Klein 1960 and Pruitt 1959). A study of radio-marked spotted owls showed that smoke alone did not drive spotted owls from their territories during a wildfire (King et al. 1998); A juvenile spotted owl was found on the road during the Hull Mountain fire and was diagnosed at a rehabilitation center as having lung damage from smoke inhalation (C. Oakely, pers. comm. as cited in USDA FWS 2014). Contrastingly, heavy smoke from a 2004 wildfire in British Columbia did not seem to have immediate negative effects on spotted owls. The fire was adjacent to a spotted owl nest site and resulted in heavy smoke for at least 48 hours during late June. The adult and juvenile spotted owls were observed during this time period and the observers reported no abnormal behavior by the owls. Visibility within the stand was limited to 30 meters and the owls appeared roosting normally during the smoke inundation (J. Hobbs. pers.

comm. December 2006 as cited USDI FWS 2014). Terrestrial wildlife, such as spotted owls, have the mobility to move away from smoke and fire and most likely would not be effected by smoke from prescribed fire; however, young or nestling spotted owls may be adversely effected by the dense smoke created by burning fuels with high moisture content in the spring of the year. The effects of smoke associated with Calf Copeland project prescribed underburning, it is assumed that heavy smoke at ground level and in forested stands may have negative effects, but light to moderate smoke that is mixing or venting well, as intended in this proposed action, is probably of little consequence to spotted owls.

Forest Canopy

Understory fires (such as prescribed burns) can change the canopy in two ways: by killing or top-killing a few of the most fire-susceptible trees, and by killing or top-killing a cohort of tree regeneration. A slight reduction in overall canopy cover of trees could occur where ladder fuel conditions cause individual tree torching during a prescribed fire. Factors which would affect the extent of individual tree mortality include crown base height, flame lengths, and associated ladders fuels. In general, underburning is expected to prune conifers and hardwoods four feet above the ground. This would have a negligible effect on spotted owls because the mid and overstory canopy that provides microclimate conditions and concealment from predators will remain unchanged. Consquently, there could be impacts to spotted owl prey habitat in that prey species forage conditions and travel pathways could temporarily be modified. However, portions of the area will not undergo prescribed fire which will leave a significant amount of prey habitat intact.

Snags and down woody material

Live tree loss, on this project, would result in the recruitment of some snags in the proposed project area. Fire may facilitate decay in trees by providing an entry point for fungi, which increases the likelihood of these trees having future cavities that becomes spotted owl prey denning habitat. Older snags often fall as the result of controlled burning, increasing downed log recruitment (at least temporarily) and this would benefit prey species that use down wood for denning, hiding or foraging. Dead wood on the ground is an essential habitat component for spotted owl prey and fire both destroys and creates down wood. PDC as described above are expected to protect large downed logs and snags and therefore discountable effects to spotted owls.

Prey Availability

The potential exists for loss of snags, logs, litter, and organic matter, although the intent of the proposed action is to retain/maintain some of these attributes. As a result, changes may occur to nutrient availability, fungal communities and seed producing plants, all important considerations of prey habitat. Direct effects of the prescribed fire could be the displacement of small mammals which are key food items of the spotted owl. Indirect effects could include the loss of prey habitat components such as snags, logs, litter and horizontal cover (Wilson 2010 and Manning 2011). At the landscape level, hiding cover will persist as anticipated due to the PDC, it is expected that landscape-scale small mammal populations will persist and/or quickly return and therefore potential impacts to them are not anticipated to be limiting to spotted owls.

Mixed conifer forests in the Southern Cascades and Siskiyou foothill were historically characterized by high frequency, mixed severity fire regime. Within this fire regime, much of the landscape would have burned at low and moderate severity leaving large conifer trees in open canopy forests and clearing out surface vegetation and some small and moderate sized trees. Recent research in northern California seems to suggest that spotted owls are likely adapted to a patchy distribution in that portion of their range (Franklin et al. 2000). The extent to which this effect extends to the mix of wet and dry forests present in the action area is unclear. As discussed above, spotted owls tend to use areas that have burned at low to moderate fire severity. In addition, individual prey species are likely to have different responses to fire, which may differentially affect spotted owl behavior (Meyer 2007); however, the fuels treatments are designed to mimic low-intensity fire, a condition common to the mixed severity fire regime of the action area.

Due to the nature of prescribed fire, in that it burns at different rates and intensities, diffuse edges that may be established due to the prescribed fire are likely to be good habitat for woodrats (*Neotoma spp*), which are an important component of spotted owl diets in Southwest Oregon (Clark 2007). Woodrats were reported to occur at high densities in early seral (brushy/ sapling to pole sized trees) and old growth forests, but were absent in closed canopy stands with medium sized trees in Northern California mixed conifer/ hardwood sites (Sakai and Noon 1993). Shrub fields adjacent to old forests, such as the mosaic of vegetation in the action area, may increase access to woodrats, who travel between the shrubs fields and openings in the old forest (Sakai and Noon 1997). However, studies of woodrat occurrence and abundance have not been conducted in or near the action area. Diffuse edges may also create better access for hunting small mammals, in general, while simultaneously providing adjacent closed canopy cover habitat. This proposed action should create just these type of habitats by burning some areas which will regenerate into suitable habitat for many types of small mammals and leaving areas unburned as habitats for other small mammals such as woodrats and Humboldt's flying squirrel. Bond et al. (2009) found that California spotted owls selected areas that burned at low and moderate severity for roosting and selected areas that burned at high severity for foraging four years following the McNally fire in the Sierra Mountains. The authors suggested that increased prey availability (woodrats) is the explanation for the increased use. The Forest anticipates that spotted owls will continue to use the post-fire stands because habitat conditions are likely to be similar to low severity wildfire conditions if not better and this is supported by the best available science. The proposed action is likely to benefit woodrats thereby providing for spotted owl foraging.

Road Construction Outside of Harvest Unit Boundaries

There are approximately 12 acres of spotted owl habitat affected by road construction (Tables 1, pg. 5). More specifically, road construction is proposed within.1 acre of NRF habitat, 2.3 acres of dispersal-only habitat and 3 acres of capable habitat and 5.7 acres of non-capable habitat. Overall, road construction outside of proposed action unit boundaries is expected to create linear gaps in the stands, 50 feet in width. Road construction will result in the removal of

approximately 8 small, linear patches – the average patch size is .75 acres, the largest patch is 1.3 acres.

Of the road construction acres mentioned above, no habitat removal is proposed in spotted owl core use areas with less than 50 percent NRF habitat.

Summary of Effects to Spotted Owl Habitat

Effects to NRF and Dispersal-only Habitat

Post-harvest, including habitat modification under the proposed action, over 96 percent of Federal land in the Action Area (per Table 6, pg. 21) is anticipated to function as dispersal quality habitat (NRF and dispersal-only habitat). For activities addressed in this Biological Assessment, "implementation" is defined as when the NEPA decision notice is signed. However, history has shown that it takes multiple years after completion of NEPA to complete a project on the ground and some might not be carried out at all. Therefore, we anticipate the effects of the activities addressed herein (particularly timber sales) will be metered out over the next five or more years.

Approximately 5,475 acres are scheduled for treatments in the Calf Copeland project. Thinning in natural stands (commercial and non-commercial), fuel breaks and prescribed fire account for 6,058 (93%) acre. Of this, 1,759 acres of commercial harvest will occur in natural stands. Within these natural stand: 1,523 acres will be in NRF habitat, 187 acres in dispersal-only and 42 acres in capable habitat. In addition, commercial harvest within plantations will be happen within 1,553dispersal and the remaining 97 acres in capable habitats. In natural stands Non-commercial thinning will occur on 280 acres, of which 21, 45 and 20 acres will be in NRF, dispersal-only and capable, respectively. Additionally, in plantation stands, non-commercial thinning will be implemented on 194 acres, of which 41 acres, 66 acres and 87 acres will be in NRF, dispersal-only and capable habitats, correspondingly. Shaded fuel break will total 1,420 acres, 867 acres are NRF, 327 acres in dispersal-only and the remaining 214 acres in capable and 12 acres in noncapable habitat, respectively. After implementation maintenance prescribed fire will occur on 1,420 acres 928 will be applied in a manner that will modify the current function of 606 acres of NRF and 223 acres of dispersal-only habitat and the remaining 166 acres of prescribed fire will occur in either capable or non-habitat. .The remaining 150 acres of proposed habitat modification activities, account for approximately 1 acre of NRF, 35.5 acres of dispersal-only and the remaining 113 acres fall within capable and non-capable owl habitat.

Habitat modification prescriptions are anticipated to continue to provide a similar habitat function post-treatment as the pre-treatment condition. For example, the stands are anticipated to have sufficient basal area and canopy cover post treatment, at or above 60 and 40 percent for NRF and dispersal-only habitat which is likely to provide vertical forest structure for spotted owl foraging perches, suitable microclimate and concealment cover for predator avoidance. Snag and down wood conditions would also be retained, per the PDC, as untreated patches of burned trees/snag within the treatment units. These conditions provide denning and foraging habitat for spotted owl prey species such as mice, voles, woodrats and flying squirrels. As a result of the prescriptions retaining key habitat elements within the stands post-treatment along with retaining

large areas of unburned habitat (up to 93 percent of the action area will remain untreated). The proposed actions will have significant effects to spotted owls because habitat conditions post-management activities will not provide a similar function to the pre-treatment condition. In addition, the Forest is not proposing activities within stands characterized as Recovery Action 32 type stands. However remnant patches may be present in the burn blocks

Effects to Spotted Owls

Critical Habitat Subunit (Total Acres)	NRF[1]	Dispersal-only[1]
WSC 5 (38,000)	25,664	7,212
KLE 1 (1,406)*	958	362
Total 39,406	**26,622 (68%)**	**7,574 (19%)**

Type of Treatment	Type of habitat impact	Inside Critical Habitat	Outside Critical Habitat
		Acres	
Natural Stands - Commercial Thinning	NRF Downgraded	1,084	270
	NRF Removed	105	0
	NRF Modified	146	28
	Dispersal-only Removed	12	0
	Dispersal-only Modified	53	81
	Capable treated	0	2
Natural Stands - Non-Commercial Thinning	NRF Downgraded	17	0
	NRF Modified	102	92
	Dispersal-only Modified	48	0
Plantations - Commercial Thinning	Dispersal-only Modified	944	267
Plantations - Accelerate Old-Growth	Dispersal-only Modified	101	259
	NRF Modified	0	91
Plantations - Non-Commercial Thinning	Dispersal-only Modified	174	20
Shaded Fuel Breaks	NRF Modified	415	456
	Dispersal-only Modified	175	149
	Capable Treated	126	105
TOTALS		**3,502**	**1,820**

*no activites will occur within the KLE 1 Critical Habitat

There is a total of 1,094 acres of NRF habitat downgrading and removal anticipated due to implementation of the proposed action. Spotted owl nesting and roosting in these areas post-treatment is considered unlikely due to reductions in canopy cover (Irwin) and large trees (Cal SO paper). Spotted owl foraging opportunities are also expected to be reduced due to reductions

in primary prey species abundance likely to be caused by reductions in snag and down wood abundance (Carey) and simplification of overstory canopy structure (Manning, Wilson and Forsman).

The distribution of these affected areas relative to historic spotted owl activity centers is such that one site (0823) will have 168 acres of NRF habitat downgraded in the core use area associated with the site, leaving it 29 percent NRF habitat (Table 7). A different historic site (0733) will have 297 acres of NRF downgraded (268 acres) and removed (29 acres) which will reduce the available NRF habitat in the associated home range to 47 percent (Table 7).

In both cases such reductions in the amount of available NRF habitat are considered likely to result in measurable reductions in demographic performance of any spotted owls occupying and attempting to reproduce at these sites (Dugger, Bart and Forsman, Franklin). However, as described elsewhere herein, protocol surveys have been conducted at all of the historic sites in the action area, and will continue throughout, project implementation, and currently there is no spotted owl residency documented within the action area. As such, a direct pathway for the anticipated habitat alterations to impact currently resident spotted owls does not appear to exist. However, any spotted owls attempting nest in the action area immediately post-implementation will encounter reduced amounts of available NRF habitat, to the extent that optimal demographic performance could be impinged upon at two historic sites, as such adverse effects are anticipated to any spotted owls attempting to utilize these affected sites post implementation

There is a total of 606 acres of NRF maintaining/modified anticipated due to implementation of the proposed action. Spotted owl nesting and roosting in these areas post-treatment is possible but due to reductions in canopy cover (Irwin 2020) and large trees is limited (Irwin 2020). Spotted owl foraging opportunities are also expected to be reduced due to reductions in primary prey species abundance likely to be caused by reductions in snag and down wood abundance (Carey 2000, 2001) and simplification of overstory canopy structure (Manning 2012, Wilson and Forsman 2013).

The distribution of these affected areas relative to historic spotted owl activity centers is such that one site (0823) will have 5 acres of NRF habitat modified in the nest patch associated with the site, leaving it 74 percent NRF habitat (Table 7). No NRF modifying will occur at the core use area at any historic site. At the home range 5 sites will have NRF modifying activities, only 1 site will have less than 50% NRF within the home range (0733). Two others (0837) and (0823) will be close to the 50% NRF threshold at 51%. (Table 7).

There is a total of 606 acres of NRF maintaining/modified anticipated due to implementation of the proposed action. Spotted owl nesting and roosting will potentially be limited in these areas post-treatment due to reductions in canopy cover and large trees (Irwin et al, 2019 p. 11, North etal, 2017, p 171). Spotted owl foraging opportunities are also expected to be reduced due to reductions in primary prey species abundance likely to be caused by reductions in snag and down wood abundance (Carey) and simplification of overstory canopy structure (Manning et al. 2011, p. 120, Wilson and Forsman 2013, p. 84).

The distribution of these affected areas relative to historic spotted owl activity centers is such that one site (0823) will have 5 acres of NRF habitat modified in the nest patch associated with the site, leaving it 74 percent NRF habitat (Table 7). No NRF modifying will occur at the core use area at any historic site. At the home range 5 sites will have NRF modifying activities, only 1 site will have less than 50% NRF within the home range (0733). Two others (0837) and (0823) will be close to the 50% NRF threshold at 51%. (Table 7).

Such reductions in the amount of available NRF habitat are considered likely to result in measurable reductions in demographic performance of any spotted owls occupying and attempting to reproduce at these sites (Dugger etal, 2005, p. 871, Bart and Forsman 1992, p. 98). However, as described elsewhere herein, protocol surveys have been conducted at all of the historic sites in the action area, and will continue throughout, project implementation, and currently there is no spotted owl residency documented within the action area. As such, a direct pathway for the anticipated habitat alterations to impact currently resident spotted owls does not appear to exist. However, any spotted owls attempting nest in the action area immediately post-implementation will encounter reduced amounts of available NRF habitat, to the extent that optimal demographic performance could be impinged upon at six historic sites, as such adverse effects are anticipated to any spotted owls attempting to utilize these affected sites post implementation.

There is a total of 201 acres of dispersal-only habitat removal anticipated due to implementation of the proposed action. Spotted owl use in these areas post-treatment is considered unlikely due to reductions in canopy cover and large trees (Irwin et al 2019 p. 11, North et al, 2017 p 171, Meiman et al 2003, entire). Spotted owl foraging opportunities are also expected to be reduced due to reductions in primary prey species abundance likely to be caused by reductions in snag and down wood abundance (Carey 2000, p. 252) and simplification of overstory canopy structure (Manning et al. 2011, p. 120, Wilson and Forsman 2013, p. 84).

The distribution of these affected areas relative to historic spotted owl activity centers is such that these sites will have a total of 20 acres of NRF habitat removed. Sites 0733, 0564 and 0837 will have 10, 9 and 1 acre respectively of dispersal habitat downgraded in the home range area (Table 7).

In the case of site 0733, such reductions in the amount of available dispersal habitat are considered likely to result in measurable reductions in demographic performance of any spotted owls occupying and attempting to reproduce at these sites (Meiman et al 2003, entire). However, as described elsewhere herein, protocol surveys have been conducted at all of the historic sites in the action area, and will continue throughout, project implementation, and currently there is no spotted owl residency documented within the action area. As such, a direct pathway for the anticipated habitat alterations to impact currently resident spotted owls does not appear to exist. However, any spotted owls attempting nest in the site #0733 immediately post-implementation will encounter reduced amounts of available dispersal habitat, to the extent that optimal demographic performance could be impinged upon at two historic sites, as such adverse effects are anticipated to any spotted owls attempting to utilize these affected sites post implementation

There is a total of 1,334 acres of dispersal habitat modifying anticipated due to implementation of the proposed action. Spotted dispersal in these areas post-treatment is possible but due to reductions in canopy cover (Irwin) and large trees (Cal SO paper) unlikely. Spotted owl foraging opportunities are also expected to be reduced due to reductions in primary prey species abundance likely to be caused by reductions in snag and down wood abundance (Carey) and simplification of overstory canopy structure (Manning, Wilson and Forsman).

The distribution of these affected areas relative to historic spotted owl activity centers is such that one site (0823) will have 1 acres of dispersal habitat modified in the nest patch associated with the site (Table 7). Historic sites (0733) and (0823) will have 24 and 80 acres, modified, which will reduce the available dispersal habitat in the associated core use area (Table 7). Besides sites (0733) 347 acres and (0823) 453 acres, three historic sites will have modified dispersal habitat after treatment. Sites 0564, 0837 and 0560 will have dispersal modified acres of 133, 309 and 105, correspondingly

Reductions in the amount of available dispersal habitat are considered likely to result in measurable reductions in demographic performance of any spotted owls occupying and attempting to reproduce at these sites (Dugger). However, as described elsewhere herein, protocol surveys have been conducted at all of the historic sites in the action area, and will continue throughout, project implementation, and currently there is no spotted owl residency documented within the action area. As such, a direct pathway for the anticipated habitat alterations to impact currently resident spotted owls does not appear to exist. Surveys were conducted on all spotted owl sites, as well as pre-project surveys on all proposed timber sale harvest units modifying NRF and dispersal-only habitat assessed in this consultation. Fuel breaks along the old fire scares were not surveyed due to no cutting of trees larger than 7 inches, spotted owl habitat is very limited in this area because of past fires (Apple Fire 2002 and ??). Many of the sites surveyed have numerous years of previous survey data. However, it is recognized that barred owls may have a suppression effect on spotted owl detections (Bailey et al. 2009) and despite this, Forsman et al. (2011) showed relatively high re-sighting probabilities of spotted owls across multiple study areas. For the purposes of this consultation, if the surveys indicated no response by spotted owls in 2015 and 2016 were completed with 6 visits starting in March-August, spot checks in 2017 and 2018, the site is considered unoccupied (per USDI FWS 2012b). As such, 18 spotted owl sites are considered currently unoccupied for the purposes of this analysis. Spot checks will continue through the designation of a new protocol (level 1 discussion and notes 2019)

As mentioned above, the Forest will continue spotted owls surveys in 2020 and beyond, as appropriate and per the survey protocol.

The majority of the proposed NRF habitat-modifying, is due to timber harvest. Of all the acreage proposed for treatment addressed in this Biological Assessment, 3,215 (of 5,475) acres (59 percent)) are located outside of the historic spotted owl core use areas in the Action Area. There are 197 (2 percent) acres within a core and 8 acres within a nest patch, but these are unoccupied. As described above, these areas received protocol spotted owl surveys (USDI FWS 2012b) and no resident spotted owls were located. 510 acres of NRF outside of northern spotted

owl home ranges will also has activities proposed. Commercial harvest will amount to 270 (53%) acres the remaining 240 acres will be thinning less than 7 inch dbh.

Commercial thinning would occur on 3,409 acres of previously managed and natural stands. The managed stands had been clearcut between 1956 and 1975 and planted to predominately Douglas-fir. Currently, the plantation range in canopy cover 50-85% with 81->300 trees per acre (TPA) greater than 7 inch dbh with an average height of 56-102 feet . The natural stands range in canopy cover from 40 to 85% with 50-270 TPA greater than 7 inch dbh and an average height of 70-130 feet. The commercial thinning would be thinned to 20 to 55 percent canopy cover and small gaps of up to 2.5 acres would be created and planted with rust resistant sugar pine or ponderosa pine. Gaps for pine restoration would total no more than 10 percent of the area of each stand with an estimated 82 acres of total gap creation across the project area for this purpose. Gaps where all, or nearly all overstory trees are harvested for the projects addressed herein will be one-quarter to two acres in size. Such gaps may contain one or more “trees with unique characteristics” e.g. wolf-trees, larger than average trees, etc. However, skips are reserved from harvest, i.e. “no harvest” zones. These areas may be linear features such as “no cut” riparian buffers or may be of other various sizes and shapes. Overall, the Calf Copeland proposed projects considered herein are anticipated to retain sufficient post-project canopy cover (40 percent canopy cover) for spotted owl dispersal.

Table 7. Existing, pre-project Habitat conditions and proposed project impacts at spotted owl sites affected by the Calf Copeland Project.

*Site IDNO	NRF			Dispersal-only		Pre-Treatment NRF (acres)	Post-Treatment NRF (acres)	% NRF Pre-Treatment	% NRF Post-Treatment
	Removed	Downgraded	Modify	Modify	Removed/ downgraded				
Nest Patch (Acres)									
0560	0	0	7	1	0	39	39	56%	56%
0564	0	0	2	1	0	60	60	86%	86%
0823	0	8	5	1	0	60	52	85%	74%
Core Use Area (Acres)									
0546	0	0	0	4	0	343	343	69%	69%
0560	0	0	0	29	0	285	285	57%	57%
0733	0	20	0	24	0	306	286	62%	56%
0823	0	168	0	80	0	316	148	64%	29%
0824	0	0	9	7	0	359	359	72%	72%
0837	3	4	0	0	0	353	348	71%	70%
0847	0	5	0	0	0	262	258	53%	52%
Home Range (Acres)									
0239	0	0	27	12	0	1,934	1,934	67%	67%
0511	0	0	15	2	0	1.984	1,984	69%	69%
0522	0	0	0	1	0	1,510	1,510	52%	52%
0837	76	264	77	309	1	1,782	1,439	62%	50%
0538	0	0	6		0	1,626	1,626	56%	56%

0540	0	0	8		0	1679	1679	58%	58%
0560	0	33	11	105	0	1,886	1,853	65%	64%
0564	0	20	46	133	9	1,886	1,866	69%	64%
0733	29	268	88	347	10	1,665	1,368	58%	47%
0739	0	0	5	10	0	1889	1889	65%	65%
0741	0	0	3	5	0	1996	1996	69%	69%
0806	0	0	10	3	0	1842	1842	64%	64%
0823	0	302	221	453	0	1,791	1,490	62%	51%
0824	0	0	12	1	0	2048	2048	71%	71%
0837	0	0	6	2	0	1782	1782	62%	62%
0846	0	0	10	12	0	1821	1821	63%	63%
0847	0	0	10	13	0	1570	1570	54%	54%
0850	0	0	16	15	0	1989	1989	69%	69%

The acre values are summed based on doughnut-shaped core use areas and home ranges, but percentages are calculated based upon entire Core Use Area and Home Range areas.

There are 18 total northern spotted owl sites within the Action Area. Four sites will not have any activities occur within them. eight sites will have activities but will be removing stems less than 7 in dbh. The remaining six (6) spotted owl sites are affected by the proposed action (Figure 5); however, only one site had a confirmed male spotted owl in the 4 years of surveys. Only this site with impacts to the core use area is described in this section. Activities are likely to occur within the critical breeding period, downgraded NRF **m*ay affect and is likely to adversely affect*** any spotted owls potentially occupying the site because the downgrade and removal of NRF is anticipated to reduce availability of nesting structure. The downgrade of habitat may also affect the success of spotted owls to forage in those areas as well. The acre values below are summed based on their entire circular areas (not doughnut shaped areas) and due to rounding, some values may not sum to the exact amount; regardless, the effects remain the same.

- 0847
    - Surveys for this site in 2016 yielded an adult male spotted owl, no response in 2017, 2018 or 2019. This site was established in 1992, when a pair of spotted owls were identified using the site. No loss or modification of existing green NRF or dispersal-only habitat will occur in the nest patch. Five acres of NRF habitat will be downgraded within the core area, (Table 7). However, sufficient suitable (NRF) in the nest patch (63%, 44 acres) and in the core use area (53%, 262 acres) and in the home range (54%, 1571 acres) will be left untreated by the proposal. The Forest, concludes habitat for owls to persist will still be retained. Treating such a small percentage of the existing habitat is expected to preserve existing prey resources for this site.

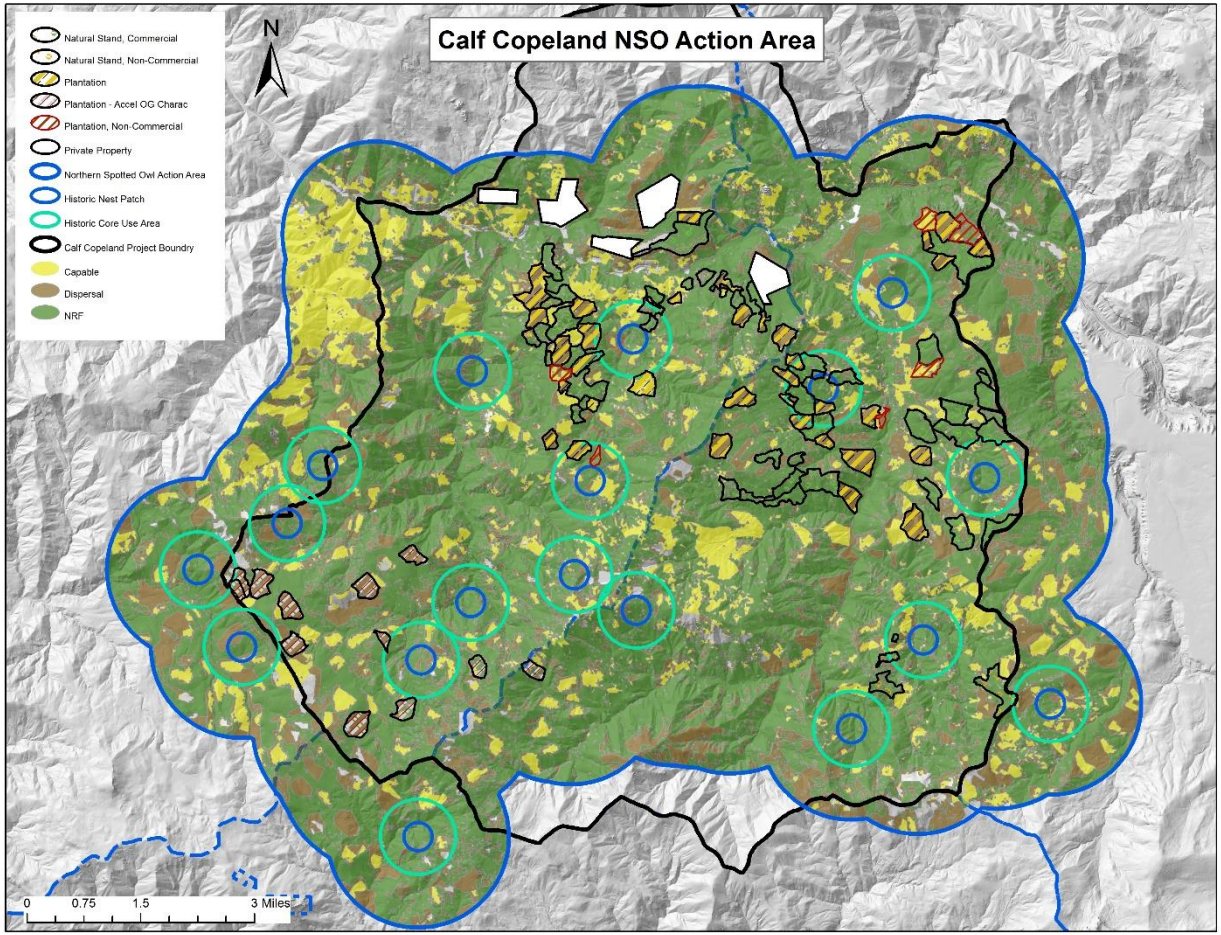


Figure 5. Effected Owl sites

Because there have been no other spotted owl responses over the course of the NSO surveys, the Forest has concluded there are no occupied spotted owl sites affected by the proposed action.

Effects of the Proposed Action on Spotted Owls due to Disturbance

The Forest plans to implement project activities that potentially could disturb nesting spotted owls within the spotted owl critical breeding period (March 1 – July 15). This is because survey efforts to date have indicated all affected spotted owl sites are unoccupied. There is a possibility for disturbance if a spotted owl site becomes occupied during project implementation.

Effects of the Proposed Action on Spotted Owl Prey Species

Harvest activities can affect spotted owls by affecting their prey base. The Humboldt's flying squirrel (*Glaucomys oregonensis*), red tree vole (*Arborimus longicaudus)* dusky-footed woodrat (*Neotoma fuscipes*), and bushy-tailed woodrat (*Neotoma cinerea*) are important prey of the northern spotted owl in this action area (Forsman et al 2004). Spotted owl prey relationships are complex and prey-switching may be important (Courtney et al 2004). Timber harvest and other types of projects may impact spotted owl foraging by changing habitat conditions for different species of prey.

Bingham and Noon (1997) reported that a spotted owl core area is the area that provides the important habitat elements of nest sites, roost sites, and access to prey, benefiting spotted owl survival and reproduction. Rosenberg and McKelvey (1999) reported that spotted owls are "central place" animals with the core area (the area closest to the nest) being the focal area. Therefore, effects to prey species are likely most critical at the nest patch and core areas. Effects to spotted owl sites at the nest patch and core areas are analyzed above and the indirect effects to prey species can be derived from this data. Minimal effects are anticipated to spotted owl prey because only small amounts of thinning treatments are proposed within the core areas of the owl sites associated with the proposed action, over time these areas will fill-in with shrubs and grasses. However, in the short-term, there are indications that spotted owl roosting (Sovern *et al.* 2014) and population densities of some primary prey species (such as flying squirrels) (Manning *et al.* 2011, Wilson *et al.* 2013) will be reduced due to the immediate impacts of the thinning activity.

Some other spotted owl prey species may also be affected by the proposed thinning. Species such as brush rabbits, woodrats, and other rodents are primarily associated with early- and mid-seral forest habitat (stands < 80 years of age) (Maser *et al*. 1981; Sakai and Noon 1993; Carey *et al*. 1999), and could benefit from increased understory and shrub development (Carey 2001; Carey and Wilson 2001; Haveri and Carey 2000). This could indirectly benefit spotted owls by providing more prey available for capture (e.g., mice, voles, chipmunks).

Variably-density thinning (pg 6) can have rapid, positive effects for many forest-floor prey species (e.g., mice, voles, chipmunks) especially due to increased understory development (Carey 2001, Carey and Wilson 2001, Haveri and Carey 2000). However, variable-density and uniform thinning may keep flying squirrel populations suppressed and may do so for several decades until long-term ecological processes provides sufficient structural complexity in the mid-story and overstory favorable to squirrels (Manning *et al.* 2012, Wilson 2010). However,

Wilson (2010) suggests a few considerations to reduce short-term effects to flying squirrels while trying to create more forest complexity that benefit squirrels in the long-term.

The thinning treatment prescriptions incorporate some of those considerations, including:

- retention of existing large decadent trees and snags;
- retention of no-treatment areas (e.g., "skips" and no treatment buffers in Riparian Reserves) to provide travel corridors from adjacent late seral habitats and across the landscape;
- retention of a range of tree size classes throughout the stand;
- Outside of maintence burn units, improvement of foraging opportunities by promoting the development of understory vegetation and promote shade-tolerant tree species throughout the stand; and
- maintenance of canopy cover within the stands (e.g., lightly and moderately thinned areas) which will provide protective cover from predators, as well as provide a tree density that allows squirrels to adequately glide between trees and move through a stand in order to access foraging areas.

The residual stands following harvest will provide a pool of candidate trees for future snag and coarse wood recruitment. Additional coarse wood and snags will be created incidentally through the harvest operations (e.g., damage leading to broken-out tops or individual tree mortality) or through weather damage (e.g., wind and snow break). In addition, the skips and lightly thinned areas will provide a continuous recruitment of snags and down wood. However, snags will be larger with more resiliency (Reukema and Smith 1987) and limb structure than snags that develop under a more competitive stand condition (Neitro 1985). The thinning treatments will provide other ecological benefits by allowing trees to grow larger faster, and to develop other suitable wildlife habitat characteristics, such as large limbs and crowns. These trees will then become a future source for large snags and downed wood

The Forest anticipates that at the action area scale, prey populations will remain healthy because the project will retain large standing and down wood in low severity patches and many untreated green patches will be retained within the project areas, which are important to spotted owl prey species. Approximately 54,574 acres of NRF and dispersal-only habitat within the action area and adjacent to harvest and prescribed fire units will not be treated, which will reduce the impacts to potential prey and foraging habitat for northern spotted owls because such a small percentage of the action area will be treated.

Standing dead and down woody material is an important habitat component, providing cover for NSO prey species and helps sites retain moisture which is also good for prey species. With the abundance of snags and down wood adjacent to proposed treatment areas (Calf Copeland wildlife report 2019 from the EIS), the project area is expected to provide abundant prey availability and foraging opportunities for any NSO that may be present, including ample perch sites within hazard tree areas to facilitate roosting and foraging by NSO if they are using these burned areas for foraging. In addition, conversion of snags to down logs may have a positive or neutral effect on NSO because it will decrease availability of perch sites for NSO but will also contribute to coarse woody material, improving habitat for some NSO prey species.

At the action area scale, it is not likely that prey, such as flying squirrels, will be significantly affected by the proposed actions because most large standing and down dead wood will be retained and canopy diversity will be maintained. However, retention of no-harvest areas could

provide travel corridors for flying squirrels from adjacent late-seral stands, depending on how they are configured. For species like brush rabbits, woodrats, and other rodents that are found in early- and mid-seral forest habitat (Maser *et al.* 1981; Sakai and Noon 1993; Carey *et al.* 1999) Within the proposed fuel breaks, 1,420 acres, there would be little understory development outside of grasses and low growing forbs however within the thinning units, 3, 894 acres, understory development would be expect to increase due to the opening of the canopy. Small mammal populations are expected to increase from the creation of early-successional habitat with diverse communities of flowering and fruiting shrubs, herbs and grasses that will provide cover and abundant forage for northern spotted owl prey species, hence benefitting the owl.

Impacts of the Proposed Action on Spotted Owl/Barred Owl Competition

Barred owls are known to occur within the Action Area of the Calf Copeland project and available evidence suggests that the presence and distribution of barred owls may affect habitat quality for spotted owls (Wiens 2012 and Yackulic et al. 2012). The Forest's proposed action is not anticipated to impact high quality, "Recovery Action 32" type habitat to any meaningful extent. The Assessment indicates all Recovery Action 32 habitat identified in the Action Area during project development has been eliminated from the final proposed commercial harvest units. However, the possibility exists for some high-quality spotted owl nesting habitat to occur within the large proposed prescribed fire burn blocks, and there are currently no measures proposed pursuant to excluding prescribed fire from those potential habitat patches. Because there are no specific measures in place to exclude fire there, this analysis anticipates habitat modification, downgrading, or even removal could occur within the burn blocks in high-quality spotted owl nesting habitat.

Effects of the Proposed Action from the Perspective of the Northwest Forest Plan (NWFP) and the Revised Recovery Plan for the Spotted Owl

Northwest Forest Plan

The Projects were designed to conform to the NWFP (USDA FS and USDI BLM 1994). As described above, 5 percent of the spotted owl NRF habitat in the action area will be affected by the proposed action, mostly by prescribed fire and noncommercial activities. Treatments are proposed in the historic nest patches or LSR 4's. Nearly all of the proposed treatments, are within late successional reserve (LSR), except 220 acres which are within the Matrix land use allocation, which is intended primarily for timber production.

Recovery Plan

The recovery provides a set of recovery actions which the Service recommends that agencies follow in developing management activities. The recovery actions most applicable and under consideration in the biological assessment are as follows:

<u>Recovery Action 6:</u>

Recovery action 6 states that *"In moist forests managed for spotted owl habitat, land managers should implement silvicultural techniques in plantations, overstocked stands and modified younger stands to accelerate the development of structural complexity and biological diversity that will benefit spotted owl recovery" (USFWS 2011).*

Approximately twenty-eight percent of dispersal-only habitat in the action area (1,851 acres) within plantations and heavily-stocked young natural stands associated with the proposed actions are proposed for thinning treatments which will encourage development of structural and species diversity, increase structural heterogeneity and introduce fine scale variation into the treated stands.

Recovery Action 10

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

To the extent practicable in keeping with the Project's purpose, the Forest developed the Project to meet the intent of Recovery Action 10 (USDI FWS 2011a). There are approximately 32,699 acres of federal forest-lands in the Action Area; of which, 52 percent (17,250 acres) is spotted owl NRF habitat and an additional 28 percent (9,317) is spotted owl dispersal-only habitat (Table 8, pg. 40). Of the NRF habitat currently available, 27 percent (8,750 acres) is within a reserved land-use allocation on USFS-administered lands.

The Forest evaluated the 10 of 18 spotted owl home ranges affected by the proposed actions (Table 8). However, despite diligently implementing four continuous years of protocol surveys (USDI FWS 2012) only 1 male spotted owl and an unknown *strix spp* have been detected up to this time. At the site where the one male was found (site # 0847) there are activities within dispersal habitat (NRF and dispersal-only); amounting to 13 total acres, 8 acres of NRF will be downgraded to dispersal-only and 5 acres of dispersal-only will be modified in the nest patch. The Forest is presuming no spotted owls currently occupy this historic site.

4 historic nso sites have proposed activities in the core-use areas Site 0823 will have 168 acres of NRF habitat downgraded to dispersal-only, the remaining 3 sites will maintain NRF above 50% NRF threshold within the core. However, none of these sites are currently occupied by territorial pairs or resident single spotted owls.

There are activities in the provincial home range of 5 sites, all of these sites will maintain NRF above 40%; none of these sites are currently occupied by territorial pairs or resident single spotted owls.

Recovery Action 32

The natural stands selected for this project were identified because of the high density of older legacy pine trees within each stand. These stands historically had open canopies and little vegetation in the understory, which is typical of pine dominated stands. As a result of fire suppression, the understory filled in with young conifers and few shrubs but overall lacked the structural complexity to be high quality habitat for spotted owls. Spotted owls may have utilized these stand within a core use area, however many did not provide suitable nesting structures or have the microclimate that provides natural buffers during extreme temperatures.

For the Calf Copeland Project, additional habitat modeling was conducted to identify higher quality habitat within previously modeled NRF. Using Lidar technology and dbh to height rations for this area, forest stands with areas of high canopy cover and large (<50in DBH) trees

were selected as potential RA32 habitat. However, these modeling techniques have limitations and field verification was required to assess the structure of the understory. As expected, there were areas of modeled habitat within proposed natural stands due to the large legacy pines and co dominate Douglas fir trees, however when field verified these areas had little to no understory structure. Areas with these understory components were almost exclusively within riparian areas. After field verification, including additional field visits with the Level 1 team, three proposed units were identified as having small portions of RA32 habitat. These areas were buffered from all activities that may have impacted the quality of the habitat. For this reason, the Calf Copeland project is consistent with Recovery Action 32.

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

CUMULATIVE EFFECTS ON THE SPOTTED OWL

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 Assessment. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA. There are approximately 287 acres of non-Federal land within the Action Area and a large proportion of it may be subject to green-tree harvest. The Forest does not track pre-harvest habitat on non- Forest-managed lands, so it is unknown how many of these acres currently function as NRF or will be removed through harvest on private land.

No known rights of Reciprocal Right of Way (ROW) occur within the action area for this consultation.

EFFECTS OF THE ACTION ON SPOTTED OWL CRITICAL HABITAT

This section evaluates how the proposed action is likely to affect the capability of affected critical habitat PCEs to support spotted owl NRF and dispersal-only habitat by considering how project impacts affect the landscape scale spotted owl life history requirements regardless of the species' presence or absence in the affected critical habitat (USDI Fish and Wildlife Service 2012).

The proposed action may potentially affect up to 2,759 acres of critical habitat in one subunit, WSC 5, with the following acres subject to removal: 31 acres of spotted owl NRF habitat (Table 8). In addition, 1,694 acres of spotted owl NRF habitat will be downgraded due to commercial and non-commercial thinning prescriptions and 67 acres will be modified. 201 acres of dispersal-only habitat will be removed due to thinning prescriptions. While 1,649 acres of dispersal-only habitat will be maintained.

Table 8. Environmental Baseline *in the Action Area* and summary of habitat impacts in designated spotted owl critical habitat due to implementation of the Calf Copeland Project. All values are in acres.

Critical Habitat Subunit (Total Acres)	NRF[1]	Dispersal-only[1]
WSC 5 (38,000)	25,664	7,212
KLE 1 (1,406)*	958	362
Total 39,406	**26,622 (68%)**	**7,574 (19%)**

Type of Treatment	Type of habitat impact	Inside Critical Habitat	Outside Critical

			Habitat
		Acres	
Natural Stands - Commercial Thinning	NRF Downgraded	1,084	270
	NRF Removed	105	0
	NRF Modified	146	28
	Dispersal-only Removed	12	0
	Dispersal-only Modified	53	81
	Capable treated	0	2
Natural Stands - Non-Commercial Thinning	NRF Downgraded	17	0
	NRF Modified	102	92
	Dispersal-only Modified	48	0
Plantations - Commercial Thinning	Dispersal-only Modified	944	267
Plantations - Accelerate Old-Growth	Dispersal-only Modified	101	259
	NRF Modified	0	91
Plantations - Non-Commercial Thinning	Dispersal-only Modified	174	20
Shaded Fuel Breaks	NRF Modified	415	456
	Dispersal-only Modified	175	149
	Capable Treated	126	105
TOTALS		**3,502**	**1,820**

***NO activities will impact critical habitat KLE 1**.

Table 9. Effects to "Proxy-Core" in Designated Critical Habitat within the Action Area.

Action Area		**NSO Critical Habitat in Action area**				
Sub-Unit	**Forest Ownership *(acres)***	**NRF**	**Post Fire Forage**	**Dispersal-only**	**Capable**	**Non-Capable**
(WSC1) Proxy Core	500	382	2	62	52	2
Modify		0	0	0	0	0
Downgrade		176	0	1	0	0
Remove		79	0	0	0	
Post Action Baseline	500	127	2	1	52	2

Values may not sum to "Total FCHU Acreage" or "Forest FCHU Acreage" due to rounding.

[1] **Habitat Definitions** – See footnotes at Table 1.

NRF Localized Area Analysis – Proxy Core

The effects to critical habitat from the proposed actions should be analyzed at the appropriate scale for the function being analyzed (USDI FWS 2012a, pg. 271). PCE 2 provides for **nesting and roosting habitat** for spotted owls while PCE 3 provides **foraging** habitat for spotted owls (77 FR 71906).

For the PCE 2 and PCE 3 analyses, the Frest delineated a circular area 805 meters in diameter (~500 acres) approximating a spotted owl core-use area – dubbed a "proxy-core". A proxy-core was established within 1subunit (i.e. WSC1) where NRF was proposed for removal and the proxy-core was located in the area where NRF removal was the most concentrated (based on ocular estimation).

The condition of a spotted owl core-use area greatly influences site occupancy and fitness parameters (Clark 2007, Dugger *et al.* 2005), is an indicator of demographic support (Forsman *et al.* 2014), and is where nesting and roosting activities are concentrated.

Core-use areas are defended by territorial spotted owls and generally do not overlap the core-use areas of other spotted owl pairs (Dugger *et al*. 2005). Within the core-use area, the habitat within 200-300 meters of the nest is important to nest site selection and habitat use by post-fledgling owls (Miller 1989; Swindle *et al*. 1999; Perkins 2000). The probability of spotted owl occupancy varies according to the amount of NRF within the core-use area (Bart 1995, Meyer *et al*. 1998, Zabel *et al*. 2003, and Dugger *et al*. 2005). These critical values vary from 30 percent (Meyer *et al*. 1998) to 69 percent (Zabel *et al*. 2003). For this analysis the level one team chose to compare impacts against 50 percent, approximately half-way between 69 and 30 percent.

C/C1 – Within the WSC1 proxy-core, 79 acres of NRF would be removed and 176 acres would be downgraded. The baseline condition of the WSC1 proxy-core would be reduced by <1 percent – from 382 acres (76 percent) of NRF to 127 acres (51 percent) of NRF in the core (**Table 9**). Because the WSC1 proxy-core is already below 50 percent and additional NRF would be removed, the proposed action ***may affect*** and is ***likely to adversely effect*** the sub-unit.

Approximately <1 percent of the SWC1 sub-unit within the Action Area would be affected through removal (79 acres) and downgrading (176 acres) (**Table 9**). SWC1 is expected to continue providing for east-west connectivity between subunits and critical habitat units, and between the Oregon Coast and the Western Cascades because >99 percent of the sub-unit is unaffected by the proposed action.

The proposed projects encompass 3,420 total acres of commercial harvest in spotted owl habitat, 474 acres of non-commercial thinning, 1,420 acres of thinning along shaded fuel breaks. 1,218 acres of maintenance prescribed fire, approximately 12 acres of temporary road construction. Wetland maintenance, instream log placement and Motor Vehicle use updates combine for a total 60 acres at many locations in the watershed on the North Umpqua and Diamond Lake Ranger Districts in sub-watersheds of the North Umpqua River in Douglas County, Oregon. The proposed actions are planned within the Matrix and Late-successional Reserve land use allocations of the NWFP, including associated thinning within plantation riparian reserves (USDA. USDI 1995).

Collectively, because of the potential for the downgrading and removal of NRF, the effects generated from the activities in the proposed action ***may affect, and are likely to adversely***

affect spotted owls since the downgrade and removal of NRF is anticipated to reduce availability of nesting structure. The downgrade of habitat may also affect the success of spotted owls to forage in those areas as well. Some structural components such as snags, clumps of large trees, and down wood will be retained in part to meet existing NWFP requirements.

However, the overall limited scale of these projects within the portions of the 1 sub unit, of which there are 169 known spotted owl sites, within the Action Area and the fact that functioning green NRF or Dispersal-only habitat may be downgraded or removed as part of the project, results in a determination that the Calf Copeland project, "**may affect, and are likely to adversely affect**" 2012 designated spotted owl critical habitat.

CUMULATIVE EFFECTS ON SPOTTED OWL CRITICAL HABITAT

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

Cumulative Effects

The Forest assumes past management practices on private lands will continue but does not track private land harvest activity. Activities on non-federal lands do have the potential to impact Northern Spotted Owl from disturbance.

Cumulatively the effects of proposed activities in combination with other past, present, and reasonably foreseeable future actions on non-federal lands could potentially have negative impacts to Northern Spotted Owl and may be additive to the effects of the proposed action.

CONCLUSION

As a result of this analysis, the adverse effects of modifying NRF and dispersal only habitat would be from thinning and burning while possible disturbance, depending on timing of burning prescription. NRF habitat as analyzed at the 500 acre scale for the units within critical habitat containing NRF resulted in the determination that the Calf Copeland Project would likely adversely affect 2012 critical habitat because adverse effects to primary constituent elements within designated critical habitat are expected. However, the project's objectives of improving structural diversity and heterogeneity in young plantations, increasing structural diversity while retaining species diversity (such as five-needle pines) in all stands, and the improvement of fire resiliency within treated stands and across the landscape is consistent with the 2012 final rule which encourages active restorative habitat management within critical habitat.

Existing habitat for Northern Spotted Owl could be impacted with the implementation of the proposed activities from vegetation modification. Effects from disturbance could be largely mitigated through application of timing restrictions and other conservation measures, if implemented. Therefore, as described above in the effects analysis, implementation of these activities **May Affect, likely to Adversely Affect (LAA)** the Northern Spotted Owl.

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APPENDIX A. STATUS OF THE SPECIES - NORTHERN SPOTTED OWL (SEPTEMBER 12, 2019)

Northern Spotted Owl

Legal Status

The northern spotted owl was listed as threatened on June 26, 1990 due to widespread loss and adverse modification of suitable habitat across the owl's entire range and the inadequacy of existing regulatory mechanisms to conserve the owl (USDI FWS 1990a, p. 26114). Listing priority numbers are assigned on a scale of 1C (highest) to 18 (lowest). The "C" reflects conflict with development, construction, or other economic activity (USDI FWS 1983, p. 43104). The northern spotted owl was originally listed with a recovery priority number of 3C, but that number was changed to 6C in 2004 during the 5-year review of the species (USDI FWS 2004, p. 55). This number reflects a high degree of threat, a low potential for recovery, and the owl's taxonomic status as a subspecies (USDI FWS 1983, p. 51895). The most recent five year status review was completed on September 29, 2011, and did not propose changes to the listing status or introduce any new threats (USDI FWS 2011a). In 2012, the U.S. Fish and Wildlife Service (Service) was petitioned to uplist the northern spotted owl from threatened to endangered status under the Endangered Species Act. In April 2015, the Service determined that petition presented substantial information indicating that the listing may be warranted due to a number of listing factors (USDI FWS 2015, pp.19259-19263). The species' status report is currently under review.

Life History

Taxonomy
The northern spotted owl is one of three subspecies of spotted owls currently recognized by the American Ornithologists' Union. The taxonomic separation of these three subspecies is supported by genetic (Barrowclough and Gutiérrez 1990, pp.741-742; Barrowclough et al. 1999, p. 928; Haig et al. 2004, p. 1354), morphological (Gutiérrez et al. 1995, p. 2), and biogeographic information (Barrowclough and Gutiérrez 1990, p.741-742). The distribution of the Mexican subspecies (*S. o. lucida*) is separate from those of the northern and California (*S. o. occidentalis*) subspecies (Gutiérrez et al. 1995, p.2). Recent studies analyzing mitochondrial DNA sequences (Haig et al. 2004, p. 1354; Chi et al. 2004, p. 3; Barrowclough et al. 2005, p. 1117) and microsatellites (Henke et al., unpubl. data, p. 15) confirmed the validity of the current subspecies designations for northern and California spotted owls. The narrow hybrid zone between these two subspecies, which is located in the southern Cascades and northern Sierra Nevada, appears to be stable (Barrowclough et al. 2005, p. 1116).

Funk et al. (2008, pp. 1-11) tested the validity of the three current recognized subspecies of spotted owls and found them to be valid. During this genetics study, bi-directional hybridization and dispersal between northern spotted owls and California spotted owls centered in southern Oregon and northern California was discovered. In addition, a discovery of intro-regression of Mexican spotted owls into the northernmost parts of the northern spotted owl populations in Washington was made, indicating long-distance dispersal of Mexican spotted owls into the

northern spotted owl range (Funk et al. 2008, pp. 1-11). Some hybridization of northern spotted owls with barred owls has been recorded (Hamer et al. 1994, pp. 487-491; Dark et al. 1998, pp. 50-56; Kelly 2001, pp. 33, 38).

Physical Description

The northern spotted owl is a medium-sized owl and is the largest of the three subspecies of spotted owls (Gutiérrez et al. 1995, p. 2). It is approximately 46 to 48 centimeters (18 inches to 19 inches) long and the sexes are dimorphic, with males averaging about 13 percent smaller than females. The mean mass of 971 males taken during 1,108 captures was 580.4 grams (1.28 pounds) (out of a range 430.0 to 690.0 grams) (0.95 pound to 1.52 pounds), and the mean mass of 874 females taken during 1,016 captures was 664.5 grams (1.46 pounds) (out of a range 490.0 to 885.0 grams) (1.1 pounds to 1.95 pounds) (Loschl, P. and E. Forsman pers. comm. 2006 cited in USDI FWS 2011b, p. A-1). The northern spotted owl is dark brown with a barred tail and white spots on its head and breast, and it has dark brown eyes surrounded by prominent facial disks. Four age classes can be distinguished on the basis of plumage characteristics (Forsman 1981; Moen et al. 1991, p. 493). The northern spotted owl superficially resembles the barred owl, a species with which it occasionally hybridizes (Kelly and Forsman 2004, p. 807). Hybrids exhibit physical and vocal characteristics of both species (Hamer et al. 1994, p. 488).

Current and Historical Range

The current range of the spotted owl extends from southwest British Columbia through the Cascade Mountains, coastal ranges, and intervening forested lands in Washington, Oregon, and California, as far south as Marin County (USDI FWS 1990a, p. 26115). The range of the spotted owl is partitioned into 12 physiographic provinces (see Figure A-1) based on recognized landscape subdivisions exhibiting different physical and environmental features (USDI FWS 2011b, p. III-1; Thomas et al. 1993). These provinces are distributed across the species' range as follows:

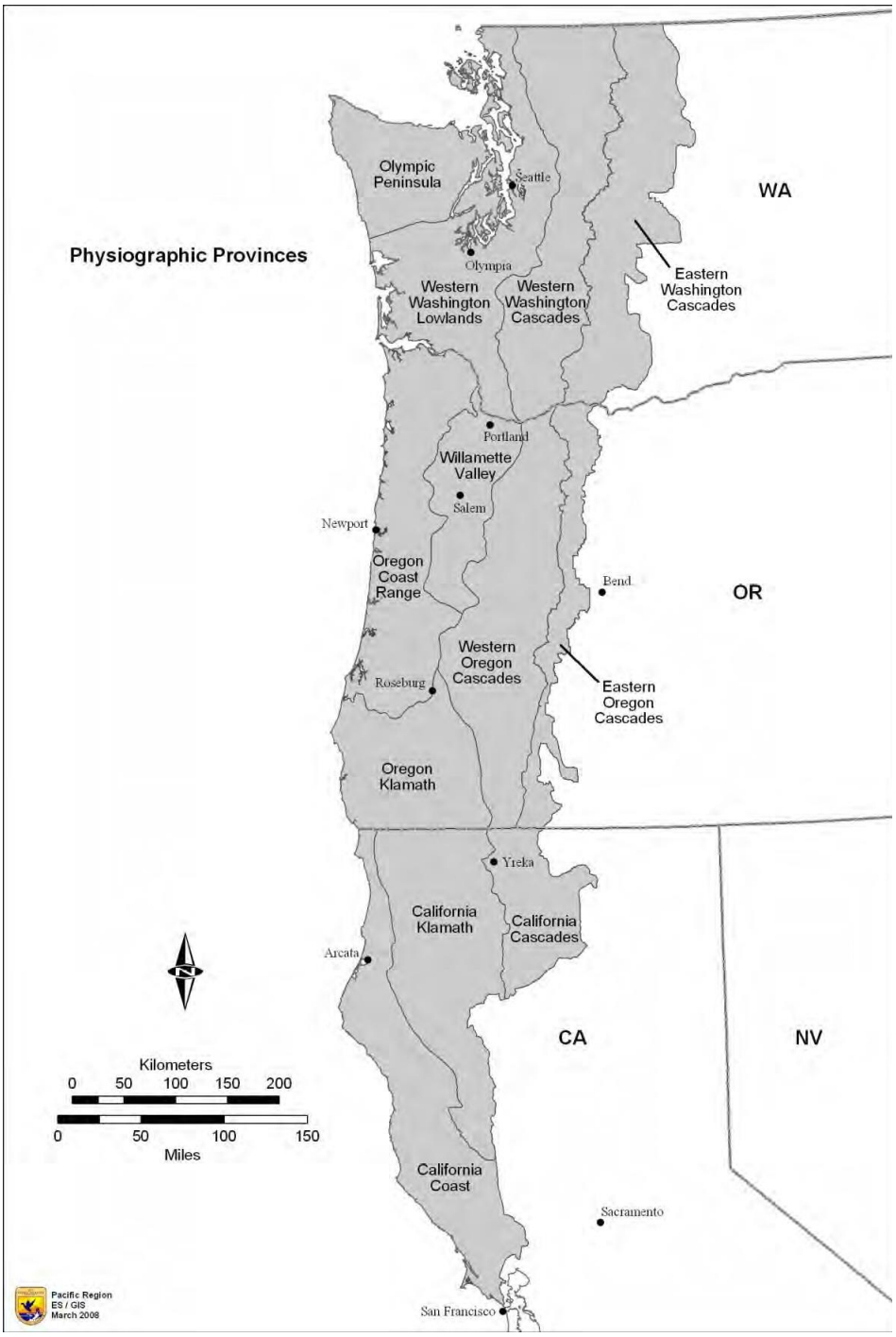
- Four provinces in Washington: Eastern Washington Cascades, Olympic Peninsula, Western Washington Cascades, Western Washington Lowlands
- Five provinces in Oregon: Oregon Coast Range, Willamette Valley, Western Oregon Cascades, Eastern Oregon Cascades, Oregon Klamath
- Three provinces in California: California Coast, California Klamath, California Cascades

The spotted owl is extirpated or uncommon in certain areas such as southwestern Washington and British Columbia. Timber harvest activities have eliminated, reduced or fragmented spotted owl habitat sufficiently to decrease overall population densities across its range, particularly within the coastal provinces where habitat reduction has been concentrated (USDI FWS 2011b, pp. B-1 to B-4; Thomas and Raphael 1993).

Behavior

Northern spotted owls are primarily nocturnal (Forsman et al. 1984, pp. 51-52) and spend virtually their entire lives beneath the forest canopy (Courtney et al. 2004, p. 2-5). They are adapted to maneuverability beneath the forest canopy rather than strong, sustained flight (Gutiérrez et al. 1995, p. 9). They forage between dusk and dawn and sleep during the day with peak activity occurring during the two hours after sunset and the two hours prior to sunrise

Figure A-1. Physiographic Provinces within the range of the northern spotted owl in the United States (from USDI FWS 2011b, A-3).



(Gutiérrez et al. 1995, p. 5; Delaney et al. 1999, p. 44). They will sometimes take advantage of vulnerable prey near their roosts during the day (Layman 1991, pp. 138-140; Sovern et al. 1994, p. 202).

Northern spotted owls seek sheltered roosts to avoid inclement weather, summer heat, and

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

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

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

Habitat Relationships

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

The habitat composition within cores and annual home ranges has been found to be directly correlated with demographic response such as occupancy, reproductive success, survival, and

fitness. Meyer et al. (1998) examined landscape indices associated with spotted owl sites versus random plots on BLM lands throughout Oregon. Across provinces, landscape indices highly correlated with the probability of spotted owl occupancy included the percent older forest (30 percent) within the 500 acres (analogous to a core-use area) surrounding the site. Zabel et al. (2003, abstract, p. 1033) found the best-fitting model for owl occupancy predictions in northwest California was at the 200-ha (500 acre) scale. Their model found a pseudo-threshold relationship to nesting and roosting habitat (meaning once the quantity of the habitat metric reached some ''threshold'' level the probability of occupancy did not increase or decrease substantially with more habitat) and a quadratic relationship to foraging habitat. Bart (1995) found that core areas should contain 30-50 percent mature and old growth forest. Results from Thomas et al. (1990), Bart and Forsman (1992) Bart (1995) and Dugger et al (2005) suggest that when spotted owl home ranges have less than 40 to 60 percent nesting/roosting/foraging (NRF), they were more likely to have lower occupancy and fitness. Olson et al. (2005) found similar results on their Oregon Coast Ranges study area.

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

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

Home-range sizes vary geographically, generally increasing from south to north, which is likely a response to differences in habitat quality (USDI FWS 1990a, p. 26117). Estimates of median size of their annual home range (the area traversed by an individual or pair during their normal activities (Thomas and Raphael 1993, pp. IX-15)) vary by province and range from 2,955 acres in the Oregon Cascades (Thomas et al. 1990, p. 194) to 14,211 acres on the Olympic Peninsula (USDI FWS 1994, p. 3). Zabel et al. (1995, p. 436) showed that these provincial home ranges are larger where flying squirrels are the predominant prey and smaller where wood rats are the predominant prey. Home ranges of adjacent pairs overlap (Forsman et al. 1984, p. 22; Solis and Gutiérrez 1990, p. 746), suggesting that the defended area is smaller than the area used for foraging. Spotted owl core areas vary in size geographically and provide habitat elements that are important for the reproductive efficacy of the territory, such as the nest tree, roost sites and foraging areas (Bingham and Noon 1997, p. 134). Some studies have found that spotted owls use smaller home ranges during the breeding season and often dramatically increase their home range size during fall and winter (Forsman et al. 1984, pp. 21-22; Sisco 1990, p. iii). In Southern

Oregon, one study found that home range and core areas remained essentially the same between seasons, concluding that perhaps this was due to the quality of available habitat (Shilling et al. 2013).

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

Habitat Use and Selection

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

Spotted owls generally rely on older forested habitats because such forests contain the structures and characteristics required for nesting, roosting, and foraging. Features that support nesting and roosting typically include a moderate to high canopy closure (60 to 80 percent); a multi-layered, multi-species canopy with large overstory trees (with diameter at breast height [dbh] of greater than 30 inches); a high incidence of large trees with various deformities (large cavities, broken tops, mistletoe infections, and other evidence of decadence); large snags; large accumulations of fallen trees and other woody debris on the ground; and sufficient open space below the canopy for spotted owls to fly (Thomas et al. 1990, p. 19). Weathers et al. 2001, (p. 686) found the spotted owl association with structurally complex habitats containing high canopy closure was in part due to their intolerance of high temperatures. Complex vertically structured habitat such as mature and old-growth forests habitats contain sufficient cover to provides protection from predators (Franklin et al. 2000, p. 578-579).

Spotted owls nest almost exclusively in trees. Like roosts, nest sites are found in forests having complex structure dominated by large diameter trees and high canopy closure (Forsman et al. 1984, p. 30; Hershey et al. 1998, p. 1402, LaHaye et al. 1997, p. 46-48). Even in forests that have been previously logged, spotted owls select forests having a structure (i.e., larger trees, greater canopy closure) different than forests generally available to them (Folliard 1993, p. 40; Buchanan et al. 1995, p. 304-305; Hershey et al. 1998, p. 1406-1407). In eastern Washington, spotted owl nest sites were found to have canopies of dominant and/or codominant and intermediate trees that were farther aboveground, more 35-60-cm (14-24 in)-dbh Douglas-fir *(Pseudotsuga menzies/,* greater basal area of Douglas-fir trees, more 61-84-cm (24-33.5 in) dbh ponderosa pine *(Pinus ponderosa)* trees, more live tree basal and more basal area of Class IV snags (broken snags with no branches and little bark).

Roost sites selected by spotted owls have more complex vegetation structure than forests generally available to them (Barrows and Barrows 1978, p. 2-3; Forsman et al. 1984, pp. 29-30; Solis and Gutiérrez 1990, pp. 742-743, 747). These habitats are usually multi-layered forests having high canopy closure and large diameter trees in the overstory.

Foraging habitat is the most variable of all habitats used by territorial spotted owls (Thomas et al. 1990; USDI FWS 2011b, p. G-2). Descriptions of foraging habitat have ranged from complex structure (Solis and Gutiérrez 1990, pp. 742-744) to a broader range of forests with lower canopy closure and smaller trees than forests containing nests or roosts (Gutiérrez 1996, p. 3-5). Foraging habitat for northern spotted owls provides a food supply for survival and reproduction. Foraging activity is positively associated with tree height diversity (North et al. 1999, p. 524), canopy closure and woody debris (Irwin et al. 2000, p. 180; Courtney et al. 2004, pp. 5-15), snag volume, density of snags greater than 20 in (50 cm) dbh (North et al. 1999, p. 524; Irwin et al. 2000, pp. 179-180; Courtney et al. 2004, pp. 5-15), density of trees greater than or equal to 31 in (80 cm) dbh (North et al. 1999, p. 524), volume of woody debris (Irwin et al. 2000, pp. 179-180), and young forests with some structural characteristics of old forests (Carey et al.1992, pp. 245-247; Irwin et al. 2000, pp. 178-179). Northern spotted owls select old forests for foraging in greater proportion than their availability at the landscape scale (Carey et al. 1992, pp. 236-237; Carey and Peeler 1995, p. 235; Forsman et al. 2004, pp. 372-373), but will forage in younger stands with high prey densities and access to prey (Carey et al. 1992, p. 247; Rosenberg and Anthony 1992, p. 165; Thome et al. 1999, pp. 56-57).

Dispersal habitat is essential to maintaining stable populations by filling territorial vacancies when resident northern spotted owls die or leave their territories, and to providing adequate gene flow across the range of the species. Dispersal habitat, at a minimum, consists of stands with adequate tree size and canopy closure to provide protection from avian predators and at least minimal foraging opportunities (USDI FWS 2011b, p. G-1). Dispersal habitat may include younger and less diverse forest stands than foraging habitat, such as even-aged, pole-sized stands, but such stands should contain some roosting structures and foraging habitat to allow for temporary resting and feeding for dispersing juveniles (USDI FWS 2011b, p. G-1). . In a study of the natal dispersal of northern spotted owls, Sovern and others (2015, pp. 257-260) found the majority of roosts were in forested habitats with at least some large (>50 cm or about 19 inches dbh) trees and they selected stands with high canopy cover (>70 percent) at the landscape scale. These authors suggested the concept of 'dispersal' habitat as a lower quality type of habitat may be inappropriate. Forsman et al. (2002, p. 22) found that spotted owls could disperse through highly fragmented forest landscapes. However, the stand-level and landscape-level attributes of forests needed to facilitate successful dispersal have not been thoroughly evaluated (Buchanan 2004, p. 1341).

Spotted owls may be found in younger forest stands that have the structural characteristics of older forests or retained structural elements from the previous forest. In redwood forests and mixed conifer-hardwood forests along the coast of northwestern California, considerable numbers of spotted owls also occur in younger forest stands, particularly in areas where hardwoods provide a multi-layered structure at an early age (Thomas et al. 1990, p. 158; Diller and Thome 1999, p. 275). In mixed conifer forests in the eastern Cascades in Washington, 27 percent of nest sites were in old-growth forests, 57 percent were in the understory reinitiation phase of stand development, and 17 percent were in the stem exclusion phase (Buchanan et al. 1995, p. 304). In the western Cascades of Oregon, 50 percent of spotted owl nests were in late-seral/old-growth stands (greater than 80 years old), and none were found in stands of less than 40 years old (Irwin et al. 2000, p. 41).

In the Western Washington Cascades, spotted owls roosted in mature forests dominated by trees greater than 50 centimeters (19.7 inches) dbh with greater than 60 percent canopy closure more

often than expected for roosting during the non-breeding season. Spotted owls also used young forest (trees of 20 to 50 centimeters (7.9 inches to 19.7 inches) dbh with greater than 60 percent canopy closure) less often than expected based on this habitat's availability (Herter et al. 2002, p. 441).

In the Coast Ranges, Western Oregon Cascades and the Olympic Peninsula, radio-marked spotted owls selected for old-growth and mature forests for foraging and roosting and used young forests less than predicted based on availability (Forsman et al. 1984, pp. 24-25; Carey et al. 1990, pp. 14-15; Thomas et al. 1990; Forsman et al. 2005, pp. 372-373). Glenn et al. (2004, pp. 46-47) studied spotted owls in young forests in western Oregon and found little preference among age classes of young forest.

Habitat use is influenced by prey availability. Ward (1990, p. 62) found that spotted owls foraged in areas with lower variance in prey densities (that is, where the occurrence of prey was more predictable) within older forests and near ecotones of old forest and brush seral stages. Zabel et al. (1995, p. 436) showed that spotted owl home ranges are larger where flying squirrels (*Glaucomys sabrinus*) are the predominant prey and smaller where wood rats (*Neotoma* spp.) are the predominant prey. The availability or abundance of prey can in turn influence reproductive success (Rosenburg et al. 2003, pp. 1720-1723).

The availability and distribution of habitats are important considerations. Landscape-level analyses in portions of Oregon Coast and California Klamath provinces suggest that a mosaic of late-successional habitat interspersed with other seral conditions may benefit spotted owls more than large, homogeneous expanses of older forests (Zabel et al. 2003, p. 1038; Franklin et al. 2000, pp. 573-579; Meyer et al. 1998, p. 43). In Oregon Klamath and Western Oregon Cascade provinces, Dugger et al. (2005, p. 876) found that apparent survival and reproduction was positively associated with the proportion of older forest near the territory center (within 730 meters) (2,395 feet). Survival decreased dramatically when the amount of non-habitat (non-forest areas, sapling stands, etc.) exceeded approximately 50 percent of the home range (Dugger et al. 2005, pp. 873-874). The authors concluded that they found no support for either a positive or negative direct effect of intermediate-aged forest—that is, all forest stages between sapling and mature, with total canopy cover greater than 40 percent—on either the survival or reproduction of spotted owls. It is unknown how these results were affected by the low habitat fitness potential in their study area, which Dugger et al. (2005, p. 876) stated was generally much lower than those in Franklin et al. (2000) and Olson et al. (2004), and the low reproductive rate and survival in their study area, which they reported were generally lower than those studied by Anthony et al. (2006). Olson et al. (2004, pp. 1050-1051) found that reproductive rates fluctuated biennially and were positively related to the amount of edge between late-seral and mid-seral forests and other habitat classes in the central Oregon Coast Range. Olson et al. (2004, pp. 1049-1050) concluded that their results indicate that while mid-seral and late-seral forests are important to spotted owls, a mixture of these forest types with younger forest and non-forest may be best for spotted owl survival and reproduction in their study area. In a large-scale demography modeling study, Forsman et al. (2011, pp. 1-2) found a positive correlation between the amount of suitable habitat and recruitment of young.

Reproductive Biology

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

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

Dispersal Biology

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

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

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

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

Dispersal can also be described as having two phases: transience and colonization (Courtney et al 2004, p. 5-13). Fragmented forest landscapes are more likely to be used by owls in the transience phase as a means to move rapidly between denser forest areas (Courtney et al 2004, p. 5-13; USDI FWS 2012a, p. 14086). Movements through mature and old growth forests occur during the colonization phase when birds are looking to become established in an area (Miller et al 1997, p. 144; Courtney et al 2004, p. 5-13). Transient dispersers use a wider variety of forest conditions for movements than colonizing dispersers, who require habitats resembling nesting/roosting/foraging habitats used by breeding birds (USDI FWS 2012a, p. 14086). Dispersal success is likely highest in mature and old growth forest stands where there is more likely to be adequate cover and food supply (USDI FWS 2012a, p. 14086).

Food Habits

Spotted owls are mostly nocturnal, although they also forage opportunistically during the day (Forsman et al. 1984, p. 51; 2004, pp. 222-223; Sovern et al. 1994, p. 202). The composition of the spotted owl's diet varies geographically and by forest type. Generally, flying squirrels (*Glaucomys sabrinus*) are the most prominent prey for spotted owls in Douglas-fir and western hemlock (*Tsuga heterophylla*) forests (Forsman et al. 1984, pp. 40-41) in Washington and Oregon, while dusky-footed wood rats (*Neotoma fuscipes*) are a major part of the diet in the Oregon Klamath, California Klamath, and California Coastal provinces (Forsman et al. 1984, pp. 40-42; 2004, p. 218; Ward et al. 1998, p. 84; Hamer et al. 2001, p. 224). Depending on location, other important prey include deer mice (*Peromyscus maniculatus*), tree voles (*Arborimus longicaudus, A. pomo*), red-backed voles (*Clethrionomys* spp.), gophers (*Thomomys* spp.), snowshoe hare (*Lepus americanus*), bushy-tailed wood rats (*Neotoma cinerea*), birds, and insects, although these species comprise a small portion of the spotted owl diet (Forsman et al. 1984, pp. 40-43; 2004, p. 218; Ward et al. 1998; p. 84; Hamer et al. 2001, p.224).

Other prey species such as the red tree vole (*Arborimus longicaudus),* red-backed voles (*Clethrionomys gapperi),* mice, rabbits and hares, birds, and insects) may be seasonally or locally important (reviewed by Courtney et al. 2004, pp. 4-27). For example, Rosenberg et al. (2003, p. 1720) showed a strong correlation between annual reproductive success of spotted owls

(number of young per territory) and abundance of deer mice (*Peromyscus maniculatus*) (r2 = 0.68), despite the fact they only made up 1.6±0.5 percent of the biomass consumed. However, it is unclear if the causative factor behind this correlation was prey abundance or a synergistic response to weather (Rosenberg et al. 2003, p. 1723). Ward (1990, p. 55) also noted that mice were more abundant in areas selected for foraging by owls. Nonetheless, spotted owls deliver larger prey to the nest and eat smaller food items to reduce foraging energy costs; therefore, the importance of smaller prey items, like *Peromyscus*, in the spotted owl diet should not be underestimated (Forsman et al. 2001, p. 148; 2004, pp. 218-219). In the southern portion of their range, where woodrats are a major component of their diet, northern spotted owls are more likely to use a variety of stands, including younger stands, brushy openings in older stands, and edges between forest types in response to higher prey density in some of these areas (Forsman et al. 1984, pp. 24-29).

Population Dynamics

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

Annual variation in population parameters for spotted owls has been linked to environmental influences at various life history stages (Franklin et al. 2000, p. 581). In coniferous forests, mean fledgling production of the California spotted owl (*Strix occidentalis occidentalis*), a closely related subspecies, was higher when minimum spring temperatures were higher (North et al. 2000, p. 805), a relationship that may be a function of increased prey availability. Across their range, spotted owls have previously shown an unexplained pattern of alternating years of high and low reproduction, with highest reproduction occurring during even-numbered years (e.g., Franklin et al. 1999, p. 1). Annual variation in breeding may be related to weather (i.e., temperature and precipitation) (Wagner et al. 1996, p. 74; Zabel et al. 1996, p.81 *In*: Forsman et al. 1996) and fluctuation in prey abundance (Zabel et al. 1996, pp.437-438).

A variety of factors may regulate spotted owl population levels. These factors may be density-dependent (e.g., habitat quality, habitat abundance) or density-independent (e.g., climate). Interactions may occur among factors. For example, as habitat quality decreases, density-independent factors may have more influence on survival and reproduction, which tends to increase variation in the rate of growth (Franklin et al. 2000, pp. 581-582). Specifically, weather could have increased negative effects on spotted owl fitness for those owls occurring in relatively lower quality habitat (Franklin et al. 2000, pp. 581-582). A consequence of this pattern is that at some point, lower habitat quality may cause the population to be unregulated (have negative growth) and decline to extinction (Franklin et al. 2000, p. 583). Recent findings of the northern spotted owl meta-analysis suggest that competition with barred owls is an important stressor of spotted owl populations, but habitat availability and climatic patterns also appear to influence survival, occupancy, recruitment, and, to a lesser extent, fecundity (Dugger et al. 2016, entire). Authors noted variable annual rates of decline across the range, but the CleElum study area in Washington and the control area in Green Diamond study area in northern California showed the highest annual rates of population decline (Dugger et al. 2016, pp.70-71; further detail provided in *Barred Owls* section below). Rangewide, the weighted mean estimated population was

determined to decline 3.8 percent per year (Dugger et al. 2016, p. 71).

Olson et al. (2005, pp. 930-931) used open population modeling of site occupancy that incorporated imperfect and variable detectability of spotted owls and allowed modeling of temporal variation in site occupancy, extinction, and colonization probabilities (at the site scale). The authors found that visit detection probabilities average less than 0.70 and were highly variable among study years and among their three study areas in Oregon. Pair site occupancy probabilities declined greatly on one study area and slightly on the other two areas. However, for all owls, including singles and pairs, site occupancy was mostly stable through time. Barred owl presence had a negative effect on these parameters (see barred owl discussion in the New Threats section below). However, there was enough temporal and spatial variability in detection rates to indicate that more visits would be needed in some years and in some areas, especially if establishing pair occupancy was the primary goal.

Threats

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

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

The Service conducted a 5-year review of the spotted owl in 1994 (USDI FWS 2004), for which the Service prepared a scientific evaluation of the status of the spotted owl (Courtney et al. 2004). An analysis was conducted assessing how the threats described in 1990 might have changed by 2004. Some of the key threats identified in 2004 were:

- "Although we are certain that current harvest effects are reduced, and that past harvest is

also probably having a reduced effect now as compared to 1990, we are still unable to fully evaluate the current levels of threat posed by harvest because of the potential for lag effects…In their questionnaire responses…6 of 8 panel member identified past habitat loss due to timber harvest as a current threat, but only 4 viewed current harvest as a present threat" (Courtney and Gutiérrez 2004, pp.11-7).

- "Currently the primary source of habitat loss is catastrophic wildfire, although the total amount of habitat affected by wildfires has been small (a total of 2.3 percent of the range-wide habitat base over a 10-year period)" (Courtney and Gutiérrez 2004, pp.11-8).

- "Although the panel had strong differences of opinion on the conclusiveness of some of the evidence suggesting [barred owl] displacement of [spotted owls], and the mechanisms by which this might be occurring, there was no disagreement that [barred owls] represented an operational threat. In the questionnaire, all 8 panel members identified [barred owls] as a current threat, and also expressed concern about future trends in [barred owl] populations" (Courtney and Gutiérrez 2004, pp. 11-8).

Threats, as identified in the 2011 Revised Recovery Plan for the Northern Spotted Owl, continue to emphasize that habitat loss and barred owls are the main threats to northern spotted owl recovery (USDI FWS 2011b, Appendix A), and that effects of high severity wildfires pose concern for habitat conservation in some portions of the range (Davis et al. 2016, p. 38).

Barred Owls (Strix varia)

Barred owls currently appear to be the primary threat to northern spotted owls. With its recent expansion to as far south as Marin County, California (Gutiérrez et al. 2004, pp. 7-12 to 7-13; Steger et al. 2006, p.226), the barred owl's range now completely overlaps that of the northern spotted owl. Evidence that barred owls are occurring in higher densities than spotted owls in many parts of the range (3–8 barred owl territories/northern spotted owl; Hamer et al. 2007; Singleton et al. 2010; Wiens et al. 2011, 2014), and, to a lesser extent, northern California spotted owls (Diller et al. 2016, Dugger et al. 2016). In a recent study, the highest densities found were in the Oregon Coast Range, with up to 20 barred owls per spotted owl territory reported (Wiens et al. 2017, p. 12).

The two species of owls share similar habitats and are likely competing for food resources (Hamer et al. 2001, p. 226, Gutiérrez et al. 2007, p. 187; Livezey and Fleming 2007, p. 319, Wiens et al., 2014, pp. 24 and 33). Hamer found a strong diet overlap (76 percent) between northern spotted and barred owl diets (pp. 221, 226). Barred owl diets are more diverse than northern spotted owl diets and include species associated with riparian and other moist habitats (e.g. fish, invertebrates, frogs, and crayfish), along with more terrestrial and diurnal species (Smith et al. 1983; Hamer et al. 2001; Gronau 2005, Wiens et al., 2014, p. 24). Even though barred owls may be taking northern spotted owls' primary prey only as a generalist, northern spotted owls may be affected by a sufficient reduction in the density of these prey items due to barred owls, leading to a depletion of prey to the extent that the northern spotted owl cannot find an adequate amount of food to sustain maintenance or reproduction (Gutiérrez et al. 2007, p. 187; Livezey and Fleming 2007, p. 319). These impacts are likely to have direct and indirect effects on ecosystem processes (Holm et al. 2017, p. 618)

In addition to completion for prey, barred owls are competing for habitats (Hamer et al. 1989, p.55; Dunbar et al. 1991, p. 467; Herter and Hicks 2000, p. 285; Pearson and Livezey 2003, p. 274; Wiens et al., 2014, pp. 24 and 33). Barred owls were initially thought to be more closely associated with early successional forests than spotted owls, based on studies conducted on the west slope of the Cascades in Washington (Hamer et al 1989, p. 34; Iverson 1993, p.39). However, more recent studies conducted in the Pacific Northwest show that barred owls frequently use mature and old-growth forests (Pearson and Livezey 2003, p. 270; Gremel 2005, Schmidt 2006, p. 1; Singleton et al. 2010, pp. 290-292). In the fire prone forests of eastern Washington, a telemetry study conducted on barred and spotted owls showed that barred owl home ranges were located on lower slopes or valley bottoms, in closed canopy, mature, Douglas-fir forest, while spotted owl sites were located on mid-elevation areas with southern or western exposure, characterized by closed canopy, mature, ponderosa pine or Douglas-fir forest (Singleton et al. 2005, p. 1).

In addition to resource competition, barred owls have been documented to physically attack spotted owls (Pearson and Livezey 2003, p. 274), and circumstantial evidence strongly indicated that a barred owl killed a spotted owl (Leskiw and Gutiérrez 1998, p. 226).

There is consensus in the literature on the negative influence barred owls are having on northern spotted owl site occupancy, fecundity, reproduction, apparent survival, and detectability, and that data indicates that over the last ten-fifteen years, they are contributing to declines in spotted owl populations (Olson et al. 2005, p. 924; Forsman et al. 2011, pp. 69-70), Dugger et al. 2011, pp. 2463-2467; Dugger et al. 2016, pp. 70-96). As barred owls have expanded, the occupancy of historical spotted owl territories appears to be declining. Over ten years ago, site occupancy of spotted owls in Washington and Oregon was significantly lower ($p < 0.001$) after barred owls were detected within 0.8 kilometer (0.5 miles) of the territory center but was "only marginally lower" ($p = 0.06$) if barred owls were located more than 0.8 kilometer (0.5 miles) from the spotted owl territory center (Kelly et al. 2003, p. 51). Pearson and Livezey (2003, p. 271) found that there were significantly more barred owl site-centers in unoccupied spotted owl circles than occupied spotted owl circles (centered on historical spotted owl site-centers) with radii of 0.8 kilometer (0.5 miles) ($p = 0.001$), 1.6 kilometer (1 mile) ($p = 0.049$), and 2.9 kilometer (1.8 miles) ($p = 0.005$) in Gifford Pinchot National Forest. In Olympic National Park, Gremel (2005, p. 11) found a significant decline ($p = 0.01$) in spotted owl pair occupancy at sites where barred owls had been detected, while pair occupancy remained stable at spotted owl sites without barred owls. Olson et al. (2005, p. 928) found that the annual probability that a spotted owl territory would be occupied by a pair of spotted owls after barred owls were detected at the site declined by 5 percent in the HJ Andrews study area, 12 percent in the Coast Range study area, and 15 percent in the Tyee study area. In contrast, Bailey et al. (2009, p. 2983), when using a two-species occupancy model, showed no evidence that barred owls excluded northern spotted owls from territories in Oregon. More recently, results from a barred owl and northern spotted owl radio-telemetry study in Washington reported two northern spotted owls fleeing their territories and traveling six and 15 miles, believed to be as a result of frequent direct encounters with barred owls; both northern spotted owls were subsequently found dead (Irwin et al. 2010, p. 3-4). Preliminary findings from an ongoing barred owl experimental control/treatment study, spotted owl pair occupancy was low, has declined in control sites; while (with the exception of one year in one study area), the occupancy by barred owls has increased (Wiens et al. 2017, tables 1 and 2). Authors also report that the probability of use by barred owls within 500 acre hexagons (1,235 acres) in the Oregon Coast Ranges study area was high in the two years of the study in the control area (>0.920) (p. 16).

Numerous studies suggest that barred owls are negatively affecting spotted owl survival and reproduction. Anthony et al. (2006, p. 32) found significant evidence for negative effects of barred owls on apparent survival of spotted owls in two of 14 study areas (Olympic and Wenatchee). They attributed the equivocal results for most of their study areas to the coarse nature of their barred owl covariate. Dugger et al. (2011, pp. 2463-2467) described synergistic effects associated with territory composition and presence of barred owls; some northern spotted owl pairs retained their territories and continued to survive and successfully reproduce during their study even when barred owls were present, but the effects of reduced old growth forest in the core habitat areas were compounded when barred owls were present - extinction rates of northern spotted owl territories nearly tripled when barred owls were detected. Yackulic and others documented similar findings; the effects of interspecific competition were likely to negatively affect spotted owls, both through its immediate effects on local extinction and by indirectly lowering colonization (Yackulic et al., 2014, pp. 271-273).

Most recently, apparent survival and local extinction rates were the key vital rates associated with barred owl presence in spotted owl populations (Dugger et al., 2016, p. 93-98). Dugger et al. (2016, pp. 98-99) suggested that barred owl densities may now be high enough across the range of the northern spotted owl that, despite the continued management and conservation of suitable owl habitat on Federal lands (Davis et al. 2011, 2015), the long-term prognosis for the persistence of northern spotted owls may be in question without additional management intervention. For example, Dugger et al. (2016) found that the removal of barred owls in the Green Diamond study area in northern California had rapid, positive effects on northern spotted owl survival and rates of population change, suggesting that, along with habitat conservation and management, barred owl removal may be able to slow or reverse northern spotted owl population declines on at least a localized scale (Diller et al. 2016).

Olson et al. (2004, p. 1048) found that the presence of barred owls had a significant negative effect on the reproduction of spotted owls in the central Coast Range of Oregon (in the Roseburg study area). The conclusion that barred owls had no significant effect on the reproduction of spotted owls in one study (Iverson 2004, p. 89) was unfounded because of small sample sizes (Livezey 2005, p. 102). It is likely that all of the above analyses underestimated the effects of barred owls on the reproduction of spotted owls because spotted owls often cannot be relocated after they are displaced by barred owls (Forsman, E. pers. comm. 2006, cited in USDI FWS 2011b, p. B-11). Anthony et al. (2006, p. 32) found significant evidence for negative effects of barred owls on apparent survival of spotted owls in two of 14 study areas (Olympic and Wenatchee). They attributed the equivocal results for most of their study areas to the coarse nature of their barred owl covariate. Dugger et al. (2011, pp. 2463-2467) confirmed the synergistic effects of barred owls and territory habitat characteristics on extinction and colonization rates of territories by northern spotted owls. Extinction rates of northern spotted owl territories nearly tripled when barred owls were detected (Dugger et al. 2011, p. 2464). The recent meta-analysis suggested weak relationships between fecundity and barred owls across all study areas; however, declines in the number of occupied spotted owl sites contributed to declines in the total number of young produced per study area (Dugger et al. 2016 p. 96).

Monitoring and management of northern spotted owls has become more complicated due to their possible reduced detectability when barred owls are present (Kelly et al. 2003, pp. 51-52; Courtney et al. 2004, p. 7-16 ; Olson et al. 2005, p. 929; Crozier et al. 2006, p.766-767).

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

In an analysis of more than 9,000 banded spotted owls throughout their range, only 47 hybrids were detected (Kelly and Forsman 2004, p. 807). Consequently, hybridization with the barred owl is considered to be "an interesting biological phenomenon that is probably inconsequential, compared with the real threat—direct competition between the two species for food and space" (Kelly and Forsman 2004, p. 808).

There is no evidence that the increasing trend in barred owls has stabilized in any portion of the spotted owl's range in the western United States, and "there are no grounds for optimistic views suggesting that barred owl impacts on northern spotted owls have been already fully realized" (Gutiérrez et al. 2004, pp. 7-38). To date, this situation does not appear to have changed.

Wildfire

At the time of listing there was recognition that large-scale wildfire posed a threat to the spotted owl and its habitat (USDI FWS 1990a, p. 26183). New information suggests fire may be more of a threat than previously thought. In 2005 the overall total amount of habitat affected by wildfires was been relatively small (Lint 2005, p. v) but since then, there have been significant losses of nesting/roosting habitats reported, particularly in the reserved land allocations of the Klamath Province and parts of the Oregon Cascades (Davis et al. 2011, pp. 43-48; Davis et al. 2016, tables 5 and 7). Table A-2 below also summarizes habitat lost from natural disturbances, the majority of which has resulted from high severity fires. 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, the ability to protect spotted owl habitat and viable populations of spotted owls from large fires through risk-reduction endeavors is uncertain (Courtney et al. 2004, pp. 12-11). The NWFP recognized wildfire as an inherent part of managing spotted owl habitat in certain portions of the range. The distribution and size of reserve blocks as part of the NWFP design may help mitigate the risks associated with large-scale fire (Lint 2005, p. 77).

Studies indicate that the effects of wildfire on spotted owls and their habitat are variable, depending on fire intensity, severity, and size. Within the fire-adapted forests of the spotted owl's range, spotted owls likely have adapted to withstand fires of variable sizes and severities. However, fire is often considered a primary threat to spotted owls because of its potential to alter habitat rapidly (Bond et al. 2009, p. 1116) and is a major cause of habitat loss on Federal lands (Courtney et al. 2004, executive summary; Davis et al. 2011, pp. 43-48; Davis et al. 2016, tables 5 and 7).

Research results on spotted owl use of burned landscapes and their demographic variables following fires at localized scales has yielded variable results that were influenced by small sample sizes, varying impacts to habitat, existing forest management practices, the condition of

pre- and post-fire landscapes, and the status of spotted owls that previously occupied the sites (Elliott 1985; Gaines et al. 1997, King et al. 1998; Bond et al. 2002; Jenness et al. 2004; Clark 2007; Seamans and Gutierrez 2007; Bond et al. 2009; Clark et al. 2011; Roberts et al. 2011; Clark et al. 2013; Comfort 2014; Lee and Bond 2015a; Lee and Bond 2015b; Bond et al. 2016; and Jones et al., 2016). Bond and others (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, p. 1025-1026). In a preliminary study conducted by Anthony and Andrews (2004, p. 8) in the Oregon Klamath Province, their sample of spotted owls appeared to be using a variety of habitats within the area of the Timbered Rock fire, including areas where burning had been moderate. Site fidelity can influence spotted owl use of burned areas that were previously suitable (Clark 2007, Bond et al. 2009, Lee et al. 2012). Also, the amount, extent, and location of high severity fires appear to be strong influences on spotted owl occupancy. One year following the extensive King Fire in the Sierra Nevada Mountains, Jones and others (2016) documented strong negative California spotted owl population impacts, with declines in occupancy and reproduction associated with severely burned sites; the probability of site extinction in that study was seven times higher one year after the fire where more than 50 percent of the site (approximately 0.7 mile radius area) burned at high severity (75–100 percent canopy mortality) (p. 303-304).

In southwest Oregon, lower occupancy and survival rates of spotted owl were found in burned areas compared to unburned, but the results were confounded by prior management and post-fire harvest (Clark 2007, Clark et al. 2011, Lee et al. 2012, Clark et al. 2013). Available data on the direct mortality of spotted owls from fire is limited. In one study, mortality was assumed to have occurred at one site, and spotted owls were present at only one of the six sites 1 year after a fire (Gaines et al. 1997, p. 126). In 1994, two wildfires burned in the Yakama Indian Reservation in Washington's eastern Cascades, affecting the home ranges of two radio-tagged spotted owls (King et al. 1998, pp. 2-3). No direct mortality of spotted owls was observed, even though thick smoke covered several spotted owl site-centers for a week. Although the amount of home ranges burned was not quantified, spotted owls were observed using areas that burned at low and medium intensities. More research is needed to understand further the relationship between fire and spotted owl habitat use. Overall, we can conclude that fires are a change agent for northern spotted owl habitat, but there are still many unknowns regarding how much fire benefits or adversely affects northern spotted owl habitat (USDI FWS 2011b, p. III-31).

Additional impacts to northern spotted owls related to wildfire include forest management that occurs after fires. Post-fire salvage logging typically occurs on the majority of private timberlands, but also occurs on Federal lands to a smaller degree. This type of harvest can directly impact habitat potentially occupied by northern spotted owls and can negatively influence ecological processes, which can impair the long-term development of spotted owl habitat (reviewed in USDI FWS 2011b, p. III-48). Action agencies, working with the Service, are attempting to influence fire severity by designing projects to reduce fire-suppressed vegetation and mimic the effects of historical fire regimes. The effects of this type of management are uncertain and highly debated in the literature (Courtney et al. 2004, pp. 12-11, Omi and Martenson 2002, pp. 19-27; Irwin et al. 2004, p. 21; Spies et al. 2006 p. 359-361; Hanson et al. 2009, pp. 1316-1319; Spies et al. 2009, pp. 331-332; Ager et al. 2012, p. 282;

Odion et al. 2014a pp. 10-12, Spies et al. 2012, pp. 10-12; Odion et al. 2014b, pp. 46-49; Gaines et al. 2010, Baker 2015, entire; Baker 2017, entire; Gallagher et al. 2018, pp. 10-13).

West Nile Virus

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

Human activities and landscape physiography appear to influence the occurrence of WNV (Dobson and Foufopoulos 2001, p. 1004; Gibbs et al. 2006, p. 80). Mountainous terrain typically associated with northern spotted owls may limit the widespread occurrence of WNV. The effect of how WNV will ultimately affect spotted owl populations is unknown but localized populations could be adversely affected (Blakesley and others 2004, *in* Courtney et al. 2004, p. 8-25-8-31). Susceptibility to infection and the mortality rates of infected individuals vary among bird species (Blakesley et al. 2004, pp. 8-33), but most owls appear to be quite susceptible. For example, breeding Eastern screech owls (*Megascops asio*) in Ohio experienced 100 percent mortality (Grubb, T. pers. comm. 2006 cited in Blakesley et al. 2004, pp. 8-33). Barred owls, in contrast, showed lower susceptibility (Hunter, B. pers. comm. no date cited in Blakesley et al. 2004, pp. 8-34). Some level of innate resistance may occur (Fitzgerald et al. 2003), which could explain observations in several species of markedly lower mortality in the second year of exposure to WNV (Caffrey and Peterson 2003). Wild birds also develop resistance to WNV through immune responses (Deubel et al. 2001). The effects of WNV on bird populations at a regional scale have not been large, even for susceptible species (Caffrey and Peterson 2003), perhaps due to the short-term and patchy distribution of mortality (McGowan, K. pers. comm. no date, cited in Courtney et al. 2004) or annual changes in vector abundance and distribution.

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

Sudden Oak Death

Sudden oak death was not listed as particular threat at the time of listing but was recognized as a potential threat to the spotted owl after it was discovered in Oregon (Courtney et al. 2004, USDI Fish and Wildlife 2011). This disease is caused by the fungus-like pathogen, *Phytopthora ramorum* that was recently introduced from Europe and is rapidly spreading as it is capable of infecting over 100 species of trees and shrubs (APHIS 2011, in Peterson et al. 2015, p. 937) . The disease has been found in several different forest types and at elevations from sea level to

over 800 m and is now known to extend over 650 km from south of Big Sur, California to Curry County, Oregon (Rizzo and Garbelotto 2003, p. 198). In some areas it has reached epidemic proportions in oak (Quercus spp.) and tanoak (*Lithocarpus densiflorus*) forests along approximately 300 kilometers (186 miles) of the central and northern California coast (Rizzo et al. 2002, p. 733). Near Brookings, Oregon it has killed tanoak and causing dieback of closely associated wild rhododendron (*Rhododendron* spp.) and evergreen huckleberry (*Vaccinium ovatum*) (Goheen et al. 2002, p. 441), common components of spotted owl habitat. Despite treatments of infected sites that remove all infected trees and shrubs as well as those occurring within a 300 foot buffer, occurrences of infected sites have increased since 2001 (Peterson et al. 2015, p. 937). The majority of infected sites in Oregon are concentrated in the Chetco River drainage, but it has been located as far north as Cape Sebastian (Peterson et al. 2015, p. 238). The spores from this pathogen are transmitted through the coastal fog and rain or through contaminated surfaces. During a study completed between 2001 and 2003 in California, one-third to one-half of the hiker's present in the study area carried infected soil on their shoes (Davidson et al. 2005, p. 587), creating the potential for rapid spread of the disease. Sudden oak death poses a threat of uncertain proportion because of its potential impact on forest dynamics and alteration of key prey and spotted owl habitat components (e.g., hardwood trees, forest structure and nest tree mortality); especially in the southern portion of the spotted owl's range (Courtney et al. 2004, pp. 6-26 through 6-27, 11-8). Eradication treatments themselves have the potential to remove habitat at the stand level as all hardwoods and shrubs identified as carriers are removed. Because of the coastal influence on this pathogen, sudden oak death is not likely to be of consequence rangewide, but could compound existing stressors in coastal provinces of the spotted owl range.

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. Earlier studies showed no indication of reduced genetic variation and past bottlenecks in Washington, Oregon, or California (Barrowclough et al. 1999, p. 922; Haig et al. 2004, p. 36). A more recent study however, reported a significant bottleneck influence in the Washington Cascades, an area known to be experiencing a significant population decline, and that other areas with significant population bottlenecks were correlated with declines in population growth rate (Funk et al. 2010, as reviewed in Haig et al. 2016, p. 187). Canadian populations may be more adversely affected by issues related to small population size including inbreeding depression, genetic isolation, and reduced genetic diversity (Courtney et al. 2004, pp. 11-9). A 2004 study (Harestad et al. 2004, p. 13) indicates that the Canadian breeding population was estimated to be less than 33 pairs and annual population decline may be as high as 35 percent. In 2007, a recommendation was made by the Spotted Owl Population Enhancement Team to remove northern spotted owls from the wild in British Columbia (USDI FWS 2012a, p. 14078). This recommendation resulted in the eventual capture of the remaining 16 wild northern spotted owls in British Columbia for a captive breeding program (USDI FWS 2012a, p. 14078). Low and persistently declining populations throughout the northern portion of the species range (see "Population Trends" below) may be at increased risk of losing genetic diversity.

Hybridization of northern spotted owls with California spotted owls, Mexican spotted owls, and barred owls has been confirmed through genetic research (Funk et al. 2008, p. 1; Hamer et al. 1994, p. 487; Gutiérrez et al. 1995, p. 3; Dark et al. 1998, p. 50; Kelly 2001, pp. 33-35).

Climate Change

Global climate change has the potential to produce entirely new environmental conditions, making predictions about future ecological consequences a more daunting challenge. Recent forecasts indicate that climate change will have long-term and variable impacts on forest habitat at local and regional scales. Locally, this could involve shifts in tree species composition that influence habitat suitability. Frey et al. (2016, pp. 1, 6) concluded that old-growth will provide some buffer from impacts of regional warming and/or slow the rate at which some species relying on old-growth must adapt, based on their modeling of the fine-scale spatial distribution, under-canopy air temperatures in mountainous terrain of central Oregon. Similarly, Lesmeister et al. (2019, p. 16) concluded that older forest can serve as a buffer to climate change and associated increases in wildfire, as these areas have the highest probability of persisting through fire events even in weather conditions associated with high fire activity. Regionally, there could be losses of habitat availability caused by advances or retreats of entire vegetative communities, and perhaps prey communities as well. Effects of climate change, including fire and pest incidence, will not only affect currently suitable habitat for the northern spotted owl, they will also likely alter or interrupt forest growth and development processes (Karl et al. 2008, pp. 15 and 18; Dale et al. 2001, entire; Yospin et al. 2015, entire) that influence forest turnover rates and the emergence of suitable habitat attributes in new locations. These changes are predicted to be driven by changes in patterns of temperature and precipitation that are projected to occur under climate change scenarios (Mote et al. 2014, entire).

Glenn et al. (2010, p.2551) noted that the potential consequences of global climate change on Pacific Northwest forests remain somewhat unclear, though there is potential for changes in forest composition and disturbance patterns that could affect northern spotted owl populations. Most models predict warmer, wetter winters and hotter, drier summers for the Pacific Northwest in the first half of the 21st century (Mote et al., 2008, Mote et al. 2014, p. 489). This may result in a change in species composition or reduction in the acreage of existing low-elevation forests. The general predicted trend in North American forests is declining occupancy by conifers and displacement by hardwoods. Both the frequency and intensity of wildfires and insect outbreaks are expected to increase over the next century in the Pacific Northwest (Littell et al. 2010, p. 130). One of the largest projected effects on Pacific Northwest forests is likely to come from an increase in fire frequency, duration, and severity. Westerling et al. (2006, pp. 940-941) analyzed wildfires and found that since the mid-1980s, wildfire frequency in western forests has nearly quadrupled compared to the average of the period from 1970-1986. The total area burned is more than 6.5 times the previous level and the average length of the fire season during 1987-2003 was 78 days longer compared to 1978-1986 (Westerling et al. 2006, p. 941). The area burned annually by wildfires in the Pacific Northwest is expected to double or triple by the 2080s (Littell et al. 2010, p. 140). Wildfires are now the primary cause of spotted owl habitat loss on Federal lands, with about 505,800 acres of nesting/roosting habitat loss attributed to wildfires from 1993 to 2012 (Davis et al. 2016, table 7, p. 22).

In its review of the status of the northern spotted owl in California (CDFW 2016, p. 153-155), the California Department of Fish and Wildlife (CDFW) evaluated the possible effects of climate change upon northern spotted owl and the forested habitats on which it depends. In general, CDFW (2016, p. 153-155) determined that climate change is occurring within the northern spotted owl's entire range, including California, with many climate projections forecasting steady changes in the future. They reported that climate change studies predict future conditions

that may negatively impact northern spotted owls, such as wet and cold springs, more frequent and severe summer heat waves, decreased fog along the coast, shifts in forest species composition, and increased frequency of severe wildfire events. However, CDFW (2016, p. 153-155) also reported that in some instances predicted future conditions, such as increased frequency of low to moderate severity fires and expansion of suitable owl habitat forest types, may be favorable to the northern spotted owl in the long-term. They further reported that in California, current rates of temperature and precipitation change predict hotter and drier conditions in some areas of the northern spotted owl's range, and wetter colder conditions in other areas of the range. They looked at past precipitation and temperature trends, and reported that drying trends across most of the northern spotted owl's range in California, coupled with warmer winters and cooler summers in the interior and cooler winters and warmer summers along the coast, may play a role in both owl and prey population dynamics. CDFW (2016, p. 153-155) recommended that further research is necessary to understand how climate change may be affecting northern spotted owls in California and throughout its range.

Potential changes in temperature and precipitation have important implications for spotted owl reproduction and survival. Wet, cold weather during the winter or nesting season, particularly the early nesting season, has been shown to negatively affect spotted owl reproduction (Olson et al. 2004, p. 1039, Dugger et al. 2005, p. 863), survival (Franklin et al. 2000 pp. 576-577, Olson et al. 2004, p. 1039, Glenn et al. 2011, p. 1279), and recruitment (Glenn et al. 2010, pp.2446-2547). Cold, wet weather may reduce reproduction and/or survival during the breeding season due to declines or decreased activity in small mammal populations so that less food is available during reproduction when metabolic demands are high (Glenn et al. 2011, pp. 1288-1289). Cold, wet nesting seasons may increase the mortality of nestlings due to chilling and reduce the number of young fledged per pair per year (Franklin et al. 2000, p.557, Glenn et al. 2011, p. 1286). Most recently, the relationships between spotted owl populations and climate was complex and variable, but rangewide, Dugger and others (2016, page 98) suggested that survival increased when winters were warmer and drier. This may become a factor in population numbers in the future; given climate change predictions for the Pacific Northwest include warmer, wetter winters.

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

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

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

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

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

Exposure to Toxicants

Toxicants were not identified as a threat when the northern spotted owl was listed, but a growing body of information suggests exposure to anti-coagulant rodenticides, fertilizers, other contaminants, as well as other factors associated with marijuana cultivation represent a growing concern for northern spotted owls. Recent accounts show that the scope and scale of exposure from illegal cultivation is increasing on federal and non-federal ownerships; these threats extend northern spotted owls and many other wildlife species and the resources they depend upon (Thompson et al. 2013, entire, Gabriel et al. 2013, entire; Wengert et al. 2015, p. 8; CDFW 2016 pp. 176-177, CEPA 2017b, p.1; Gabriel et al. 2018, entire; Higley et al. 2017 (abstracts). Known grow sites have been found to intersect with both subspecies of spotted owl ranges throughout California. On Forest Service lands in 2014, more than 620,000 marijuana plants on about 1,500 ac (607 ha) were removed from 167 different sites; about 90 percent of which were in California (US Senate press release 2015). Over 600 trespass grow sites were reported on mixed California ownerships in 2010 (Wengert et al. 2015, p. 8). Increases in mortalities from and exposure to pesticides in fishers in the Sierras and Northern California indicate that toxicants from marijuana cultivation suggest increasing trends (Gabriel et al. 2015, pp. 5-8, 14).

Illegal cultivation is a serious issue in the Klamath Physiographic Province, an area recognized as an important area for northern spotted owl populations (Schumaker et al. 2014). In Southwestern Oregon in Jackson and Josephine Counties alone, a multi-agency Drug Task force reported a total of 100 illegal marijuana cultivation sites containing approximately 294,090 plants between 2005-2014 (Caruthers, R. pers. comm. 2017). Many of these sites were located within known spotted owl home ranges, cores, or nest stands (Clayton, D. pers. comm. 2017).

Known exposure and recent data on impacts to barred owls suggest serious implications for

northern spotted owls. In Hoopa Tribal lands in northwestern California, of 176 barred owls tested for exposure to anticoagulant rodenticides, 65 percent tested positive for one or more second generation ARs; many of these were collected from known spotted owl home ranges (Higley et al. 2017). From another data set in northwestern California, barred owls collected from 37 historical northern spotted owl territories have been tested for ARs (Gabriel et al. 2018, p. 4). In Oregon, 40 percent of barred owls sampled (n=10) tested positive for rodenticides.

Disturbance

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

The effects of noise on spotted owls are largely unknown, and whether noise is a concern has been a controversial issue. The effect of noise on birds is extremely difficult to determine due to the inability of most studies to quantify one or more of the following variables: 1) timing of the disturbance in relation to nesting chronology; 2) type, frequency, and proximity of human disturbance; 3) clutch size; 4) health of individual birds; 5) food supply; and 6) outcome of previous interactions between birds and humans (Knight and Skagan 1988, pp. 355-358). Additional factors that confound the issue of disturbance include the individual bird's tolerance level, ambient sound levels, physical parameters of sound, and how it reacts with topographic characteristics and vegetation, and differences in how species perceive noise.

Information specific to behavioral responses of spotted owls to disturbance is limited, research indicates that recreational activity can cause Mexican spotted owls (*S. o. lucida*) to vacate otherwise suitable habitat (Swarthout and Steidl 2001, p. 314) and helicopter overflights can reduce prey delivery rates to nests (Delaney et al. 1999, p. 70). Additional effects from disturbance, including altered foraging behavior and decreases in nest attendance and reproductive success, have been reported for other raptors (White and Thurow 1985, p. 14; Andersen et al. 1989, p. 296; McGarigal et al. 1991, p. 5).

Although it has not been conclusively demonstrated, it is anticipated that nesting spotted owls may be disturbed by heat and smoke as a result of burning activities during the breeding season.

Conservation Needs of the Spotted Owl

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

Habitat-specific Needs

1. Large blocks of habitat capable of supporting clusters or local population centers of spotted owls (e.g., 15 to 20 breeding pairs) throughout the owl's range;
2. Suitable habitat conditions and spacing between local spotted owl populations throughout its range that facilitate survival and movement;
3. Suitable habitat distributed across a variety of ecological conditions within the northern spotted owl's range to reduce risk of local or widespread extirpation;
4. A coordinated, adaptive management effort to reduce the loss of habitat due to catastrophic wildfire throughout the spotted owl's range, and a monitoring program to clarify whether these risk reduction methods are effective and to determine how owls use habitat treated to reduce fuels; and
5. In areas of significant population decline, sustain the full range of survival and recovery options for this species in light of significant uncertainty.

Habitat-independent Needs

1. A coordinated research and adaptive management effort to better understand and manage competitive interactions between spotted and barred owls; and
2. Monitoring to understand better the risk that WNV and sudden oak death pose to spotted owls and, for WNV, research into methods that may reduce the likelihood or severity of outbreaks in spotted owl populations.

Conservation Strategy to Address Habitat Loss and Fragmentation

Since 1990, various efforts have addressed the conservation needs of the spotted owl and attempted to formulate conservation strategies based upon these needs. These efforts began with the ISC's Conservation Strategy (Thomas et al. 1990); they continued with the designation of critical habitat (USDI FWS 1992b), the Draft Recovery Plan (USDI FWS 1992a), and the Scientific Analysis Team report (Thomas et al. 1993), report of the Forest Ecosystem Management Assessment Team (Thomas and Raphael 1993); and they culminated with the NWFP (USDA FS/USDI BLM 1994a). Recently, the management strategy for portions of Bureau of Land Management lands in Oregon (2.5 million acres) was modified and is no longer following all measures described in the NWFP (USDI BLM 2016, entire and USDI BLM 2016b, entire). In comparison to the NWFP land use allocations, the Late-Successional Reserve (LSR) designs of the revised Resource Management Plans (RMPs) make similar contributions to the development and spacing of the large habitat blocks needed for northern spotted owl conservation. The RMPs includes approximately 177,000 more acres (71,629 ha) of LSR and Riparian Reserves than in the NWFP. These land use allocations represent 36 and 27 percent of the RMP lands, respectively, and will be managed for the retention and development of large trees and complex forests across the RMP landscape (USDI FWS 2016a, Table 1, p. 9). Two additional key provisions differ from previous strategies, including a mitigation that the BLM would participate in, cooperate with, and provide support for an interagency program for barred owl management to implement Recovery Action 30 when the Service determines the best manner in which barred owl management can contribute to the recovery of the northern spotted owl. Also, timber sales that would cause the incidental take of northern spotted owls from timber harvest would not be authorized until implementation of a barred owl management program has begun (USDI BLM 2016, p 19 and USDI BLM 2016b, p. 19). Overall fundamentals of these large-scale conservation strategies have been based upon the reserve

design principles first articulated in the ISC's report, which are summarized as follows:

- Species that are well distributed across their range are less prone to extinction than species confined to small portions of their range.
- Large blocks of habitat, containing multiple pairs of the species, are superior to small blocks of habitat with only one to a few pairs.
- Blocks of habitat that are close together are better than blocks far apart.
- Habitat that occurs in contiguous blocks is better than habitat that is more fragmented.
- Habitat between blocks is more effective as dispersal habitat if it resembles suitable habitat.

Federal Contribution to Recovery
Since it was signed on April 13, 1994, the NWFP has guided the management of Federal forest lands within the range of the spotted owl (USDA FS/USDI BLM 1994a, 1994b). The NWFP was designed to protect large blocks of old growth forest and provide habitat for species that depend on those forests including the spotted owl, as well as to produce a predictable and sustainable level of timber sales. The NWFP included land use allocations which would provide for population clusters of northern spotted owls (i.e., demographic support) and maintain connectivity between population clusters. Certain land use allocations in the plan contribute to supporting population clusters: LSRs, Managed Late-successional Areas, and Congressionally Reserved areas. Riparian Reserves, Adaptive Management Areas, and Administratively Withdrawn areas can provide both demographic support and connectivity/dispersal between the larger blocks, but were not necessarily designed for that purpose. Matrix areas were to support timber production while also retaining biological legacy components important to old-growth obligate species (in 100-acre owl cores, 15 percent late-successional provision, etc. (USDA FS/USDI BLM 1994a, USDI FWS 1994) which would persist into future managed timber stands.

The NWFP with its rangewide system of LSRs was based on work completed by three previous studies (Thomas et. al. 2006): the 1990 Interagency Scientific Committee (ISC) Report (Thomas et. al. 1990), the 1991 report for the Conservation of Late-successional Forests and Aquatic Ecosystems (Johnson et. al. 1991), and the 1993 report of the Scientific Assessment Team (Thomas et. al. 1993).

The Forest Ecosystem Management Assessment Team and the NWFP predicted, based on expert opinion, the spotted owl population would decline in the Matrix land use allocation over time, while the population would stabilize and eventually increase within LSRs as habitat conditions improved over the next 50 to 100 years (Thomas and Raphael 1993, p. II-31; USDA FS/USDI BLM 1994a, 1994b, p. 3&4-229). The results of the first decade of monitoring, Lint (2005, p. 18) did not yield conclusions 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 did not provide any reason to depart from the objective of habitat maintenance and restoration as described in the NWFP (Lint 2005, p. 18; Noon and Blakesley 2006, p. 288). 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.

On June 28, 2011, the Service published the Revised Recovery Plan for the Northern Spotted Owl (USDI FWS 2011b). The recovery plan identifies threats from competition with barred owls, ongoing loss of northern spotted owl habitat as a result of timber harvest, loss or modification of northern spotted owl habitat from uncharacteristic wildfire, and loss of amount and distribution of northern spotted owl habitat as a result of past activities and disturbances (USDI FWS 2011b, p. II-2 and Appendix A). To address these threats, the current recovery strategy identifies five main steps: 1) development of a rangewide habitat modeling framework; 2) barred owl management; 3) monitoring and research; 4) adaptive management; and 5) habitat conservation and active forest restoration (USDI FWS 2011b, p. II-2). The recovery plan lists recovery actions that address each of these items, some of which were retained from the 2008 recovery plan (USDI FWS 2008). The Managed Owl Conservation Areas and Conservation Support Areas recommended in the 2008 recovery plan are not a part of the recovery strategy outlined in the Revised Recovery Plan. The Service completed a rangewide, multi-step habitat modeling process to help evaluate and inform management decisions and critical habitat development (USDI FWS 2011b, Appendix C).

The Revised Recovery Plan recommended implementing a robust monitoring and research program for the spotted owl. The recovery plan encourages these efforts by laying out the following primary elements to evaluate progress toward meeting recovery criteria: monitoring spotted owl population trends, comprehensive barred owl research and monitoring, continued habitat monitoring; inventory of spotted owl distribution, and; explicit consideration for climate change mitigation goals consistent with recovery actions (USDI FWS 2011b, p. II-5). The Revised Recovery Plan also strongly encourages land managers to be aggressive in the implementation of recovery actions, including strategies that include active forest management. In other words, land managers should not be so conservative that, to avoid risk, they forego actions that are necessary to conserve the forest ecosystems that are necessary to the long-term conservation of the spotted owl. But they should also not be so aggressive that they subject spotted owls and their habitat to treatments where the long-term benefits do not clearly outweigh the short-term risks. Finding the appropriate balance to this dichotomy will remain an ongoing challenge for all who are engaged in spotted owl conservation (USDI FWS 2011b, p. II-12). The Revised Recovery Plan estimates that recovery of the spotted owl could be achieved in approximately 30 years (USDI FWS 2011b, p. II-3). The Revised Recovery Plan and the critical habitat designation build on the NWFP and recommends continued implementation of the NWFP and its standards and guides (USDI FWS 2011b, p. I-1).

Spotted Owl Recovery Units

The 2011 Final Revised Recovery Plan for the Northern Spotted Owl determined that the 12 existing physiographic provinces meet the criteria for use as recovery units (USDI FWS 2011b, p. III 1-2). Recovery criteria, as described in the 2011 Final Revised Recovery Plan (p. 11-3), are measurable and achievable goals that are believed to result through implementation of the recovery actions described in the recovery plan. Achievement of the recovery criteria will take time and are intended to be measured over the life of the plan, not on a short-term basis. The criteria are the same for all 12 identified recovery units. The four recovery criterion are: 1) stable population trend, 2) adequate population distribution, 3) continued maintenance and recruitment of northern spotted owl habitat, and 4) post-delisting monitoring (USDI FWS 2011b, p III-3).

The 2011 Revised Recovery Plan for the Northern Spotted Owl (USDI FWS 2011b) contains 14 recovery actions that specifically address northern spotted owl habitat loss and degradation. Two actions of primary importance are recovery actions 10 and 32:

- Recovery Action 10: Conserve northern spotted owl sites and high value northern spotted owl habitat to provide additional demographic support to the northern spotted owl population. This action addresses both nesting/roosting and foraging habitat.
- Recovery Action 32: Because northern spotted owl recovery requires well distributed, older and more structurally complex multi-layered conifer forests on Federal and non-Federal lands across its range, land managers should work with the Service…to maintain and restore such habitat while allowing for other threats, such as fire and insects, to be addressed by restoration management actions. These high-quality northern spotted owl habitat stands are characterized as having large diameter trees, high amounts of canopy cover, and decadence components such as broken-topped live trees, mistletoe, cavities, large snags, and fallen trees. This action addresses nesting/roosting habitat.

Recovery actions 10 and 32 are implemented on reserved areas by the USFS and BLM through the NWFP and the Resource Management Plans (RMPs); these two regulatory actions are discussed in more detail in Section 6. The large reserve network created under the NWFP and RMPs facilitates implementation of recovery actions 10 and 32 by protection of current nesting/roosting and foraging habitat, protection of spotted owl nest sites, and allowing for recruitment of new northern spotted owl habitat. Through the section 7 consultation process, the Service reviews the management activities implemented under the NWFP and RMPs and provides technical assistance to the USFS and BLM in making activities within or outside of reserves consistent with recovery actions 10 and 32 to the extent consistent with other land management priorities. Nesting/roosting and foraging habitat associated with both recovery actions 10 and 32 may decrease in local areas, but over the larger area and time, habitat that is associated with these recovery actions is increasing and will continue to increase under both the NWFP and RMPs.

Conservation Efforts on Non-Federal Lands

Non-Federal lands contributed 3,149,700 ac (1,274,638 ha) to the total 12,103,700 ac (4,898,193 ha) of nesting/roosting habitat available for breeding northern spotted owls in 2012 (Davis et al. 2016, pp. 21-22). There are portions of the range where habitat on Federal lands is lacking or of low quality, or where there is little Federal ownership; State and private lands may be important to provide demographic support (pair or cluster protection) and habitat connectivity for northern spotted owl in key areas such as southwestern Washington, northwestern Oregon (potentially including parts of the Tillamook and Clatsop State Forests), and northeastern California (USDI FWS 2011b, p. III-51). Timber harvest on State and private lands in Washington, Oregon, and California is regulated by each State's forest practice rules. The level of northern spotted owl conservation included in each State's regulations varies. Furthermore, while recovery efforts for the northern spotted owl are primarily focused on Federal land, Recovery actions 14 in the 2011 Revised Recovery Plan centered on seeking partnership with non-Federal landowners to supplement Federal conservation efforts, including voluntary actions like Habitat Conservation Plans (HCPs) and Safe Harbor Agreements (SHAs). There are a total of 21 current conservation plans in these states, including 7 HCPs and 3 SHAs located in Washington, 2 HCPs and 5 SHAs in Oregon, and 2 HCPs and one SHA in California, with an additional SHA occurring in both

Washington and Oregon.

U.S. Fish and Wildlife Habitat Conservation Plans and Safe Harbor Agreements

The purpose of the HCP and SHA process is to provide for the conservation of endangered and threatened species while at the same time authorizing the incidental take of those species. HCPs are required as part of an application for an incidental take permit. They describe the anticipated effects of the proposed taking; how those impacts will be minimized, and mitigated; and how the HCP is to be funded among other things. The Secretary must issue the permit if statutory issuance criteria are met, including that the applicant will minimize and mitigate the effects of the taking to the maximum extent practicable, the taking will not jeopardize the continued existence of the species, and funding to implement the plan is assured. 16 U.S.C. 1539(a)(2)(B). In developing HCPs, people applying for incidental take permits describe measures designed to minimize and mitigate the effects of their actions and receive formal assurances from the Service that if they fulfill the conditions of the HCP, the Service will not require any additional or different management activities by the participants without their consent. SHAs are voluntary agreements between non-Federal property owners and the Service; in exchange for actions that contribute to the recovery of listed species on non-Federal lands, participating property owners may return the enrolled property to the baseline conditions that existed at the beginning of the SHA. Incidental Take Permits that result from both HCPs and SHAs are intended to allow non-Federal entities to undertake actions that incidentally "take" species protected under the Act.

HCPs are not required to have a net benefit and SHAs are designed to have a temporary net gain for northern spotted owls. Under these plans, timber harvest has continued, resulting in the loss of nesting/roosting, foraging, and dispersal habitat; we do not currently have an analysis of habitat loss on lands without conservation plans compared to habitat loss on lands covered by HCPs and SHAs. Although the HCPs do not provide a net conservation benefit to northern spotted owl, they provide mitigation for habitat loss or slow down habitat loss through the required conservation measures. SHAs do provide a net conservation benefit to the northern spotted owl, and both conservation plans eliminate uncertainty with respect to landowners' actions in northern spotted owl habitat, and provide the Service an opportunity to provide technical assistance to landowners in the development of conservation measures included in the agreements. Therefore, in this context, both HCPs and SHAs have contributed to the overall conservation of spotted owls.

In Washington, there are seven northern spotted owl-related HCPs currently in effect covering 2 million ac (80,9371 ha) of non-Federal lands, one of which covers Washington Department of Natural Resources (DNR) lands. These HCPs still allow timber harvest but are designed to retain some nesting habitat and or connectivity over the next few decades. There are four northern spotted owl-related SHAs in Washington, with one including some lands in Oregon. The primary intent of SHAs is to maintain or create potential northern spotted owl habitat. In addition, there is a long term habitat management agreement covering 13,000 ac (5,261 ha) in which authorization of take was provided through an incidental take statement (section 7) associated with a Federal land exchange (USDI FWS 2011b, p. A-15). While timber harvest and habitat loss continues on lands covered by these agreements, the plans retain some nesting/roosting habitat throughout the area or in strategic locations, and provide habitat connectivity. Overall, HCPs, and SHAs in Washington provide some protection to northern spotted owls and their habitat. However, nesting/roosting and foraging habitat continue to decline due to timber harvest on non-Federal lands in Washington.

In Oregon, there are two northern spotted owl-related HCPs currently in effect covering 210,400 ac (85,146 ha) of non-Federal lands. These HCPs still allow timber harvest but are designed to retain some nesting habitat and or connectivity over the next few decades. There are two northern spotted owl-related SHAs occurring in Oregon. One SHA is a Washington SHA that covered some Oregon lands. The other SHA is a programmatic SHA with the Oregon Department of Forestry with 13 landowners with 3,484 acres enrolled. The primary intent of SHAs is to maintain or create potential northern spotted owl habitat. Strategies employed in the programmatic Oregon Department of Forestry SHA include, maintaining existing suitable habitat, increase time between harvests to allow for habitat development, and to lightly to moderately thin younger forestry stands that are currently not habitat (to increase tree diameter and stand diversity) (USDI FWS 2011b, p. A-16). There are 4 additional SHAs in Oregon related to the Barred Owl Removal Experiment explained below in the barred owl section. While timber harvest and habitat loss continue on lands covered by these HCPs and SHAs in Oregon, the plans retain some nesting/roosting habitat throughout the area or in strategic locations, and provide habitat connectivity. Overall, HCPs, and SHAs in Oregon provide some protection to northern spotted owls and their habitat. However, nesting/roosting and foraging habitat continue to decline due to timber harvest on non-Federal lands in Oregon.

In California, there are two northern spotted owl-related HCPs currently in effect covering 211,765 ac (85,698ha) of non-Federal lands. These HCPs still allow timber harvest but are designed to retain some nesting habitat and or connectivity over the next few decades. There is one northern spotted owl-related SHA in California. The primary intent of SHAs is to maintain or create potential northern spotted owl habitat. While timber harvest and habitat loss continues on lands covered by these agreements, the plans retain some nesting/roosting habitat throughout the area or in strategic locations, and provide habitat connectivity. Overall, HCPs, and SHAs in California provide some protection to northern spotted owls and their habitat. However, nesting/roosting and foraging habitat continue to decline due to timber harvest on non-Federal lands in California.

State Forest Practice Rules

The majority of northern spotted owl conservation is expected from Federal lands, but 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. Timber harvest on State and private lands in Washington, Oregon, and California is regulated by each State's forest practice rules. The level of northern spotted owl conservation included in each State's regulations varies Each State's rules are described below.

Washington

The northern spotted owl was listed as endangered species in Washington State by the Washington Fish and Wildlife Commission in 1988 to prioritize conservation for the subspecies (WDFW 2017). Timber harvest on State and private lands in Washington is guided by a number of State laws and policies, except for Washington Department of Natural Resources (WDNR) lands that are covered by an HCP. The Washington State Environmental Policy Act (SEPA) requires analysis of environmental impacts and consideration of reasonable alternatives for actions proposed by the State. State timber harvest activities must also comply with the State

Forest Practices Act (Chapter 76.09 RCW), which regulates all forest management activities in Washington. The management of State trust lands, specifically, is guided by the Forest Resource Plan, which was adopted by the Board of Natural Resources in 1992. Among other things, the policies of the Plan require the Washington DNR analyze and potentially modify the impacts of its activities on watersheds, wildlife habitat, special ecological features, wetlands, and other natural resources to maintain healthy forests for future generations.

In 1996, the State Forest Practices Board adopted rules (Washington Forest Practices Board 1996) that would contribute to conserving the northern spotted owl and its habitats 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 northern spotted owl conservation (Hanson et al. 1993, pp. 11-15; Buchanan et al. 1994, p. ii). The 1996 rule package was developed by a stakeholder policy group and then reviewed and approved by the Forest Practices Board (Buchanan and Swedeen 2005, p. 9). The 1996 rules identified 10 landscapes, or Spotted Owl Special Emphasis Areas (SOSEAs) where owl protections on non-Federal lands would be emphasized. Protections provided under the State Environmental Policy Act for those portions of owl sites located beyond the boundaries of the SOSEAs were largely eliminated (Buchanan and Swedeen 2005, p. 7). The overarching policy goal of the Washington Forest Practices Rules is to complement the conservation strategy on Federal lands, and as such the SOSEAs are adjacent to Federal lands. The SOSEAs are designed to provide a larger landscape for demographic and dispersal support for northern spotted owls with the long-term goal of supporting a viable population of northern spotted owls in Washington.

The Forest Practices Rules for northern spotted owls can be described as containing three basic types of provisions: 1) regulations that apply outside SOSEAs, 2) a circle-based protection scheme for northern spotted owl sites inside SOSEAs (retain all suitable habitat within 0.7 mi (1 km) of site center and retain 40 percent of suitable habitat within 1.8 to 2.7 mi (2.9 to 4.3 km) radius of home range), and 3) landscape-level planning options for inside SOSEAs. To avoid disturbance of nesting northern spotted owls inside SOSEAs, the rules also include timing restrictions from March 1 to August 31 within 0.25 miles of a site center for several potentially disruptive activities (e.g., road construction). Forest practices rules outside the SOSEAs are designed to protect the immediate vicinity of northern spotted owl site centers during the nesting season (March 1 to August 31) by restricting harvest within the best 70 ac (28 ha) of habitat around the site center and requiring additional environmental analysis for permitting (of harvesting, road construction, or aerial application of pesticides), but outside the nesting season there are no owl-related protections outside SOSEAs that constrain harvest of suitable northern spotted owl habitat in spotted owl management circles (Buchanan and Swedeen 2005, p. 14).

Within SOSEAs, the rules were intended to maintain the viability of each northern spotted owl site center by establishing that enough suitable habitat should be maintained to protect the viability of owls associated with each northern spotted owl site center, or to provide for the goals established in Spotted Owl Special Emphasis Areas. Due to extensive timber harvest activities in the decades leading up to listing of the northern spotted owl, most northern spotted owl management circles centered on non-Federal lands have far less habitat than the viability threshold identified (see below) when the rule went into effect. Because the rules do not include provisions for restoration of habitat to achieve the viability threshold at northern spotted owl sites these circles remain far below those thresholds. For individual site centers, the habitat

considered necessary to maintain viability is as follows: (a) all suitable northern spotted owl habitat within 0.7 mi (1.1 km) of each northern spotted owl site center; (b) at least 5,863 ac (2,373 ha) of suitable northern spotted owl habitat within of 2.7 mi (4.3 km) of a site center in the Hoh-Clearwater Spotted Owl Special Emphasis Area on the western Olympic Peninsula, and (c) at least 2,605 ac (1,054 ha) of suitable northern spotted owl habitat within 1.8 mi (2.9 km) of a site center in all other Spotted Owl Special Emphasis Areas. At all sites within SOSEAs, any proposed harvest of suitable northern spotted owl habitat within a territorial owl circle (status 1, 2, or 3 in the Washington Department of Fish and Wildlife database) would be considered a "Class-IV special" and would trigger State Environmental Policy Act review; such activities would require a Class IV special forest practices permit and an environmental impact statement per the State Environmental Policy Act (Buchanan and Swedeen 2005, p. 15-16).

The Forest Practices Board in Washington has a long-standing relationship with the Service and collaborates extensively on owl conservation. The Service provided extensive technical assistance in the development of the Board's existing owl rules. The Board was recognized in the Revised Recovery Plan for the Northern Spotted Owl (USDI FWS 2011b) for its ongoing owl conservation efforts in Recovery Action 18 encouraged to continue to use its existing processes "to identify areas on non-Federal lands in Washington that can make strategic contributions to northern spotted owl conservation over time. The Service encourages timely completion of the Board's efforts and will be available to assist as necessary." The Board convened the Northern Spotted Owl Implementation Team (NSOIT) in 2010 to develop incentives for landowners to achieve conservation goals for northern spotted owls and to identify the temporal and spatial allocation of conservation efforts on non-Federal lands; a draft product is due to be completed in 2017. The NSOIT conducted a pilot project testing different thinning prescriptions in northern spotted owl habitat but the project has since been discontinued. These efforts underway have evolved over years of collaboration and are designed to change the dynamic away from fear and resistance to partnership and participation. The Service has and is providing funding to support the work of the NSOIT. Overall, State forest practice rules in Washington provide some protection to northern spotted owls and their habitat. However, nesting/roosting and foraging habitat continue to decline due to timber harvest on non-Federal lands in Washington.

Oregon

The northern spotted owl is listed as a threatened species in Oregon (ODFW 2017). The Oregon Fish and Wildlife Commission's long-term goal for species listed as threatened or endangered under the Oregon Endangered Species Act is to manage the species and their habitats so that the status of the species improves to a point where listing is no longer necessary. Timber harvest on non-Federal lands in Oregon is guided by the Forest Practices Act and Forest Practices Rules (ODF 2014). The Oregon Forest Practices Act restricts timber harvest within 70 ac (28 ha) core areas around sites occupied by an adult pair of northern spotted owls capable of breeding (as determined by recent protocol surveys), but it does not provide for protection of northern spotted owl habitat beyond these areas (ODF 2014, pp. 61-62). In general, no large-scale northern spotted owl habitat protection strategy or mechanism currently exists for non-Federal lands in Oregon.

State forests in particular are managed to achieve "greatest permanent value," considering economics, environmental, and cultural goals. Each State Forest has a Forest Management Plan

that seeks to implement these ideals. Ultimately, the State's goal is to produce timber revenue and also provide for a range of habitats across ownerships. Specific policies and procedures have been adopted on State lands to protect and conserve the northern spotted owl and its habitat. The State Forests Division has an extensive survey program across all districts as part of annual harvest planning (approximately $1.4 million spent in 2016) and conducts density surveys on two districts. Division policy directs districts to avoid any harvest activity on State lands which results in less than 40% suitable habitat within the provincial home range of an owl or pair (a 1.2 – 1.5-mi (1.9- 2.4 km) radius circle centered on a nest site or activity center). Division policy also directs districts to avoid any harvest activity which results in less than 500 ac (202 ha) of suitable habitat within a 0.7-mi (1.1 km) radius (1000 ac (405 ha)) of a nest site or activity center. In addition, 30 percent of Oregon State forests must be managed for the development of "complex forest structure" and late-seral tree species, which could provide some level of conservation benefit for a number of wildlife species of concern, including the northern spotted owl (IEc 2012). Thirty percent of Oregon State forests must be managed for "complex forest structures" and late seral tree species, for the benefit of a number of wildlife species. The locations of these managed lands are based in part on locations of northern spotted owl nest sites. Within these areas, a variety of treatments are employed to promote complex habitat and species diversity. Overall, State forest practice rules in Oregon provide some protection to northern spotted owls and their habitat. However, nesting/roosting and foraging habitat continue to decline due to timber harvest on non-Federal lands in Oregon.

California

The northern spotted owl was listed as an endangered species under the California Endangered Species Act (CESA) in early 2016 (CDFW 2017). The incidental take of state-listed species is prohibited under the California Code of Regulations (783-783.8 and the California Fish and Game Code 2080 (CDFW 2016), unless permitted by an HCP. Forest management and forest practices on private lands in California, including harvesting for forest products or converting land to another use are regulated by the State under Division 4 of the Public Resources Code, and in accordance with the California Forest Practice Rules (CFPR)(California Code of Regulations, (CCR) Title 14, Sections 895-1115; CFPR)(CFPR 2017). The CFPR require surveys for northern spotted owls in nesting/roosting and foraging habitat and restrict timber harvest within 0.7–1.3 mi (1-2 km) of a northern spotted owl activity center. Under this framework, the California Department of Forestry and Fire Protection (CALFIRE) is the designated authority on forest management and forest practices on private lands in California.

All private land timber harvesting in California must be conducted in accordance with a site-specific Timber Harvest Plan (THP, for industrial timberlands) or Nonindustrial Timber Management Plan (NTMP, for non-industrial private timberland owners) that is submitted by the owner and is subject to administrative approval by the CALFIRE. The THP/NTMP must be prepared by a State-registered professional forester, and must contain site-specific details on the quantity of timber involved, where and how it will be harvested, and the steps that will be taken to mitigate potential environmental damage. The THP/NTMP and CALFIRE's review process are recognized as the functional equivalent to the environmental review processes required under the California Environmental Quality Act of 1970 (CEQA). The CFPRs require surveys for northern spotted owls in suitable habitat and to provide protection around activity centers. Under the CFPRs, no THP or NTMP 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.

For private timber lands in California not covered by a HCP or SHA, the policy of the State with regard to the northern spotted owl and timber harvest can be characterized as one of "take avoidance," for which the Service (Arcata and Yreka Fish and Wildlife Offices) has recommended measures to avoid take of northern spotted owls, primarily through recommendations for habitat retention, timing of timber operations and survey procedures for northern spotted owls (described briefly below). The Director of CALFIRE is not authorized to approve any proposed THP or NTMP that would result in take of a federally-listed species, including the northern spotted owl, unless that taking is authorized under a Federal Incidental Take Permit (review process is outlined in 14 CCR 919.9 and 919.10). This latter point creates an incentive for private landowners to enter into HCPs or SHAs, or to implement take avoidance measures recommended by the USFWS.

Prior to 2000, the California Department of Fish and Wildlife (then, California Department of Fish and Game; CDFW) reviewed THPs and NTMPs to ensure that take of northern spotted owls was not likely to occur. From about 2000 until 2010, the Service assumed this role and reviewed THPs and NTMPs (hundreds per year) for northern spotted owl "take avoidance." From 2010, the Service and CALFIRE shared duties for northern spotted owl take avoidance review of THPs and NTMPs. Beginning in 2014, the northern spotted owl was listed as a candidate species for potential listing under the California Endangered Species Act; consequently, in 2014, CDFW began reviewing a small number of THPs and NTMPs annually for northern spotted owl take avoidance. On August 25, 2016, the California Fish and Game Commission recommended that the northern spotted owl be added to the State list of threatened and endangered animals. Regarding timber harvest on private lands in California after 2016, the Service, CALFIRE and CDFW have not formally discussed how the agencies will share reviewing duties for northern spotted owl take avoidance associated with THPs and NTMPs, but recommended habitat retention standards (i.e., Attachments A and B) and survey recommendations remain in effect. California is currently engaged in discussions with the Service addressing northern spotted owl use of post-fire landscapes currently lacking in the California Forest Practice Rules.

For timber harvest activities that occur on non-Federal lands (excluding California State Parks and lands covered under a HCP) within CAL FIRE's Coast Forest District (generally, within the range of the coast redwood), the Service (Arcata Fish and Wildlife Office) provided to CAL FIRE and foresters a document titled, Northern Spotted Owl Take Avoidance Analysis and Guidance for California Coast Forest District ("Attachment A"), dated March 15, 2011. In general, recommended habitat retention guidelines around known active northern spotted owl activity centers in include: (1) delineation of a 100 ac (40 ha) "Core Area" comprised of "nesting/roosting" habitat (defined in Attachment A), in which timber harvest does not occur; (2) retention of at least an additional 100 ac (40 ha) of "nesting/roosting" habitat within 0.7 mi (1.1 km) of an activity center; and (3) retention of at least 300 ac (121 ha) of "foraging" habitat (defined in Attachment A) within 0.7 mi (1.1 km) of an activity center.

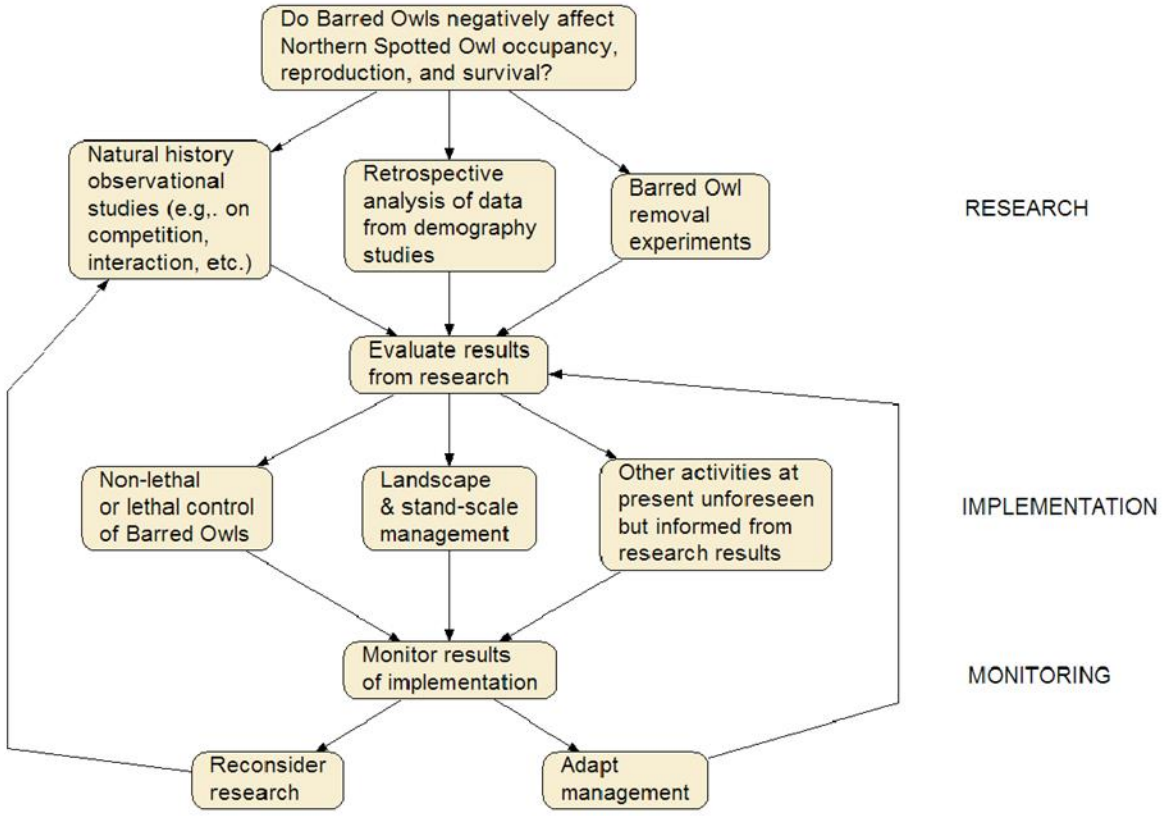
For timber harvest activities that occur on non-Federal lands within CAL FIRE's Interior Forest District, the Service (Arcata and Yreka Fish and Wildlife Offices) provided to CAL FIRE and foresters a document titled, Attachment B: Take Avoidance Analysis-Interior, dated February 27, 2008. In general, recommended habitat retention guidelines around known active northern spotted owl activity centers in include: (1) no harvest within 1,000 ft (305 m) of an activity center; (2) within 0.5 mi (0.8 km) radius (502 ac (203 ha) of an activity center, retention of four

habitat types (as defined in Attachment B), including at least 100 ac (40 ha) "high quality nesting/roosting" habitat, 150 ac (61 ha) of "nesting/roosting" habitat, 100 ac (40 ha) of "foraging" habitat and 50 ac (20 ha) "low-quality foraging habitat"; and (3) between 0.5 mi (0.8 km) and 1.3 mi (2 km) radius circles on an activity center (2896 ac (1172 ha)), retention of greater than 935 ac (378 ha) of habitat, including at least 655 ac (265 ha) foraging habitat and at least 280 ac (113 ha) low-quality foraging habitat. Overall, State forest practice rules in California provide some protection to northern spotted owls and their habitat. However, nesting/roosting and foraging habitat continue to decline due to timber harvest on non-Federal lands in California.

Conservation Measures to Address Barred Owls

The 2011 Revised Recovery Plan for the Northern Spotted Owl contains ten recovery actions specific to addressing the barred owl threat. These include the establishment of protocols to detect barred owls and document barred owl site status and reproduction (Recovery Action 24), and the design and implementation of large-scale control experiments to assess effects of barred owl removal on spotted owl site occupancy, reproduction, and survival (Recovery Action 29). The manner in which this set of ten Recovery Actions is expected to contribute to northern spotted owl recovery is presented in Figure A-2.

Figure A-2. Flowchart of barred owl Recovery Actions (USDI FWS 2011b, p. III-66, Figure III-1).



Several barred owl recovery actions have been completed, and recovery Action 29 is currently ongoing. The Barred Owl Removal Experiment (USDI FWS 2013 and 78 FR 57171) was developed based on a pilot project at Green Diamond Resources study area that demonstrated barred owl removal had rapid, positive effects on northern spotted owl survival and the rate of population change (Dugger et al. (2016, p. 58). This experiment is currently being implemented under the direction of USGS, the Hoopa Tribe, and APHIS in partnership with the Service. The research program is evaluating the effectiveness of barred owl removal as a potential recovery strategy for northern spotted owls on one study area in Washington, two study areas in Oregon, and one study area in northern California. Barred owl removal was implemented on the California study area in fall/winter 2013-2014, and on the Washington and one of the Oregon study areas in fall/winter 2015-2016. Barred owl removal on the final Oregon study area was initiated in fall of 2016. Removal was scheduled to occur for a minimum of four consecutive years at each study area, but could be extended if spotted owl population results from the initial removal are not definitive.

Under the BLM RMPs, the BLM will support barred owl management on their lands as informed by the outcome of the Barred Owl Removal Experiment. In the interim, the BLM is avoiding incidental take of northern spotted owls resulting from timber harvest on their lands. This support is intended to mitigate for the adverse effects associated with timber harvest and other resource programs, and result in a net positive impact on the recovery of northern spotted owls (USDI FWS 2016a, p. 701).

Results from this experiment will provide future management guidance for the recovery of the northern spotted owl. Annual reports on study progress are provided each year, and a final report is anticipated in 2022. While results of the this experiment are not yet fully analyzed, removal has resulted in a substantial increase in the apparent survival of spotted owls on the Hoopa Reservation in California, the longest running of the study areas in the experiment, improving by nearly 10 percent over the apparent survival for the 5 years prior to the initiation of removal (Carlson et. al. 2019, p 9). On the three study areas in Oregon and Washington, the occupancy of spotted owl sites continues to decline on the control areas where no barred owls are removed, but appears to have stabilized or increased slightly on the treatment areas where barred owls are removed. However, the number of spotted owls on these areas is very low. Statistical analysis has not been completed on these areas yet (Wiens et. al. 2019, pp 12-13).

Safe Harbor Agreements in Oregon for Barred Owl Experiment

There are currently four SHAs specific to the Service's ongoing Barred Owl Removal Experiment in Oregon. The SHAs were limited to areas managed by landowners that were willing to work with the Service to provide access for survey and removal of barred owls on their lands within the study areas. Agreements were established with Roseburg Resources Company, Oxbow I LLC, Weyerhaeuser Company, and Oregon Department of Forestry to facilitate successful completion of this research project. The Barred Owl Removal Experiment implements Recovery Action 29 of the 2011 Revised Recovery Plan for the Northern Spotted Owl (USDI FWS 2011b, p. III-65). The Barred Owl Removal Experiment is being implemented on two study areas in Oregon, one in the Oregon Coast Ranges west of Eugene, Oregon, and one in the forest lands around Canyonville, Oregon. While the experiment is focused on Federal lands, the landscapes involved in the study areas include significant interspersed private and state

lands. In the Oregon Coast Ranges study area, this includes lands owned by Roseburg Resources Company and Oxbow Timber I, LLC (SHA covers 9,400 ac (3,804 ha) of land total, 308 ac (125 ha) of currently unoccupied northern spotted owl habitat for which an incidental take permit was issued); Weyerhaeuser Company (SHA covers 1,072 ac (434 ha) total, 817 ac (331 ha) of currently unoccupied northern spotted owl habitat for which an incidental take permit was issued), and lands managed by Oregon Department of Forestry (SHA covers 20,000 ac (8,093 ha) total, 3,345 ac (1,354 ha) of currently unoccupied northern spotted owl habitat for which an incidental take permit was issued). In the Union/Myrtle (Klamath) study area in southern Oregon, this includes lands owned by Roseburg Resources Company (SHA covers 45,100 ac (18,251 ha) of land total, 7,080 ac (2865 ha) of currently unoccupied northern spotted owl habitat for which an incidental take permit was issued). Access on these non-Federal lands is important to the effective and efficient completion of the experiment.

Through these four SHAs, Roseburg Resources Company, Oxbow I LLC, Weyerhaeuser Company, and Oregon Department of Forestry will contribute to the conservation of the northern spotted owl by allowing the researchers to survey for barred owls on their lands throughout the Study Area, and remove barred owls from their lands within the removal portion of the experiment. The section 10 permit issued to them as part of the SHA provides these landowners with short-term incidental take authorization through habitat modification for spotted owls that may return to non-baseline northern spotted owl sites (unoccupied by resident spotted owls for the three years prior to the initiation of removal on the area) after the removal of barred owls. However, this information and access is crucial to efficient and effective implementation of this experiment. Information from this experiment is critical to the development of a long-term management strategy to address the barred owl threat to the northern spotted owl.

Rangewide Environmental Baseline

The environmental baseline of the species incorporates the effects of all past human activities and natural events that led to the present-day status of the species and its habitat, including all previously consulted on effects (USDI FWS/USDC NMFS 1998, pp. 4-19).

Habitat Trends

The Service has used information provided by the USFS, BLM, and National Park Service to update the habitat baseline conditions by tracking relative habitat changes over time on Federal lands for northern spotted owls on several occasions, since the northern spotted owl was listed in 1990 (USDA FS/USDI BLM 1994b, USDI FWS 2001, Lint 2005, Davis et al. 2011, Davis et al. 2016). These NWFP monitoring reports assess the status and trends of spotted owl habitat across 22.1 million acres of federally administered forest lands in addition to 23.8 million acres of nonfederal forest lands within the range in the United States. The estimate of 7.4 million acres used for the NWFP in 1994 (USDA FS/USDI BLM 1994b) was believed to be representative of the general amount of northern spotted owl habitat on NWFP lands at that time. These periodic rangewide evaluations of northern spotted owl habitat (Lint 2005, Davis et al. 2011, Davis et al. 2016) are used to determine if the rate of potential change to northern spotted owl habitat has been consistent with changes in amount of habitat anticipated under the NWFP and described in the Final Supplemental Environmental Impact Statement (FSEIS; USFS and USDI 1994b). Each analysis has used more up-to-date and higher quality data than the previous analyses and new analytical methods have been incorporated over time. While this improved the overall quality of the information provided, it also means that individual reports should not be compared

directly without fully understanding the processes used to develop the results.

Trends for suitable habitat are largely declining rangewide, with rates of loss varying by province and land allocation. Approximately 9,089,700 acres of spotted owl nesting/roosting habitat existed on Federal lands and 3,436,000 acres existed on non-federal lands at the beginning of the NWFP in 1994/1996 Davis and others (2016, pp.23-24). Two decades into the NWFP, Davis and others (2016, tables 6 and 7, pp. 21-22) reported a gross loss of about 650,200 acres of nesting/roosting habitat, representing about 7.2 percent of what was present in 1994/1996. Most of the losses (73 percent) occurred within the federally reserved LUAs, or a loss of about 7.5 percent of the habitat reserved by the NWFP; the majority of these losses were due to high severity fires within the Klamath Physiographic Provinces.

Some recruitment of nesting/roosting habitat was noted (Davis et al. 2016, p. 24). The recruitment of habitat in non-reserved areas led to a net increase in nesting/roosting habitat of 4.3 percent since 1993. Most of the gains occurred in the moister physiographic provinces (e.g., Coast Ranges and Western Cascades) however, there was also a large gain (13.5 percent) in the Oregon Eastern Cascades. Authors noted that habitat recruitment estimates have a higher level of uncertainty than estimates of habitat loss for reasons detailed in the NWFP 15-year monitoring report (Davis et al. 2011, pgs. 48 and 49). Although the spatial resolution of this new habitat map currently makes it unsuitable for tracking habitat effects at the scale of individual projects, the Service has evaluated the map for use in tracking provincial and rangewide habitat trends and now considers these data as the best available information on the distribution and abundance of extant spotted owl habitat within its range as of 2012 for Oregon and Washington, and California, when the base imagery was collected.

The Service also considers habitat effects that are documented through the section 7 consultation process since 1994. The analytical framework of these consultations focuses on the reserve and connectivity goals established by the NWFP land-use allocations (USDA FS/USDI BLM 1994a), with effects expressed in terms of changes in suitable northern spotted owl habitat within those land-use allocations.

In February 2013, the Service adopted the 2006/07 satellite imagery data on spotted owl habitat as the new rangewide habitat baseline for Federal lands which effectively resets the timeframe for establishing changes in the distribution and abundance of spotted owl habitat. These data were refreshed in May of 2017 to reflect the 2012 remotely-sensed layer utilized in Davis et al., 2016. Until these data are refreshed, the assessment of local, provincial and rangewide spotted owl habitat status in this and future Opinions as well as Biological Assessments will rely on these habitat data associated with 2012 imagery to characterize changes in the status of spotted owl habitat.

Service's Consultation Database

To update information considered in 2001 (USDI FWS 2001), the Service designed the Consultation Effects Tracking System database in 2002, which recorded impacts to northern spotted owls and their habitat at different spatial and temporal scales. In 2011, the Service replaced the Consultation Effects Tracking System with the Consulted on Effects Database located in the Service's Environmental Conservation Online System (ECOS). The ECOS Database corrected technical issues with the Consultation Effects Tracking System. Data are currently entered into the ECOS Database under various categories including; land management

agency, land-use allocation, physiographic province, and type of habitat affected.

Rangewide Consultation Effects: 1994 to October 9, 2019

Between 1994 and October 9, 2019, the Service has consulted on the proposed removal/downgrade of approximately 227,672 acres of federal nesting/roosting habitats (Table A-1) or about 2.4 percent of the 9.09 million acres of northern spotted owl nesting/roosting habitat estimated by Davis et al. (2016, p. 21) to have occurred on Federal lands in 1994. These changes in suitable northern spotted owl habitat are consistent with the expectations for implementation of the NWFP, which anticipated a rate of habitat harvested at 2.5 percent per decade (USDA FS/USDI BLM 1994a).

The Service also tracks habitat changes on non-NWFP lands through consultations including long-term Habitat Conservation Plans, Safe Harbor Agreements, or Tribal Forest Management Plans. Consultations conducted since 1994 have documented the eventual combined reduction of about 523,079 acres of habitat on non-NWFP lands. Most of the losses on non-NWFP lands have yet to be realized because they are part of long-term management plans.

In 2017, the Service updated the nesting /roosting habitat baseline which impacts are evaluated against, based on the 2012 habitat layer documented in Davis et al. (2016, p. 21) which is the most current evaluation of spotted owl habitat. The acre values for the Service's 2012 baseline in Table A-2 varies slightly from the acre values in Davis et al. (2016, p. 21), with the total acre variation being 0.09 percent. Davis et al. (2016, p. 21) rounded to the nearest 100 acres, but this does not explain all the variation. In 2016, the BLM in Oregon changed their land use allocations. Therefore, the 2012 base habitat layer was divided by different land use allocations representing reserves and non-reserved lands than was used to produce Davis et al. (2016, p. 21). Due to raster data (2012 habitat layer) overlaid on polygons (land use allocations representing reserves and non-reserved lands) there is some error in the identification of acres. The use of a different polygon layer, than used for the Davis et al. (2016, p. 21) land use allocations, resulted in different physiographic province reserves and non-reserved lands habitat acres. The combination of errors is extremely small and is still the best available information to use. This highlights that this data is to be used at a landscape level and may not be appropriate at the finer local scale. Since 2012, the acres reported as removed/downgraded are summarized by origin and by province (Table A-2).

Table A-1: Spotted owl Take/Effect Reports Table A - Rangewide summary of effects to northern spotted owl nesting/roosting habitat[1] (acres) documented through ESA section 7 consultations or technical assistance reports; 1994 to Present.

Wed Oct 09 14:32:32 MDT 2019

Land Ownership	Consulted On Habitat Changes[2]		Other Habitat Changes[3]	
	Removed/ Downgraded	Maintained/ Improved	Removed/ Downgraded	Maintained/ Improved
USFS, BLM, and NPS	227,672	657,640	406,912	144,730
Bureau of Indian Affairs / Tribes	114,574	28,372	2,398	0
Habitat Conservation Plans/Safe Harbor Agreements	339,692	14,539	N/A	N/A
Other Federal, State, County, Private Lands	68,813	28,447	2,607	0
Total Changes	**750,751**	**728,998**	**411,917**	**144,730**

Notes:

1. Northern spotted owl suitable habitat includes nesting/roosting habitat, and foraging habitat. Nesting/roosting habitat supports all life-history functions for spotted owls including foraging, and is sometimes referred to as nesting, roosting, and foraging habitat (NRF). Foraging-only habitat is a separate category that can include more open and fragmented forests, and does not provide structures for nesting/roosting. Habitat effects summarized in this table are all classified as impacts to nesting/roosting habitats. Impacts to foraging-only habitat are tracked separately.
2. Includes effects documented through ESA section 7 consultations for the period from 1994 to 6/26/2001 (USFWS 2001) and all subsequent effects reported in the USFWS Tracking and Integrated Logging System - Northern Spotted Owl Consultation Effects Database (web application and database).
3. Includes effects to spotted owl nesting/roosting habitat documented through technical assistance reports resulting from wildfires and other natural causes, private timber harvest, and/or land exchanges not associated with ESA section 7 consultations.

Table A-2. Spotted owl Take/Effect Reports Table B - Summary of northern spotted owl nesting/roosting[1] habitat (acres) removed or downgraded as documented through ESA section 7 consultations on Federal lands. Environmental baseline and summary of effects by state, province, and land use function from 2012 to present.

Wed Oct 09 14:33:06 MDT 2019

State	Physiographic Province[2]	Evaluation Baseline (2012)[3]			Nesting/Roosting Habitat Removed/Downgraded[4]							% Provincial Baseline Affected	% Range-wide Effects
					Land Management Effects			Habitat Loss from Natural Events			Total NR removed/ downgraded		
		NR Acres in Reserves	NR Acres in Non-Reserves	Total NR Acres	Reserves[5]	Non-Reserves[6]	Total	Reserves	Non-Reserves	Total			
WA	Eastern Cascades	554,786	224,876	779,662	1,563	55	1,618	63,931	0	63,931	65,549	8.41	29.81
	Olympic Peninsula	714,555	23,084	737,639	1	0	1	0	0	0	1	0	0
	Western Cascades	957,314	212,325	1,169,639	15	188	203	0	0	0	203	0.02	0.09
	Western Lowlands	12,964	3	12,967	0	0	0	0	0	0	0	0	0
OR	Cascades East	206,719	133,080	339,799	893	2,186	3,079	2,159	1,528	3,687	6,766	1.99	3.08
	Cascades West	1,425,026	949,045	2,374,071	750	9,936	10,686	13,129	3,384	16,513	27,199	1.15	12.37
	Coast Range	468,575	38,898	507,473	986	1,712	2,698	0	0	0	2,698	0.53	1.23
	Klamath Mountains	706,840	227,726	934,566	4,885	9,112	13,997	21,520	23,055	44,575	58,572	6.27	26.64
	Willamette Valley	3,688	3,938	7,626	0	0	0	0	0	0	0	0	0
CA	Cascades	120,067	89,316	209,383	0	174	174	0	0	0	174	0.08	0.08
	Coast	113,857	9,999	123,856	0	0	0	0	2,205	2,205	2,205	1.78	1
	Klamath	1,143,050	622,027	1,765,077	387	630	1,017	15,528	39,973	55,501	56,518	3.2	25.7
Total		**6,427,441**	**2,534,317**	**8,961,758**	**9,480**	**23,993**	**33,473**	**116,267**	**70,145**	**186,412**	**219,885**	**2.45**	**100**

Notes:

1. Northern spotted owl suitable habitat includes nesting/roosting habitat, and foraging habitat. Nesting/roosting habitat supports all life-history functions for spotted owls including foraging, and is sometimes referred to as nesting, roosting, and foraging habitat (NRF). Foraging-only habitat is a separate category that can include more open and fragmented forests, and does not provide structures for nesting/roosting. Habitat effects summarized in this table are all classified as impacts to nesting/roosting habitat. Impacts to foraging-only habitat are tracked separately.
2. Defined in the Revised Recovery Plan for the Northern Spotted Owl (USFWS 2011) as Recovery Units as depicted on page A-3.
3. Spotted owl nesting/roosting (NR) habitat on Federal lands (includes USFS, BLM, NPS, DoD, USFWS) based on GIS data developed for the Northwest Forest Plan 20-year monitoring report for northern spotted owl habitat as reported by Davis et al. 2016 (PNW-GTR-929). Nesting/roosting habitat acres are approximate values based on 2012 satellite imagery. Values reported here may vary slightly from values reported in PNW-GTR-929.
4. Estimated nesting/roosting habitat removed or downgraded from land management (e.g., timber sales) or natural events (e.g., wildfires) as documented through section 7 consultation or technical assistance. Effects reported here include acres removed or downgraded from 2012 to present.

5. Reserve land use allocations intended to provide spotted owl demographic support include Late-Successional Reserves identified in the Northwest Forest Plan on National Forests, designated Wilderness, and other Congressionally-reserved lands. Reserves on BLM lands in western Oregon managed under the 2016 revised Land and Resource Management Plans include Late-Successional Reserves, Congressionally-reserved lands, National Landscape Conservation System lands, and some District Designated Reserves (e.g., Areas of Critical Environmental Concern).
6. Non-reserve lands intended to provide spotted owl dispersal connectivity between reserves include USFS and BLM designations for timber production (matrix and harvest land base designations), Adaptive Management Areas, and other non-reserved land use designations.

Recently, the Service modified the database input to account for effects to the habitats that could be used as foraging, but that lack the age or structural characteristics of habitats used for nesting and roosting (NR). This distinction may not be made in all consultations. These data represent effects as reported in individual consultations and likely do not represent the entirety of impacts to foraging habitat within critical habitat since 2012. For many projects, affected foraging likely is captured within the “NR” acres as foraging habitat was lumped into “nesting/roosting/foraging habitat” at the time of consultation. Table A-3 summarizes the acres of foraging habitat removed or downgraded.

Table A-3. Spotted owl Take/Effect Reports Table B2 - Summary of northern spotted owl foraging habitat[1] (acres) removed or downgraded as documented through ESA section 7 consultations on Federal lands. Summary of effects by state, province, and land use function from 2012 to present.

Wed Oct 09 14:33:33 MDT 2019

State	Physiographic Province[2]	Foraging Habitat Removed/Downgraded[3]						
		Land Management Effects			Habitat Loss from Natural Events			Total Foraging Habitat removed/ downgraded
		Reserves[4]	Non-Reserves[5]	Total	Reserves	Non-Reserves	Total	
WA	Eastern Cascades	0	0	0	0	0	0	0
	Olympic Peninsula	0	0	0	0	0	0	0
	Western Cascades	0	10	10	0	0	0	10
	Western Lowlands	0	0	0	0	0	0	0
OR	Cascades East	124	2,738	2,862	0	62	62	2,924
	Cascades West	263	1,417	1,680	0	0	0	1,680
	Coast Range	0	1,934	1,934	0	0	0	1,934
	Klamath Mountains	242	3,351	3,593	0	0	0	3,593
	Willamette Valley	0	0	0	0	0	0	0
CA	Cascades	571	248	819	0	0	0	819
	Coast	0	1	1	0	1,049	1,049	1,050
	Klamath	1,454	413	1,867	8,558	9,916	18,474	20,341
Total		**2,654**	**10,112**	**12,766**	**8,558**	**11,027**	**19,585**	**32,351**

Notes:

1. Northern spotted owl foraging habitat occurs in a much broader range of forest types than what is generally represented by nesting/roosting habitat. Foraging-only habitat is a separate category from spotted owl nesting/roosting habitat, and does not provide structures for spotted owl nesting/roosting. The foraging habitat effects summarized in this table are for foraging-only habitat, and do not include effects to nesting/roosting habitat. Environmental baseline information for foraging habitat as a separate habitat category is not available at a provincial scale.
2. Defined in the Revised Recovery Plan for the Northern Spotted Owl (USFWS 2011) as Recovery Units as depicted on page A-3.

3. Estimated foraging-only habitat removed or downgraded from land management (e.g., timber sales) or natural events (e.g., wildfires) as documented through ESA section 7 consultations or technical assistance. Effects reported here include acres removed or downgraded from 2012 to present.
4. Reserve land use allocations intended to provide spotted owl demographic support include Late-Successional Reserves identified in the Northwest Forest Plan on National Forests, designated Wilderness, and other Congressionally-reserved lands. Reserves on BLM lands in western Oregon managed under the 2016 revised Land and Resource Management Plans include Late-Successional Reserves, Congressionally-reserved lands, National Landscape Conservation System lands, and some District Designated Reserves (e.g., Areas of Critical Environmental Concern).
5. Non-reserve lands intended to provide spotted owl dispersal connectivity between reserves include USFS and BLM designations for timber production (matrix and harvest land base designations), Adaptive Management Areas, and other non-reserved land use designations.

Other Past Habitat Trend Assessments

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

Moeur et al. 2005 estimated an increase of approximately 1.25 to 1.5 million acres of medium and large older forest (greater than 20 inches dbh, single and multi-storied canopies) on Federal lands in the NWFP area between 1994 and 2003. The increase occurred primarily in the lower end of the diameter range for older forest. In the greater than 30 inch dbh size class, the net area increased by only an estimated 102,000 to 127,000 acres (Moeur et al. 2005). The estimates were based on change-detection layers for losses due to harvest and fire and re-measured inventory plot data for increases due to ingrowth. Transition into and out of medium and large older forest over the 10-year period was extrapolated from inventory plot data on a subpopulation of Forest Service land types and applied to all

Federal lands. Because size class and general canopy layer descriptions do not necessarily account for the complex forest structure often associated with northern spotted owl habitat, the significance of these acres to northern spotted owl conservation remains unknown.

Population Trends

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

The current range of the spotted owl extends from southwest British Columbia through the Cascade Mountains, coastal ranges, and intervening forested lands in Washington, Oregon, and California, as far south as Marin County (USDI FWS 1990a, p. 26114). The range of the spotted owl is partitioned into 12 physiographic provinces (Figure A-1) based on recognized landscape subdivisions exhibiting different physical and environmental features (USDI FWS 1992a, p. 31). The spotted owl has become rare in certain areas, such as British Columbia, southwestern Washington, and the northern coastal ranges of Oregon.

Because the existing survey coverage and effort are insufficient to produce reliable rangewide 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 to estimate trends in the populations of the spotted owl (Anderson and Burnham 1992; Burnham et al. 1994; Forsman et al. 1996; Anthony et al. 2006; Forsman et al. 2011; Dugger et al. 2016).

The most recent meta-analysis (Dugger et al. 2016) found continued declines in virtually all demographic parameters evaluated (Table A-4). Estimates of annual rates of population change, occupancy rates, and realized population change showed continuing declines across the range, and that the annual rate of decline was increasing in many areas, including southern Oregon and northern California. With the exception of treatment areas the Green Diamond Study Area (GDR-T) where removal of barred owls was initiated in 2009, Dugger et al. (2016, p. 70) reported that the populations in all study areas were declining, including those study areas that had been relatively stable in earlier analyses. Notably, the rate of realized population change for northern spotted owls in Cle Elum and the Olympic Peninsula demographic study areas in Washington showed a 60-70 percent decline over the past two decades. Lower rates were observed in the Oregon and California study areas where the realized rate of population change has shown a decline of 31-64 percent over the past two decades; the

confidence intervals for some of the estimates of rate of population change slightly overlap zero, the results indicated a significant negative time trend at seven of the eleven study areas (Dugger et al. 2016, p. 70). These findings indicate that these populations are declining over time and the rate of decline is increasing.

The probability of occupancy has declined in all three states over the past two decades. Dugger et al. (2016, pp. 73-74); reported that occupancy rates in Washington declined from a range of 56 to100 percent in 1995, to a range of 11 to 26 percent in 2013. During this same time period, occupancy rates in Oregon declined from a range of 61 to 88 percent in 1995, to a range of 28 to 48 percent in 2013. In California, occupancy rates declined from a range of approximately 42 to 92 percent in 1993, to a range of 38 to 55 percent in 2013. This 2016 analysis was the first rangewide assessment of northern spotted owl population status to include estimates of occupancy dynamics (i.e. proportion of northern spotted owl territories occupied by a resident single or pair in a given year compared to the total number of territories surveyed), which revealed that territory occupancy of northern spotted owls has declined substantially in all 11 study areas since the early 1990s (Dugger et al. 2016, p. 79). The lowest occupancy rates were observed in 2013 (the final year included in this study) in the Oregon Coast Ranges Study Area (28 percent) and at the 3 study areas in Washington (Olympic, Cle Elum, Rainier).

Two methods of estimating populations have been described - records of known sites and population modeling. As of July 1, 1994, there were 5,431 known site-centers of spotted owl pairs or resident singles: 851 sites (16 percent) in Washington, 2,893 sites (53 percent) in Oregon, and 1,687 sites (31 percent) in California (USDI FWS 1995, p. 9495). The actual number of currently occupied spotted owl locations across the range is unknown because many areas remain unsurveyed (USDI FWS 2011b, p. A-2). In addition, many historical sites are no longer occupied because spotted owls have been displaced by barred owls, timber harvest, or severe fires, and it is possible that some new sites have been established due to reduced timber harvest on Federal lands since 1994. The totals above represent the cumulative number of locations recorded in the three states, not population estimates. Estimated populations were modeled during the 2012 critical habitat designation which projected a steady-state rangewide population size of roughly 3,400 female northern spotted owls. Population sizes varied regionally from low in the north, especially the northwest (e.g., about 100 in the North Coast Olympics and West Cascades North modeling regions), to high in parts of southern Oregon and northern California (e.g. about 750 each in the Inner California Coast, Klamath East, Klamath West, Redwood Coast, and West Cascades South modeling regions) (Dunk et al., 2012, p. 64). These estimates likely over represent the numbers of females as this modeling effort does not reflect rates of declines from 2008 - 2011 (as described in Dugger et al. 2016). Additionally, the actual number of currently occupied spotted owl locations across the range is unknown because many areas remain un-surveyed (USDI FWS 2011a, p. A-2) and many historical sites are no longer occupied because spotted owls have been displaced by barred owls, timber harvest, or severe fires. Other factors such as impacts of anticoagulant rodenticides have likely negatively affected localized spotted owl populations (Gabriel et al. 2018, p. 6).

Another unmeasured factor might include the possibility that some new sites have been established due to reduced timber harvest on Federal lands since 1994.

Table A-4. Summary of most recent spotted owl population trends from in demographic study areas in Washington, Oregon, and California 1985-2013 (Derived from Dugger et al. 2016, Tables 2, 4 and 25).

Study Area [a]	Fecundity	Apparent Survival	Occupancy Rates	Lamda	Mean Lamda	% Pop Size
Washington						
CLE	Declining	Declining	Declining	No trend	0.916	–77%
RAI	No trend	Declining	Declining	No trend	0.953	–61%
OLY	No trend	No trend	Declining	No trend	0.961	–59%
Oregon						
COA	Declining	No trend	Declining	Declining	0.949	–64%
HJA	Declining	Declining	Declining	Declining	0.965	–47%
TYE	Declining	Declining	Declining	Declining	0.976	–31%
KLA	Declining	No trend	Declining	Declining	0.972	–34%
CAS	No trend	Declining	Declining	No trend	0.963	–44%
California						
NWC	Declining	Declining	Declining	Declining	0.970	–55%
HUP	Declining	Declining	Declining	Declining	0.977	–32%
GDR-CB	Declining	Declining	Declining	Declining	0.988	–31%
GDR-TB	Declining	Declining	Declining	Declining	0.961	–26%
GDR-CA	**	**	Declining	**	0.878	–41%
GDR-TA	**	**	N/A [c]	**	1.030	–9%

[c] Data used for occupancy modeling in the GDR study area excluded treatment areas after Barred Owl removals began in 2009.

** Too few years since Barred Owl removal to evaluate a trend.

In the northern-most portion of the range in British Columbia, few spotted owls are remaining. Chutter et al. (2004, p. v) suggested immediate action was required to improve the likelihood of recovering the spotted owl population in British Columbia. In 2007, personnel in British Columbia captured and brought into captivity the remaining 16 known wild spotted owls (USDI FWS 2011b, p. A-6). Prior to initiating the captive-breeding program, the population of spotted owls in Canada was declining by as much as 10.4 percent per year (Chutter et al. 2004, p. v). As of 2016, this program was comprised of 17 spotted owls, eight of which were born in captivity (British Columbia 2017, p. 1). The program is targeted produce annually up to 20 captive-born owls ready for release back into the wild until the population reaches 200; the first year of release expected to occur in the spring of 2018. The amount of previous interaction between spotted owls in Canada and the United States is unknown.

Spotted Owl Critical Habitat

Legal Status

The final rule designating critical habitat for the northern spotted owl was published on December 4, 2012 (USDI FWS 2012a), and became effective on January 3, 2013. Critical habitat for the northern spotted owl now includes approximately 9,577,969 acres in 11 units and 60 subunits in California, Oregon, and Washington.

Designation of critical habitat serves to identify those lands that are necessary for the conservation and recovery of the listed species. In this case, the Service's primary objective in designating critical habitat was to identify capable and existing essential northern spotted owl habitat and highlight specific areas where management of the northern spotted owl and its habitat should be given highest priority. The expectation of critical habitat is to ameliorate habitat-based threats. The recovery of the northern spotted owl requires habitat conservation in concert with the implementation of recovery actions that address other, non-habitat-based threats to the species, including the barred owl (USDI FWS 2012a, p. 71879). The conservation role of northern spotted owl critical habitat is to "adequately support the life-history needs of the species to the extent that well-distributed and inter-connected northern spotted owl nesting populations are likely to persist within properly functioning ecosystems at the critical habitat unit and range-wide scales" (USDI FWS 2012a, p. 71938). The specific conservation roles of the subunits included in the action area are described below in the Environmental Baseline.

Physical or Biological Features and Primary Constituent Elements

When designating critical habitat, the Service considers "the physical or biological features [PBFs] essential to the conservation of the species and which may require special management considerations or protection" (50 CFR §424.12; USDI FWS 2012a, p. 71897). "These include, but are not limited to: (1) space for individual and population growth and for normal behavior; (2) food, water, air, light, minerals, or other nutritional or physiological requirements; (3) cover or shelter; (4) sites for breeding, reproduction, or rearing (or development) of offspring; and (5) habitats that are protected from disturbance or are representative of the historical, geographical, and ecological distributions of a species" (USDI FWS 2012a, p. 71897). The final critical habitat rule states that "for the northern spotted owl, the physical or biological features essential to the conservation of the species are forested areas that are used or likely to be used for nesting, roosting, foraging, or dispersing" (USDI FWS 2012a, p. 71897). The final critical habitat rule for the northern spotted owl provides an in-depth discussion of the PBFs, which may be referenced for further detail (USDI FWS 2012a, pp. 71897-71906).

The final rule for critical habitat defines the primary constituent elements (PCEs) as the specific elements of the PBFs that are considered essential to the conservation of the northern spotted owl and are those elements that make areas suitable as nesting, roosting, foraging, and dispersal habitat (USDI FWS 2012a, p. 71904). The PCEs should be arranged spatially such that it is favorable to the

persistence of populations, survival, and reproductive success of resident pairs, and survival of dispersing individuals until they are able to recruit into a breeding population (USDI FWS 2012a, p. 71904). Within areas essential for the conservation and recovery of the northern spotted owl, the Service has determined that the PCEs are:

i) Forest types that may be in early-, mid-, or late-seral stages and that support the northern spotted owl across its geographic range;
ii) Habitat that provides for nesting and roosting;
iii) Habitat that provides for foraging;
iv) Habitat to support the transience and colonization phases of dispersal, which in all cases would optimally be composed of nesting, roosting, or foraging habitat (PCEs 2 or 3), but which may also be composed of other forest types that occur between larger blocks of nesting, roosting, or foraging habitat (USDI FWS 2012, pp. 72051-72052).

In 2016, the Service returned to the use of statutory reference of PBFs rather than PCEs when evaluating and discussing the availability and function of, as well as the effects to the attributes of critical habitat in the adverse modification analysis (USDI FWS and USDC NOAA 2016, p. 2716). Some critical habitat subunits may contain all of the PBFs and support multiple life history requirements of the northern spotted owl, while some subunits may contain only those PBFs necessary to support the species particular use of that habitat. All of the areas designated as critical habitat, however, do contain PCE 1, forest type. As described in the final rule, PCE 1 always occurs in concert with at least one other PCE (PCE 2, 3, or 4; USDI FWS 2012a, p. 72051). Northern spotted owl critical habitat does not include meadows, grasslands, oak woodlands, aspen woodlands, or manmade structures and the land upon which they are located (USDI FWS 2012a, p. 71918).

PCE 1: Forest Types

The primary forest types that support the northern spotted owl are: Sitka spruce, western hemlock, mixed conifer, mixed evergreen, grand fir, Pacific silver fir, Douglas-fir, white fir, Shasta red fir, redwood/Douglas-fir, and moister ponderosa pine (USDI FWS 2012a, p. 72051).

PCE 2: Nesting and Roosting Habitat

Nesting and roosting habitat habitats provide structural features for nesting, protection from adverse weather conditions, and cover to reduce predation risk for adults and young. Unlike foraging habitat, structural conditions of nesting roosting habitats do not vary much across the range. The final rule describes characteristics associated with nesting and roosting habitats sufficient for foraging by territorial pairs, moderate to high canopy cover (60 to over 80 percent), multilayered and multispecies

canopies with large overstory trees (20 to 30 inches dbh), basal area greater than 240 square feet per acre, high diversity of tree diameters, high incidence of large live trees with various deformities (e.g., large cavities, broken tops, mistletoe infections, and other evidence of decadence), large snags and large accumulations of woody debris on the ground, and sufficient open space beneath the canopy for flight (USDI FWS 2012a, p. 72051). Nesting and roosting habitats will also function as foraging and dispersal habitat (FWS 2012a, p. 71884).

PCE 3: Foraging Habitat

Foraging habitat varies across the range, depending upon ecological conditions and disturbance regimes that influence vegetation structure and prey species distributions. Across most of the owl's range, nesting and roosting habitat is also foraging habitat, but in some regions (particularly in the southern portion of the range) northern spotted owls may additionally use other habitat types for foraging as well (differences in foraging habitats between ecological provinces are discussed below).

PCE 4: Dispersal Habitat

Northern spotted owl dispersal habitat is habitat that supports the transience and colonization phases of owl dispersal, and in all cases would optimally be composed of nesting, roosting, or foraging habitat (PCE 2 or 3), but which may also be composed of other forest types that occur between larger blocks of northern spotted owl nesting, roosting, or foraging habitat. In cases where nesting, roosting, or foraging habitats are insufficient to provide for dispersing or nonbreeding owls, the specific dispersal PCEs are: habitat supporting transience phase of dispersal (protection from avian predators, minimal foraging opportunities, younger and less diverse forests that provide some roosting structures and foraging opportunities) and habitat supporting the colonization phase of dispersal (nesting, roosting, and foraging habitat but in smaller amounts than needed to support a nesting pair) (USDI FWS 2012a, p. 72052).

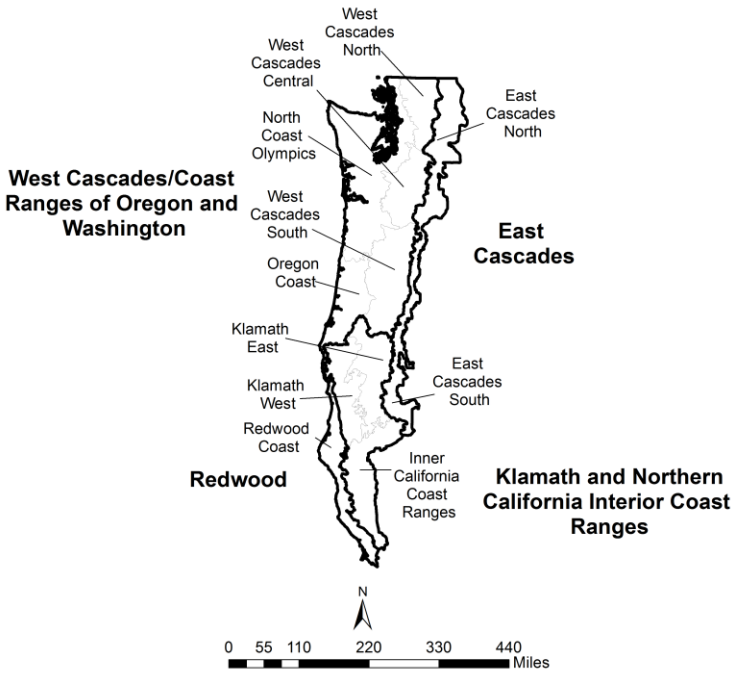
Zones of Habitat Associations used by Northern Spotted Owls

Differences in patterns of habitat associations used by the northern spotted owl across its range suggest four different broad zones of habitat use, which we characterize as the (1) West Cascades/Coast Ranges of Oregon and Washington, (2) East Cascades, (3) Klamath and Northern California Interior Coast Ranges, and (4) Redwood Coast (Figure A-3). We configured these zones based on a qualitative assessment of similarity among ecological conditions and habitat associations within the 11 different regions analyzed during the critical habitat designation process (see USDI FWS 2012a). These four zones capture the range in variation of some of the PBFs essential to the conservation of the northern spotted owl. Habitat modeling indicates that vegetation structure has a dominant influence on owl population performance, with habitat pattern and topography also contributing. High canopy cover, high density of large trees, high numbers of sub-canopy vegetation layers, and low to moderate slope positions are all important features. Summarized below are the PBFs for each of these four zones,

emphasizing zone-specific features that are distinctive within the context of general patterns that apply across the entire range of the northern spotted owl.

West Cascades/ Coast Range of Oregon and Washington - This zone includes five regions west of the Cascade crest in Washington and Oregon (Western Cascades North, Central and South; North Coast Ranges and Olympic Peninsula; and Oregon Coast Ranges; USDI FWS 2011b, p. C–13). Climate in this zone is characterized by high rainfall and cool to moderate temperatures. Variation in elevation between valley bottoms and ridges is relatively low in the Coast Ranges, creating conditions favorable for development of contiguous forests. In contrast, the Olympic and Cascade ranges have greater topographic variation with many high-elevation areas supporting permanent snowfields and glaciers. Douglas-fir and western hemlock dominate forests used by northern spotted owls in this zone. Root diseases and wind-throw are important natural disturbance mechanisms that form gaps in forested areas. Flying squirrels (*Glaucomys sabrinus*) are the dominant prey, with voles and mice also representing important items in the northern spotted owl's diet.

Figure A-3. Regions and zones of habitat associations used by northern spotted owls in Washington, Oregon, and California.



West Cascade/Coast Ranges of Oregon and Washington - Nesting habitat in this zone is mostly limited to areas with large trees with defects such as mistletoe brooms, cavities, or broken tops. The subset of foraging habitat that is not nesting/roosting habitat generally had slightly lower values than nesting habitat for canopy cover, tree size and density, and canopy layering. Prey species (primarily the northern flying squirrel) in this zone are associated with mature to late-successional forests, resulting in small differences between nesting, roosting, and foraging habitats.

East Cascades -This zone includes the Eastern Cascades North and Eastern Cascades South regions (USDI FWS 2011b, p. C–13). This zone is characterized by a continental climate (cold, snowy winters and dry summers) and a high frequency of natural disturbance due to fires and outbreaks of forest insects and pathogens. Flying squirrels are the dominant prey species, but the diet of northern spotted owls in this zone also includes relatively large proportions of bushy-tailed woodrats (*Neotoma cinerea*), snowshoe hare (*Lepus americanus*), pika (*Ochotona princeps*), and mice (*Microtus spp*. (Forsman et al. 2001, pp. 144–145).

Our modeling indicates that habitat associations in this zone do not show a pattern of dominant influence by one or a few variables (USDI FWS 2011b, Appendix C). Instead, habitat association models for this zone included a large number of variables, each making a relatively modest contribution (20 percent or

less) to the predictive ability of the model. The features that were most useful in predicting northern spotted owl habitat quality were vegetation structure and composition, and topography, especially slope position in the north. Other efforts to model habitat associations in this zone have yielded similar results (e.g., Garm et al. 2010, pp. 2048–2050; Loehle et al. 2011, pp. 25–28).

Relative to other portions of the northern spotted owls' range, nesting and roosting habitat in this zone includes relatively younger and smaller trees, likely reflecting the common usage of dwarf mistletoe (*Arceuthobium douglasii*) brooms (dense growths) as nesting platforms (especially in the north). Forest composition that includes high proportions of Douglas-fir is also associated with this nesting structure. Additional foraging habitat in this zone generally resembles nesting and roosting habitat, with reduced canopy cover and tree size, and reduced canopy layering. High prey diversity suggests relatively diverse foraging habitats are used. Topographic position was an important variable, particularly in the north, possibly reflecting competition from barred owls (Singleton et al. 2010, pp. 289, 292). Barred owls, which have been present for over 30 years in the northern portions of this zone, preferentially occupy valley-bottom habitats, possibly compelling northern spotted owls to establish territories on less productive, mid-slope locations (Singleton et al. 2010, pp. 289, 292).

Klamath and Northern California Interior Coast Ranges - This zone includes the Klamath West, Klamath East, and Interior California Coast regions (USDI FWS 2011b, p. C–13). This region in southwestern Oregon and northwestern California is characterized by very high climatic and vegetative diversity resulting from steep gradients of elevation, dissected topography, and large differences in moisture from west to east. Summer temperatures are high, and northern spotted owls occur at elevations up to 5,800 feet. The western portions of this zone support a diverse mix of mesic forest communities interspersed with drier forest types. Forests of mixed conifers and evergreen hardwoods are typical of the zone. The eastern portions of this zone have a Mediterranean climate with increased occurrence of the ponderosa pine. Douglas-fir/dwarf mistletoe is rarely used for nesting platforms in the western part of the northern spotted owl's range, but is commonly used in the east.

The prey base for northern spotted owls in this zone is correspondingly diverse, but dominated by dusky-footed woodrats, bushy-tailed woodrats, and flying squirrels. Northern spotted owls have been well studied in the western Klamath portion of this zone (Forsman et al. 2004, p. 217), but relatively little is known about northern spotted owl habitat use in the eastern portion and the California Interior Coast Range portion of the zone.

Our habitat association models for this zone suggest that vegetation structure and topographic features are nearly equally important in influencing owl population performance, particularly in the Klamath. High canopy cover, high levels of canopy layering, and the presence of very large dominant trees were all important features of nesting and roosting habitat. Compared to other zones, additional foraging habitat for this zone showed greater divergence from nesting habitat, with much lower canopy cover and

tree size. Low to intermediate slope positions were strongly favored. In the eastern Klamath, the presence of Douglas-fir was an important compositional variable in our habitat model (USDI FWS 2011b, Appendix C).

Redwood Zone - This zone is confined to the northern California coast, and is represented by the Redwood Coast region (USDI FWS 2011b, p. C–13). It is characterized by a maritime climate with moderate temperatures and generally mesic conditions. Near the coast, frequent fog delivers consistent moisture during the summer. Terrain is typically low-lying (0 to 3,000 feet). Forest communities are dominated by redwood, Douglas-fir–tanoak (*Lithocarpus densiflorus*) forest, coast live oak (*Quercus agrifolia*), and tanoak series. Dusky footed woodrats are the dominant prey items for northern spotted owls in this zone.

Habitat association models for this zone diverged strongly from models for other zones. Topographic variables (slope position and curvature) had a dominant influence with vegetation structure having a secondary role. Low position on slopes was strongly favored, along with concave landforms.

Several studies of northern spotted owl habitat relationships suggest that stump-sprouting and rapid growth of redwood trees, combined with high availability of woodrats in patchy, intensively managed forests, enables northern spotted owls to occupy a wide range of vegetation conditions within the redwood zone. Rapid growth rates enable young stands to develop structural characteristics typical of older stands in other regions. Thus, relatively small patches of large remnant trees can also provide nesting habitat structure in this zone.

Climate Change and Range-wide Spotted Owl Critical Habitat

There is growing evidence that recent climate change has impacted a wide range of ecological systems (Stenseth et al. 2002, entire; Walther et al. 2002, entire; Ådahl et al. 2006, entire; Karl et al. 2009, entire; Moritz et al. 2012, entire; Westerling et al. 2011, p. S459; Marlon et al. 2012, p. E541). Climate change, combined with effects from past management practices, is exacerbating changes in forest ecosystem processes and dynamics to a greater degree than originally anticipated under the NWFP. Environmental variation affects all wildlife populations; however, climate change presents new challenges as systems may change beyond historical ranges of variability. In some areas, changes in weather and climate may result in major shifts in vegetation communities that can persist in particular regions. (See expanded discussion in environmental baseline section above).

Climate change will present unique challenges to the future of northern spotted owl populations and their habitats. Northern spotted owl distributions (Carroll 2010, entire) and population dynamics (Franklin et al. 2000, entire; Glenn et al. 2010, entire; Glenn et al. 2011a, entire) may be directly

influenced by changes in temperature and precipitation. In addition, changes in forest composition and structure as well as prey species distributions and abundance resulting from climate change may impact availability of habitat across the historical range of the subspecies. The *2011 Northern Spotted Owl Revised Recovery Plan* provides a detailed discussion of the possible environmental impacts to the habitat of the northern spotted owl from the projected effects of climate change (USDI FWS 2011b, pp. III-5 to III-11).

Because both northern spotted owl population dynamics and forest conditions are likely to be influenced by large-scale changes in climate in the future, we have attempted to account for these influences in our designation of critical habitat by recognizing that forest composition may change beyond the range of historical variation, and that climate changes may have unpredictable consequences for both Pacific Northwest forests and northern spotted owls. Our critical habitat designation also recognizes that forest management practices that promote ecosystem health under changing climate conditions will be important for northern spotted owl conservation.

Current Condition of Range-Wide Critical Habitat

The current condition of critical habitat incorporates the effects of all past human activities and natural events that led to the present-day status of the habitat (USDI FWS/USDC NMFS 1998, p. 4-19). With the revision of spotted owl critical habitat, the rangewide condition has been “reset” as of December 4, 2012.

The Service updated the ECOS database to reflect the 2006/2007 habitat baseline developed for the NWFP 15-year monitoring report (Davis et al. 2011, Appendix D, Table D). Additional updates were made in May of 2017 to reflect 2012 imagery utilized in the 20-year NWFP monitoring report (Davis et al. 2016).

The Service’s ECOS database indicates that as of September 12, 2019, approximately 4.86 million acres nesting/roosting (NR) habitat occur within the rangewide 9.577 million acres of spotted owl critical habitat (Table A-5, baseline data). Since the imagery date of 2012, an estimated 31,958 acres of NR habitat in critical habitat have been removed or downgraded range-wide (about .26 percent of the available nesting/roosting). The majority of these impacts originated in the Washington East Cascades, Oregon West Cascades and the Oregon and California Klamath Physiographic Provinces. Rangewide, about 15,087 acres were associated with natural disturbances, and about 16,871 were associated with land management actions.

Table A-5. Spotted owl Take/Effect Reports Table D - Designated northern spotted owl critical habitat. Summary of northern spotted owl nesting/roosting[1] habitat (acres) removed or downgraded as documented through ESA section 7 consultations. Summary of effects by state, province, and land use function from 2012 to present.

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Physiographic Province[2]		Evaluation Baseline		Nesting/Roosting Habitat Removed/Downgraded[5]							% Provincial Baseline Affected	% Range-wide Effects
				Land Management Effects			Habitat Loss from Natural Events			Total NR Acres Removed		
		Total Designated Critical Habitat Acres[3]	Nesting/Roosting Acres[4]	Reserves[6]	Non-Reserves[7]	Total	Reserves	Non-Reserves	Total			
WA	Eastern Cascades	1,022,960	467,221	1,552	55	1,607	3,895	0	3,895	5,502	1.18	17.20
	Olympic Peninsula	507,165	211,373	1	0	1	0	0	0	1	0.00	0.00
	Western Cascades	1,387,567	606,093	15	185	200	0	0	0	200	0.03	0.63
OR	Cascades East	529,652	187,798	893	1,442	2,335	1,003	195	1,198	3,533	1.88	11.05
	Cascades West	1,965,407	1,255,027	663	4,230	4,893	662	617	1,279	6,172	0.49	19.30
	Coast Range	1,151,874	483,846	96	757	853	0	0	0	853	0.18	2.67
	Klamath Mountains	911,681	542,119	2,109	4,065	6,174	2,517	2,727	5,244	11,418	2.11	35.70
CA	Cascades	243,205	97,248	0	114	114	0	0	0	114	0.12	0.36
	Coast	149,044	94,033	0	0	0	0	2,030	2,030	2,030	2.16	6.35
	Klamath	1,708,787	945,505	292	430	722	30	1,411	1,441	2,163	0.23	6.76
Total		**9,577,342**	**4,890,263**	**5,621**	**11,278**	**16,899**	**8,107**	**6,980**	**15,087**	**31,986**	**0.33%**	**100%**

Notes:

1. Northern spotted owl suitable habitat includes nesting/roosting habitat, and foraging-only habitat. Nesting/roosting habitat supports all life-history functions for spotted owls including foraging, and is sometimes referred to as nesting, roosting, and foraging habitat. Foraging-only habitat is a separate category that can include more open and fragmented forests, and does not provide structures for nesting/roosting. Habitat effects summarized in this table are all classified as impacts to nesting/roosting habitats. Impacts to foraging-only habitat are tracked separately.
2. Defined in the Revised Recovery Plan for the Northern Spotted Owl (USFWS 2011) as Recovery Units as depicted on page A-3.
3. Northern spotted owl critical habitat as designated December 4, 2012 (77 FR 71876). Total designated critical habitat acres listed here (9,577,342 acres) are derived from GIS data, and vary slightly from the total acres (9,577,969 acres) listed in the Federal Register (-627 acres).
4. Spotted owl nesting/roosting (NR) habitat based on GIS data developed for the Northwest Forest Plan 20-year monitoring report by Davis et al. 2016 (PNW-GTR-929). NR habitat acres are approximate values based on 2012 satellite imagery.
5. Estimated nesting/roosting habitat removed or downgraded from land management (e.g., timber sales) or natural events (e.g., wildfires) as documented through section 7 consultation or technical assistance. Effects reported here include acres removed or downgraded from 2012 to present.
6. Reserve land use allocations intended to provide spotted owl demographic support include Late-Successional Reserves identified in the Northwest Forest Plan on National Forests, designated Wilderness, and other Congressionally-reserved lands. Reserves on BLM lands in western Oregon managed under the 2016 revised Land and Resource Management Plans include Late-Successional Reserves, Congressionally-reserved lands, National Landscape Conservation System lands, and some District Designated Reserves (e.g., Areas of Critical Environmental Concern).

7. Non-reserve lands intended to provide spotted owl dispersal connectivity between reserves include USFS and BLM designations for timber production (matrix and harvest land base designations), Adaptive Management Areas, and other non-reserved land use designations.

Recently, the Service modified the ECOS database input to account for effects to the habitats that could be used as foraging, but that lack the age or structural characteristics of habitats used for nesting and roosting. This distinction may not be made in all consultations. These data represent effects as reported in individual consultations and likely do not represent the entirety of impacts to foraging habitat within critical habitat since 2012. For many projects, affected foraging likely is captured within the NR acres as foraging habitat was lumped into "nesting/roosting/foraging habitat" at the time of consultation. Trends to date mirror impacts reported by Davis et al. 2016, where habitat reductions are disproportionally affecting reserved lands and the Oregon and Klamath Province (Table A-6).

Table A-6: Spotted owl Take/Effect Reports Table D2 - Designated northern spotted owl critical habitat. Summary of northern spotted owl foraging habitat[1] (acres) removed or downgraded as documented through ESA section 7 consultations. Summary of effects by state, province, and land use function from 2012 to present.

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Physiographic Province[2]		Foraging Habitat Removed/Downgraded[4]							
		Total Designated Critical Habitat Acres[3]	Land Management Effects			Habitat Loss from Natural Events			Total Foraging Habitat removed/ downgraded
			Reserves[5]	Non-Reserves[6]	Total	Reserves[5]	Non-Reserves[6]	Total	
WA	Eastern Cascades	1,022,960	0	0	0	0	0	0	0
	Olympic Peninsula	507,165	0	0	0	0	0	0	0
	Western Cascades	1,387,567	0	0	0	0	0	0	0
OR	Cascades East	529,652	0	29	29	0	0	0	29
	Cascades West	1,965,407	263	687	950	0	0	0	950
	Coast Range	1,151,874	0	441	441	0	0	0	441
	Klamath Mountains	911,681	242	1,789	2,031	0	0	0	2,031
CA	Cascades	243,205	98	91	189	0	0	0	189
	Coast	149,044	0	1	1	0	885	885	886
	Klamath	1,708,787	1,449	281	1,730	772	133	905	2,635
Total		**9,577,342**	**2,052**	**3,319**	**5,371**	**772**	**1,018**	**1,790**	**7,161**

Notes:

1. Northern spotted owl suitable habitat includes nesting/roosting habitat, and foraging-only habitat. Nesting/roosting habitat supports all life-history functions for spotted owls including foraging, and is sometimes referred to as nesting, roosting, and foraging habitat. Foraging-only habitat is a separate category that can include more open and fragmented forests, and does not provide structures for nesting/roosting. Habitat effects summarized in this table are all classified as impacts to foraging-only habitat. Impacts to nesting/roosting habitat are tracked separately. Environmental baseline information for foraging habitat as a separate habitat category is not available at a provincial scale.
2. Defined in the Revised Recovery Plan for the Northern Spotted Owl (USFWS 2011) as Recovery Units as depicted on page A-3.
3. Northern spotted owl critical habitat as designated December 4, 2012 (77 FR 71876). Total designated critical habitat acres listed here (9,577,342 acres) are derived from GIS data, and vary slightly from the total acres (9,577,969 acres) listed in the Federal Register (-627 acres).

4. Estimated foraging-only habitat removed or downgraded from land management (e.g., timber sales) or natural events (e.g., wildfires) as documented through ESA section 7 consultations or technical assistance. Effects reported here include acres removed or downgraded from 2012 to present.
5. Reserve land use allocations intended to provide spotted owl demographic support include Late-Successional Reserves identified in the Northwest Forest Plan on National Forests, designated Wilderness, and other Congressionally-reserved lands. Reserves on BLM lands in western Oregon managed under the 2016 revised Land and Resource Management Plans include Late-Successional Reserves, Congressionally-reserved lands, National Landscape Conservation System lands, and some District Designated Reserves (e.g., Areas of Critical Environmental Concern).
6. Non-reserve lands intended to provide spotted owl dispersal connectivity between reserves include USFS and BLM designations for timber production (matrix and harvest land base designations), Adaptive Management Areas, and other non-reserved land use designations.

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APPENDIX B. MONITORING FORM

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

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

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

Section II: Ownership and Location Identifier Information[1]

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

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

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

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

[3]California only.

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

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

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

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

Section II & III: General Note and Comments

APPENDIX C. Calf Copeland Project Proposed Maintenance Burn and Fuel break

APPENDIX D. Road actions associated with Calf Copeland Project for the U.S. Forest Service

Route	Length (miles)	Existing Conditions	Current Authorized Motor Vehicle Use	Proposed Authorized Motor Vehicle Use	Proposed Treatment	Reasoning for proposed change	Retained as a Road for Future Management Needs (Yes/No)
2715-310	0.47	Overgrown with vegetation	Open to All Vehicles	Closed to All Vehicles	Road Placed in Storage for Future Use, Road Closed to All Motorized Vehicles	Change reflects current road condition	Yes
2715-362	0.36	Inaccessible, overgrown with vegetation	Trail Open to Vehicles <50	Closed to All Vehicles	Closed to All Motorized Vehicles and Removed from the Trail System, Road placed in to Storage	Limited recreational opportunity	Yes
2715-370	0.12	Inaccessible, overgrown with vegetation	Trail Open to Vehicles <50	Closed to All Vehicles	Closed to All Motorized Vehicles and Removed from the Trail System, Road placed in to Storage	Limited recreational opportunity	Yes
2715-480	0.16	Overgrown with vegetation	Trail Open to Vehicles <50	Closed to All Vehicles	Closed to All Motorized Vehicles and Removed from the Trail System, Road placed in to Storage	Limited recreational opportunity	Yes

Route	Length (miles)	Existing Conditions	Current Authorized Motor Vehicle Use	Proposed Authorized Motor Vehicle Use	Proposed Treatment	Reasoning for proposed change	Retained as a Road for Future Management Needs (Yes/No)
2715-570	0.26	Overgrown with vegetation	Open to All Vehicles	Closed to All Vehicles	Road Placed in Storage for Future Use, Road Closed to All Motorized Vehicles	Change reflects current road condition	Yes
2715-585	1.53	Inaccessible, overgrown with vegetation, roadway drainage issues	Open to All Vehicles	Closed to All Vehicles	Road Placed in Storage for Future Use, Road Closed to All Motorized Vehicles	Minimize resource impacts	Yes
2715-588	0.39	Overgrown with vegetation	Trail Open to Vehicles <50	Closed to All Vehicles	Closed to All Motorized Vehicles and Removed from the Trail System, Road placed in to Storage	Change reflects current condition	Yes
2715-592	0.40	Overgrown with vegetation	Open to All Vehicles	Trail Open to Vehicles <50 inches width	Designation of Route as Motorized Trail (ATVs less than 50 inches in width); all Other Motorized Vehicles Prohibited	Change reflects current condition	Yes

Route	Length (miles)	Existing Conditions	Current Authorized Motor Vehicle Use	Proposed Authorized Motor Vehicle Use	Proposed Treatment	Reasoning for proposed change	Retained as a Road for Future Management Needs (Yes/No)
2800-611	0.64	Accessible with high clearance vehicles	Open to All Vehicles 5/1 to 11/30	Closed to All Vehicles	Road Placed in Storage for Future Use, Road Closed to All Motorized Vehicles	Minimize aquatic resource impacts	Yes
2800-800	1.36	Accessible with ATV less than 50 inches in width	Open to All Vehicles 5/1 to 11/30	Trail Open to Vehicles <50 inches width 5/1 to 11/30	Designation of Route as Motorized Trail (ATVs less than 50 inches in width); all Other Motorized Vehicles Prohibited	Change reflects current condition	Yes
2800-830	0.39	Inaccessible, overgrown with vegetation	Open to All Vehicles 5/1 to 11/30	Closed to All Vehicles	Road Placed in Storage for Future Use, Road Closed to All Motorized Vehicles	Change reflects current road condition	Yes
2800-830	0.17	Inaccessible, overgrown with vegetation	Open to All Vehicles 5/1 to 11/30	Closed to All Vehicles	Road Placed in Storage for Future Use, Road Closed to All Motorized Vehicles	Change reflects current road condition	Yes

Route	Length (miles)	Existing Conditions	Current Authorized Motor Vehicle Use	Proposed Authorized Motor Vehicle Use	Proposed Treatment	Reasoning for proposed change	Retained as a Road for Future Management Needs (Yes/No)
2800-835	0.06	Inaccessible, overgrown with vegetation	Open to All Vehicles 5/1 to 11/30	Closed to All Vehicles	Road Placed in Storage for Future Use, Road Closed to All Motorized Vehicles	Change reflects current road condition	Yes
2800-900	0.74	Accessible with high clearance vehicles	Open to All Vehicles 5/1 to 11/30	Closed to All Vehicles	Road Placed in Storage for Future Use, Road Closed to All Motorized Vehicles	Minimize aquatic resource impacts, current drainage structures are passage	Yes
2800-902	0.26	Accessible with high clearance vehicles	Open to All Vehicles 5/1 to 11/30	Closed to All Vehicles	Road Placed in Storage for Future Use, Road Closed to All Motorized Vehicles	Road tributary to 2800-900 which is proposed to be Closed to All Vehicles	Yes
2800-951	0.16	Overgrown with vegetation	Trail Open to Vehicles <50 5/1 to 11/30	Closed to All Vehicles	Closed to All Motorized Vehicles and Removed from the Trail System, Road placed in to Storage	Change reflects current condition	Yes

Route	Length (miles)	Existing Conditions	Current Authorized Motor Vehicle Use	Proposed Authorized Motor Vehicle Use	Proposed Treatment	Reasoning for proposed change	Retained as a Road for Future Management Needs (Yes/No)
2801-000	1.71	Open and accessible	Open to All Vehicles 5/1 to 11/30	Closed to All Vehicles	Decommission Road	See rationale for decommissioning below table	No
2801-130	0.20	Inaccessible, overgrown with vegetation	Trail Open to Vehicles <50 5/1 to 11/30	Closed to All Vehicles	Closed to All Motorized Vehicles and Removed from the Trail System, Road placed in to Storage	Change reflects current condition	Yes
2801-211	0.22	Overgrown with vegetation	Open to All Vehicles 5/1 to 11/30	Closed to All Vehicles	Decommission Road	Change reflects current road condition	No
2801-250	0.26	Inaccessible, overgrown with vegetation	Trail Open to Vehicles <50 5/1 to 11/30	Closed to All Vehicles	Closed to All Motorized Vehicles and Removed from the Trail System, Road placed in to Storage	Change reflects current condition	Yes
2801-275	0.61	Overgrown with vegetation	Open to All Vehicles	Closed to All Vehicles	Road Placed in Storage for Future Use, Road Closed to All Motorized Vehicles	Minimize aquatic resource impacts	Yes

Route	Length (miles)	Existing Conditions	Current Authorized Motor Vehicle Use	Proposed Authorized Motor Vehicle Use	Proposed Treatment	Reasoning for proposed change	Retained as a Road for Future Management Needs (Yes/No)
2801-300	4.96	Moderate to high aquatic risk. Numerous slides and down trees along roadway	Open to All Vehicles 5/1 to 11/30	Closed to All Vehicles	Road Placed in Storage for Future Use, Road Closed to All Motorized Vehicles	Minimize aquatic resource impacts	Yes
2801-330	1.05	Overgrown with vegetation	Open to All Vehicles 5/1 to 11/30	Closed to All Vehicles	Road Placed in Storage for Future Use, Road Closed to All Motorized Vehicles	Road tributary to 2801-300 which is proposed to be Closed to All Vehicles	Yes
2801-331	0.28	Overgrown with vegetation	Open to All Vehicles 5/1 to 11/30	Closed to All Vehicles	Road Placed in Storage for Future Use, Road Closed to All Motorized Vehicles	Change reflects current road condition	Yes
2801-340	1.23	Overgrown with vegetation	Open to All Vehicles 5/1 to 11/30	Closed to All Vehicles	Road Placed in Storage for Future Use, Road Closed to All Motorized Vehicles	Road tributary to 2801-300 which is proposed to be Closed to All Vehicles	Yes

Route	Length (miles)	Existing Conditions	Current Authorized Motor Vehicle Use	Proposed Authorized Motor Vehicle Use	Proposed Treatment	Reasoning for proposed change	Retained as a Road for Future Management Needs (Yes/No)
2801-345	0.43	Overgrown with vegetation	Open to All Vehicles 5/1 to 11/30	Closed to All Vehicles	Road Placed in Storage for Future Use, Road Closed to All Motorized Vehicles	Road tributary to 2801-300 which is proposed to be Closed to All Vehicles	Yes
2801-450	0.85	Inaccessible, overgrown with vegetation. Roadway not present	Closed to All Vehicles	NA	Decommission Road	Change reflects current condition	No
2801-451	0.22	Inaccessible, overgrown with vegetation. Roadway not present	Closed to All Vehicles	NA	Decommission Road	Change reflects current condition	No
4700-501	0.30	Inaccessible, overgrown with vegetation	Open to All Vehicles	Closed to All Vehicles	Decommission Road	Change reflects current condition, road template not present in areas	No

Route	Length (miles)	Existing Conditions	Current Authorized Motor Vehicle Use	Proposed Authorized Motor Vehicle Use	Proposed Treatment	Reasoning for proposed change	Retained as a Road for Future Management Needs (Yes/No)
4720-755	0.24	Inaccessible, overgrown with vegetation	Closed to All Vehicles	NA	Decommission Road	Change reflects current road condition	No
4720-760	0.25	Inaccessible, overgrown with vegetation	Closed to All Vehicles	NA	Decommission Road	Change reflects current road condition	No
4750-200	0.42	Overgrown with vegetation	Open to All Vehicles 5/1 to 11/30	Closed to All Vehicles	Road Placed in Storage for Future Use, Road Closed to All Motorized Vehicles	Change reflects current road condition	Yes
4750-240	0.34	Inaccessible, overgrown with vegetation	Trail Open to Vehicles <50 5/1 to 11/30	Closed to All Vehicles	Closed to All Motorized Vehicles and Removed from the Trail System, Road placed in to Storage	Change reflects current condition	Yes
4750-300	0.05	Inaccessible, overgrown with vegetation	Open to All Vehicles 5/1 to 11/30	Closed to All Vehicles	Road Placed in Storage for Future Use, Road Closed to All Motorized Vehicles	Minimize resource impacts	Yes

Route	Length (miles)	Existing Conditions	Current Authorized Motor Vehicle Use	Proposed Authorized Motor Vehicle Use	Proposed Treatment	Reasoning for proposed change	Retained as a Road for Future Management Needs (Yes/No)
4750-500	0.28	Overgrown with vegetation	Open to All Vehicles	Closed to All Vehicles	Road Placed in Storage for Future Use, Road Closed to All Motorized Vehicles	Change reflects current road condition	Yes
4750-580	0.54	Overgrown with vegetation	Open to All Vehicles	Closed to All Vehicles	Road Placed in Storage for Future Use, Road Closed to All Motorized Vehicles	Change reflects current road condition	Yes
4750-600	1.26	Accessible with ATV less than 50 inches in width	Open to All Vehicles	Trail Open to Vehicles <50 inches width	Designation of Route as Motorized Trail (ATVs less than 50 inches in width); all Other Motorized Vehicles Prohibited	Change reflects current condition	Yes
4750-930	0.16	Inaccessible, overgrown with vegetation	Trail Open to Vehicles <50	Closed to All Vehicles	Closed to All Motorized Vehicles and Removed from the Trail System, Road placed in to Storage	Change reflects current condition, limited recreational opportunity	Yes

Route	Length (miles)	Existing Conditions	Current Authorized Motor Vehicle Use	Proposed Authorized Motor Vehicle Use	Proposed Treatment	Reasoning for proposed change	Retained as a Road for Future Management Needs (Yes/No)
4770-160	1.87	Overgrown with vegetation	Open to All Vehicles 5/1 to 11/30	Closed to All Vehicles	Road Placed in Storage for Future Use, Road Closed to All Motorized Vehicles	Minimize aquatic resource impacts	Yes
4770-210	0.19	Accessible with high clearance vehicles	Open to All Vehicles 5/1 to 11/30	Closed to All Vehicles	Road Placed in Storage for Future Use, Road Closed to All Motorized Vehicles	Road tributary to 4750-160 which is proposed to be Closed to All Vehicles	Yes
4770-320	1.19	Overgrown with vegetation	Open to All Vehicles 5/1 to 11/30	Closed to All Vehicles	Road Placed in Storage for Future Use, Road Closed to All Motorized Vehicles	Minimize aquatic resource impacts	Yes
4770-320	0.44	Overgrown with vegetation	Trail Open to Vehicles <50	Closed to All Vehicles	Closed to All Motorized Vehicles and Removed from the Trail System, Road placed in to Storage	Minimize aquatic resource impacts	Yes

Route	Length (miles)	Existing Conditions	Current Authorized Motor Vehicle Use	Proposed Authorized Motor Vehicle Use	Proposed Treatment	Reasoning for proposed change	Retained as a Road for Future Management Needs (Yes/No)
4770-330	0.18	Inaccessible, overgrown with vegetation	Trail Open to Vehicles <50	Closed to All Vehicles	Closed to All Motorized Vehicles and Removed from the Trail System, Road placed in to Storage	Limited recreational opportunity	Yes