UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
Roseburg District Office
777 NW Garden Valley Blvd
Roseburg, OR 97471

In Reply Refer to:
6840 (OR100)

Mr. Jim Thrailkill
Field Office Supervisor, U.S. Fish and Wildlife Service
2900 Stewart Parkway
Roseburg, OR 97470

Ref.: Request for Biological Opinion on Roseburg District's Secretarial Pilot Project, an action that BLM has concluded is **likely to adversely affect** the northern spotted owl and a conference opinion on a determination of **likely to adversely affect** the proposed critical habitat for the northern spotted owl.

Dear Mr. Thrailkill:

This is to convey the Bureau of Land Management's Biological Assessment for the proposed Secretarial Pilot Project.

BLM biologists have worked extensively with U.S. Fish & Wildlife Service biologists, through Level I procedures of the interagency Streamlined Consultation process. We appreciate the regular interaction with yourself and Mr. Center on this project since its inception in December 2010.

The Level 1 team has reviewed and commented on draft versions of the enclosed Biological Assessment in regards to the proposed project and its effects on the spotted owl. It is the conclusion of this Biological Assessment that the proposed action may affect the northern spotted owl. We request concurrence on effects determinations for the proposed Secretarial Pilot Project that is **likely to adversely affect** the northern spotted owl.

Because we have interacted extensively with the Service in conformance with the Streamlined Consultation Level I process, we request receipt of the Biological Opinion on the **likely to adversely affect** action within the 60 day timeframe agreed to in the interagency Streamlining Agreement.

Please contact Chris Foster, the South River Supervisory Natural Resource Specialist, at 541-464-3359, or myself, at 541-464-3211 if you have any questions concerning the attached Biological Assessment.

Sincerely,

/S/ Steven D. Lydick

Steven D. Lydick
Field Manager,
South River Field Office, BLM

Enclosure

cc: Chris Foster, South River
Rex McGraw, DM Staff

A Biological Assessment of the ***Secretarial Pilot Project***, Roseburg District, BLM.

Prepared by:
Christopher C. Foster
Supervisory Natural Resource Specialist
South River Field Office
Roseburg District, BLM

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I. INTRODUCTION

Purpose of the Assessment

This Biological Assessment was prepared as part of consultation under Section 7 of the Endangered Species Act of 1973 (ESA), as amended, for Roseburg Secretarial Demonstration Pilot Project (Pilot Project) on the Roseburg District (District), Bureau of Land Management (BLM) (Figure 1).

The Biological Assessment (Assessment) describes and evaluates the potential effects of the proposed action (described in Section II) on the northern spotted owl (spotted owl, *Strix occidentalis caurina*), its designated Critical Habitat (USDI FWS 2008), and proposed revised Critical Habitat (USDI FWS 2012). This Assessment also describes the environmental baseline for the Action Area.

Scope of the Assessment

This Assessment addresses a timber sale proposed on the approximately 438 acres of federal lands managed by the Bureau of Land Management. This project occurs in the Myrtle Creek and Little River Watersheds.

The Assessment describes and evaluates the anticipated effects of project activities on the northern spotted owl and it's designated and proposed critical habitat. The Assessment evaluates all anticipated effects including those during the critical breeding periods of the species and those that are caused by noise and visual disturbance.

Consultation History

The U.S. Fish and Wildlife Service (Service) issued a biological opinion on the adoption of the Northwest Forest Plan (NFP) on February 10, 1994 (USDA/USDI 1994b). The action agencies (BLM and US Forest Service) and the Service consulted on the preferred alternative described in the Draft NFP and the Service determined that actions consistent with the NFP were not likely to preclude the recovery of species then listed or decrease these species' range such that their future existence would be in jeopardy. Wildlife species then listed included American peregrine falcon (*Falco peregrinus*), American bald eagle (*Haliaeetus leucocephalus*), Columbian white-tailed deer (*Odocoileus virginianus leucurus*), the murrelet, and the spotted owl. The American peregrine falcon was delisted in 1998 (USDI 1999a), the Columbian white-tailed deer was delisted in 2003, and the bald eagle was delisted in 2007. The Roseburg District Resource Management Plan (RMP, USDI 1995) is tiered to and consistent with the NFP.

In February 2011, the Roseburg District Bureau of Land Management (BLM) initiated a collaborative forestry pilot to demonstrate:

1) To create complex, early-successional habitat that will function for an extended period of time, that will: support birds that depend on flowering and fruiting plants, provide forage for ungulates (deer and elk), provide habitat for cavity-nesting birds, provide forage for a variety of moths and butterflies, and provide

forage and habitat for small mammals (wood rats, deer mice, brush hares, etc.) that may provide greater prey abundance for the northern spotted owl.

2) To design the sale with participation of the U.S. Fish and Wildlife for the purpose of applying Recovery Actions from the Northern Spotted Owl Recovery Plan.

3) The third objective is to design and offer timber sales that will provide jobs and contribute timber for manufacturing. Specific ROD/RMP management direction provides for:
    a. Conducting timber harvest and other silvicultural activities in that portion of the Matrix with suitable forest lands (ROD/RMP, p. 33).
    b. Planning and designing forest management activities to produce a sustained yield of products to support local and regional economic activity. A diversity of forest products (timber and non-timber) will be offered to support large and small commercial operations and provide for personal use (ROD/RMP, p. 55).
    c. Providing timber sale volume toward the Roseburg District Allowable Sale Quantity of 7.0 million cubic feet (45 million board feet (ROD/RMP, p. 60)).

Compliance with Planning Decisions and Interagency Consultation Policy

The proposed actions comply with the Record of Decision and the Standards and Guidelines of the NFP and the District Resource Management Plan (RMP, USDI 1995).

This assessment was prepared in accordance with Interagency Streamlined Consultation Procedures for Section 7 of the Endangered Species Act (July 1999). Specialists from both the District and Service contributed to the content and analysis of this document. A complete administrative record of this assessment is on file at the Roseburg District Office.

The proposed action addressed herein will also comply with Revised Recovery Plan for the Northern Spotted Owl (USDI 2011).

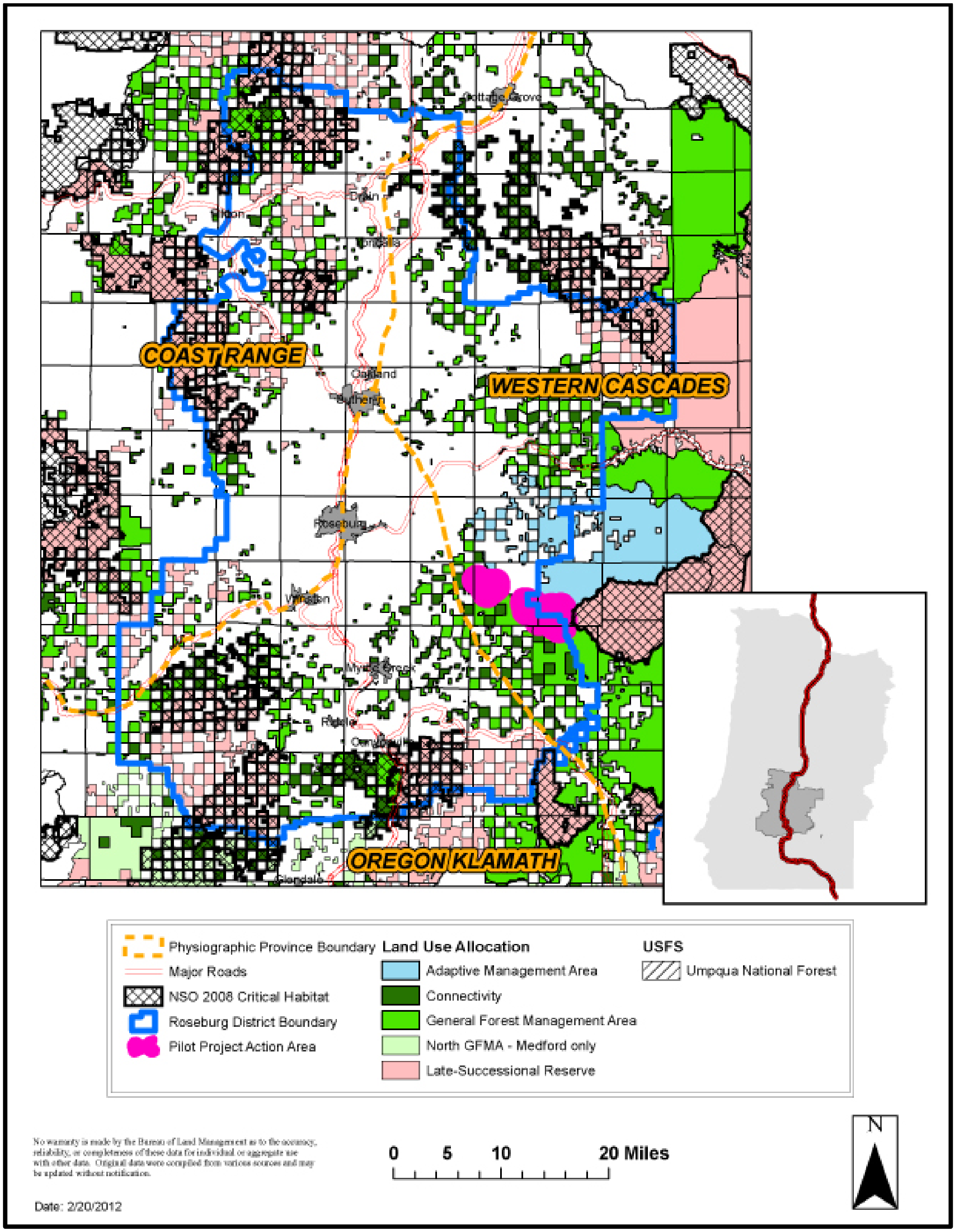

Figure 1. Secretarial Pilot Project area of analysis.

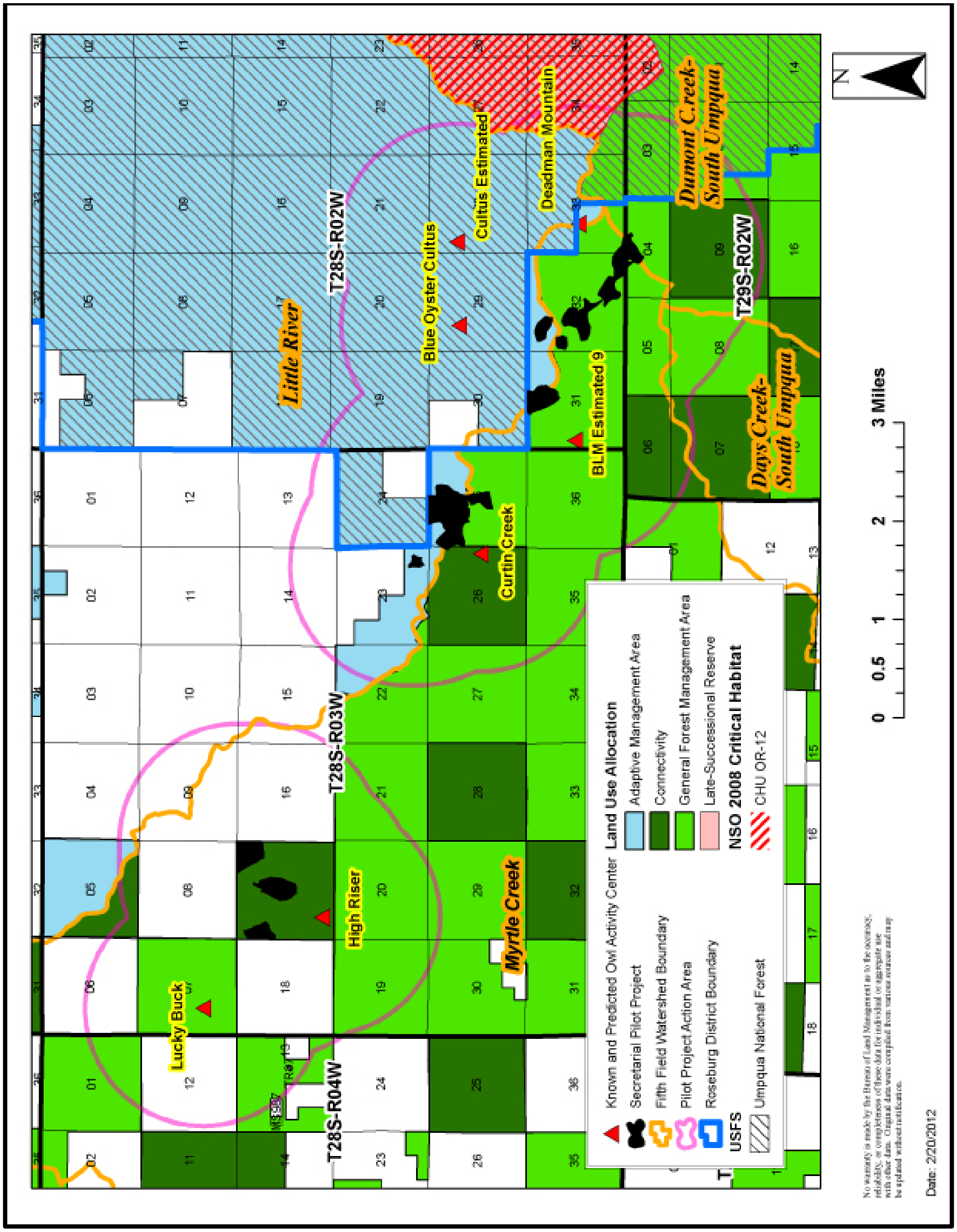

Figure 2. Action area for analysis of effects for the Secretarial Pilot Project.

Definitions

Land Use Allocations

Late-Successional Reserves (LSR) are managed to protect and enhance habitat conditions for late-successional and old-growth related species. These reserves are designed to maintain a functional, interacting late-successional and old-growth ecosystem.

Riparian Reserves (RR) are areas along all streams, wetlands, ponds, lakes, and unstable and potentially unstable areas where riparian-dependent resources receive primary emphasis.

Matrix consists of those federal lands not in the categories above. There are two Matrix land use allocations on the District:

> **General Forest Management Area** (GFMA) is managed primarily for timber production using intensive forestry practices, while maintaining long-term site productivity and biological legacies.
>
> **Connectivity/Diversity Blocks** (C/D) are managed to provide ecotypic richness and diversity as well as a moderately high level of timber production.

Activity Periods

The **breeding period** of the spotted owl is March 1 - September 30.

The **critical breeding period** of the spotted owl is March 1 – July 15.

Spotted Owl

A **known spotted owl site** (known site) is defined as a location with evidence of continued use by spotted owls, including: breeding, repeated location of a pair or single birds during a single season and /or over several years, presence of young before dispersal, or some other strong indication of continual occupation. A known site may include one or more **alternate sites**. Alternate sites are designated when new nest trees are established outside of an existing nest patch. Known sites are identified with a unique four-digit number plus a letter, called the IDNO. The IDNO for the original known site is given the letter O for 'Original,' while subsequent alternate site IDNOs are assigned consecutive letters. For example, the original Gossett Creek known site has IDNO 0355O, while two alternates have IDNOs 0355A and 0355B. Known site locations are based on field survey data.

All known sites located on the District from 1985 to 2010 were used for this analysis. New sites located during the 2011 survey season that are directly impacted by proposed management action projects are included to provide as current a picture as possible for any potential incident take calculation the Service may conduct. A single known site representing the most current location was selected to represent the nest patch, core area, and home range centers. For known sites surveyed during the last five years, the most recently occupied location was used. For known sites which had not been recently surveyed the most recently occupied location was also chosen in these cases.

An **estimated spotted owl site** (estimated site) is a computer-generated location used to analyze effects in areas where survey information is insufficient. Estimated site locations were derived from the analysis of survey data from similar areas within the range of the spotted owl and habitat configuration information from the analysis area. Nearest-neighbor distances and known spotted owl density estimates were used to place estimated sites outside of known home ranges. Estimated sites that fell outside of NRF habitat were manually moved to appropriate locations within the nearest suitable habitat patch of sufficient size; those more than one mile from suitable habitat were discarded. Estimated sites are identified in text and maps with an IDNO using the letters EST (estimated), plus a number beginning with 1 (EST1, EST2, ..etc.).

A combination of known and estimated sites, called the **Northern Spotted Owl Occupancy Map** (NSOOM) was used to analyze the effects of proposed actions for this BA (USFWS, BLM, USFS 2007). The NSOOM includes estimated sites located in unsurveyed habitat, but does not include estimated sites which were verified as unoccupied by field surveys. Known and estimated sites outside the District boundary, but near enough to be affected by proposed actions were included in the NSOOM [PP_owl_sites.shp].

A **provincial home range** (home range) is a circle centered on a spotted owl nest site that represents the area spotted owls are assumed to use for nesting, roosting, and foraging when occupying that site. Home ranges may overlap and the habitat within them is commonly shared between adjacent resident spotted owls and by dispersing owls. Provincial home range radii and acreages vary by physiographic province: Coast Range = 1.5 miles (4,524 acres), Klamath = 1.3 miles (3,340 acres), and Western Cascades = 1.2 miles (2,955 acres). Spotted owls use multiple sites from year to year, and thus their combined home range circles exceed the area around a single site.

The **core area** is a 0.5-mile radius circle to delineate the area most heavily used by spotted owls during the nesting season. Core areas represent areas defended by territorial spotted owls and generally do not overlap the core areas of other spotted owl pairs (USFWS, *et al* 2007). Within the core area, the **nest patch** is defined as forested habitat within 300 meters of a nest tree ((USDI Fish and Wildlife Service, USDI Bureau of Land Management, and USDA Forest Service, 2008)).

Habitats

Capable habitat for the spotted owl is habitat that is either currently suitable or that can become suitable in the future. Roads and non-forest lands (open water, agricultural or urban areas, rock outcrops, grasslands, etc) are considered **non-capable**. An average width of 20 feet was used for all roads in the transportation database included in this analysis.

Spotted Owl

Dispersal habitat for the spotted owl consists of conifer-dominated forest stands with canopy closures of 40 percent or greater and an average diameter at breast height (DBH) of 11 inches or greater. Spotted owls use dispersal habitat to move between blocks of suitable habitat; juveniles use it to disperse from natal territories. Dispersal habitat may have roosting and foraging components, enabling spotted owls to survive, but lacks structure suitable for nesting. Although suitable habitat also functions as dispersal habitat, these terms are used separately. Given forest productivity and growth on the District, conifer stands between 40 and 80 years of age were considered dispersal habitat for this analysis. Roads are not considered dispersal habitat. An average width of 20 feet was used for all roads included in the transportation database, and these acres were subtracted from stand acres.

Suitable habitat for the spotted owl is used for nesting <u>and</u> roosting <u>and</u> foraging, it is also called NRF habitat. Suitable habitat also functions as dispersal habitat, but these terms are used separately. Generally, this habitat is 80 years of age or older, contains large-diameter trees and snags with nesting structure, is multi-storied, and has sufficient vertical and horizontal cover to provide opportunities for nesting, roosting and foraging. The canopy closure generally exceeds 60 percent. Stands with birthdates of 1931 or earlier were considered suitable habitat for this analysis. Roads are not considered suitable habitat. An average width of 20 feet was used for all roads included in the transportation database, and these acres were subtracted from the stand acres [PP_aa_NSO_Habitat_new.shp].

Unoccupied suitable habitat has been surveyed for three years, to protocol standards, with sufficient evidence to declare that the habitat is unoccupied by the spotted owl. **Unsurveyed suitable habitat** does not meet this standard (U.S. Fish and Wildlife Service, 2011).

Critical Habitat for the spotted owl was designated in 2008 in Federal Register 73 and describes the **Primary Constituent Elements** that support nesting, roosting, foraging, and dispersal. Designated Critical Habitat also includes forest land that is currently unsuitable, but has the capability of becoming suitable habitat in the future (73 FR 47347). A proposed rule is currently out that redefines critical habitat location and **Primary Constituent Elements** (77 Federal Register 14062). Newly propose **Primary Constiuent Elements** include 1) many forest types that include early-, mid-, and late-seral stage; 2) nesting and roosting habitat; 3) foraging habitat; and 4) habitat that supports the colonization phase of dispersal.

Habitat Modifications

Maintain habitat means to affect the quality of habitat without altering its function. This term includes situations where the short term effect to habitat may be a reduction in quality, but the long term effect is neutral or beneficial, as long as the reduction in quality does not amount to changing the function.

Downgrade habitat means to alter the function of spotted owl suitable habitat so that the habitat no longer supports nesting and roosting and foraging. Downgraded suitable habitat will support spotted owl dispersal.

Remove habitat means to alter spotted owl suitable or dispersal habitat, or murrelet suitable habitat, so that the habitat no longer provides any function for the species.

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 would be expected to exceed the level of discountable or insignificant, or might cause the incidental "take" of a listed animal. Thus, within the disruption distance, actions would 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. The **disruption threshold** is the distance within which activities 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 2004b:51) (**Table 1**).

A **disturbance distance** is the distance within which the effects to listed species from noise, human intrusion, and mechanical movement associated with an action would be expected to be discountable or insignificant and incidental "take" would 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 would 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 according to 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 (shown in Table 1) from known or estimated spotted owl sites, unsurveyed suitable owl habitat, murrelet occupied sites or unsurveyed suitable murrelet 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 1. Disturbance and Disruption threshold distances for northern spotted owl.

	Spotted Owl	
Activity	Disruption Threshold Distance	Disturbance Threshold Distance
Blast of more than two pounds of explosives	1 mile	
Blast of two pounds or less of explosives	120 yards	
Impact pile driver, jackhammer, or rock drill	60 yards	440 yards
Type I or II helicopter	440 yards	880 yards
Type III or IV helicopter or single engine airplane	120 yards	440 yards
Use of chainsaws	65 yards	440 yards
Use of heavy equipment	35 yards	440 yards
Rock crusher	180 yards	440 yards
Prescribed burning	440 yards	

II. DESCRIPTION OF THE PROPOSED ACTION

The Secretarial Pilot Project occurs in the Northeast corner of the South River Field Office, Roseburg District (**Figure 1**). The proposal is to apply a variable retention harvest (VRH) techniques, as described by Drs, Johnson and Franklin (2009) to 438 acres of upland forests, including 21 acres of density management to riparian buffer areas (

Table 2). Density management would be limited to areas outside of streamside "no-treatment areas" (those areas within 35 feet of a non-fish bearing stream channel and 60 feet of fish-bearing channel, and other unique geologic and hydrologic features).

Table 2. Overview of the proposed Variable Retention Harvest units within the Secretarial Pilot Project.

Unit	Total Unit Area (ac)	Available Habitat (ac)		Dispersed Retention Area (ac)	Treated Riparian Reserve (ac)	Untreated Riparian Reserve (ac)	Untreated Aggregate Retention Area (ac)
		NRF	Dispersal				
28-2-31A	26	26	0	22	0	0	4
28-2-31B	15	15	0	13	0	0	2
28-2-32A	71	2	69	51	0	13	7
28-2-32B	45	2	43	14	0	29	2
28-2-32C	9	7	1	7	0	0	2
28-2-32D	18	18	0	15	0	0	3
28-3-17A	24	0	24	14	5	4	1
28-3-17B	43	0	43	29	7	4	3
28-3-17C	41	0	41	23	9	4	5
28-3-23A	8	8	0	3	0	0	5
28-3-25A	138	138	0	93	0	14	31
Total	**438**	**216**	**221**	**284**	**21**	**68**	**65**

Primary access would be provided by roads under the control of the BLM, the Umpqua National Forest, and Douglas County supplemented by the following (

Table 3):

- Construction of 14 spur roads with a combined length of 1.2 miles,
- Improvements to 0.16 miles of existing system and non-system[1] roads, and

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[1] Non-system roads are roads that were constructed in the past, but for which no records of their authorization and

- Maintenance/renovation to 7.44 miles of existing system and non-system roads.

Maintenance/Renovation and improvement will be performed on existing road beds whereas construction will build roads. Approximately 1.98 miles of road will be decommissioned following harvest operations and could include one or more of the following methods: removing drainage structures or culverts, subsoiling, adding waterbars where needed, mulching with logging slash where available (or with straw if logging slash is not available), blocking with trench barrier(s), and/or using the logging slash mulch as the blocking device (

Table 3).

Table 3. Road activity on the Secretarial Pilot Project

Road Activity	Substrate – Rock (miles)	Substrate – Natural (miles)	Substrate – Paved (miles)	Total Length (miles)
Construction	0.7	0.5	0.0	1.2
Improvement	0.16	0.0	0.0	0.16
Maintenance/Renovation	6.79	0.62	0.03	7.44
TOTAL	7.65	1.12	0.03	8.8
Decommissioning	0.86	1.12	0.0	1.98

Riparian Reserves

Riparian Reserves in the Myrtle Creek and Middle South Umpqua River-Dumont Creek watersheds and in the Little River watershed would be established based on a site-potential tree height calculated from the average site index of inventory plots throughout each of the individual watersheds that are located on lands capable of supporting commercial timber stands. The calculated site-potential tree heights for the three watersheds are 160 feet, 180 feet, and 180 feet, respectively.

On intermittent non-fish-bearing streams Riparian Reserves would be one site-potential tree height in width, slope distance, measured from the top of the stream bank. On all fish-bearing streams, perennial or intermittent, and on perennial streams that are not fish-bearing Riparian Reserves width would be two site-potential tree heights in width, slope distance, measured from the top of the stream bank. On wetlands greater than one-acre in size, Riparian Reserves would be one site-potential tree height in width measured from the outer edge of riparian vegetation, or the extent of seasonally saturated soils. (ROD/RMP, p. 24)

Where density management is not prescribed, timber felling in the dispersed retention areas would be directionally felled away from Riparian Reserves to protect and maintain their physical integrity. No yarding or equipment operation would be allowed within them. If necessary to use trees in Riparian Reserves as tailholds, measures

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construction exist. These may include truck roads for previous timber harvest, tractor roads constructed for fire suppression access, and way roads and jeep roads.

would be implemented to protect the trees from serious damage by requiring the use of straps, plates or cribbing. If cutting of tailhold trees was necessary, the trees would be left on site to supplement existing large wood for potential instream recruitment.

Aggregated and Dispersed Retention

Units would be designed to retain a minimum of 20 percent of the pre-harvest stand basal area through a combination of aggregates and dispersed retention trees. The majority of the retention would be in the form of aggregates one-quarter of an acre or larger in area, while the remainder would be in the form of dispersed retention represented by scattered individual trees, or groups and clumps of trees less than one-quarter of an acre in area. Candidate areas for aggregates would include:

- Representative patches of the pre-harvest forest stand;
- Concentrations of trees that are older and larger than the prevailing stand conditions;
- Trees with uncommon characteristics (e.g., deformed boles, cavities, etc.);
- Concentrations of large down wood;
- Concentrations of snags;
- Special habitats such as seeps, rocky outcrops, and areas of high species diversity;
- Riparian Reserves; and
- Patches dominated by hardwoods.

Aggregates would be well distributed throughout the proposed harvest units, although the type of harvest system to be used, specifically cable yarding, could constrain the potential location of the aggregates. For a given level of retention there would also be tradeoffs between aggregate size and distributional objectives, e.g., focusing on distribution may require creating more small aggregates rather than a few large ones.

Dispersed retention would focus on predominant, dominant and co-dominant trees, some of which would be expected to provide snags and large down wood within the harvested area. As with aggregates, operational considerations would affect placement of dispersed retention. Retention trees, within the dispersed retention areas, would reflect the existing conifer species composition of the stands and full range of diameter classes greater than 20 inches diameter breast height (ROD/RMP, p. 64). Entries into younger stands would reserve the largest available trees (ROD/RMP, p. 151).

Green tree retention required by the ROD/RMP would be met at individual unit scale by summing qualifying trees in both the aggregate and dispersed retention.

VRH differs from normal NWFP regeneration harvests in a number of ways:

1. Under VRH prescriptions retention of aggregates are intended to protect special habitat features, or a representative portion of the available habitat; under the NWFP prescription dispersed retention may be used to protect similar features, but it is not required. In many instances, aggregate retention under the NWFP were only required for riparian reserves and special habitat features, not down wood, snag clumps, older tree patches, etc. Aggregates, under VRH, are intended to be a focal point for habitat/structural diversity in the developing stand.
2. Lower planting densities – approximately 600 tpa[2] would be planted under the NWFP, under VRH we are only planting 200 tpa. The objective of this lower planting density is to lengthen the period of open canopy condition from 10-15 years until 30 years, the removal of conifer may be considered if canopy closure is expected to occur prior to 30 years. It is for this purpose that VRH was proposed, to create quality early

[2] tpa = Trees per acre

seral habitat, relying on site condition, natural seed fall and native herbivory to dictate successional progress. It is these "natural" early seral conditions that are lacking on the landscape (Johnson and Franklin 2009).

3. Decommissioning of road normally includes subsoiling, seeding with native/sterile grasses, and mulching. In the Pilot Project we are proposing to seed and plant native forbs and deciduous shrubs in addition to grasses.
4. The intent of VRH, to create a more natural early-successional habitat permits us to opportunistically plant non-conifer tree species, for example: red-osier dogwood, Pacific dogwood, and chokecherry with the appropriate pockets of the dispersed retention areas. Even though NWFP sales contain ecological forestry components, it is still implemented to produce timber products, minimizing early-successional habitat conditions and length on the landscape.

The difference in the role of these aggregate retention blocks is evident in **Table 4** and Table 5. These two tables summarize the retention level for each unit (expressed for aggregate retention blocks as a percentage of total stand area; dispersed retention is expressed as a percentage of total stand basal area(pre-harvest)), under VRH and traditional NWFP regeneration harvest (The difference in unconstrained versus constrained accounting is that unconstrained includes all retention blocks even if they essentially define the outside cutting boundary of the unit, constrained only counts riparian reserves areas when they interact with the interior of the treatment area.). Units 28-3-17A, 17B, and 17C are not compared in Table 5 because under the NWFP they would not be available for regeneration harvest. The total estimates illustrate the differences--under VRH 23 percent of the unit area will be retained in aggregate retention blocks (constrained), compared to 9 percent under NWFP; an additional 6 percent of the unit basal area (pre-harvest) will be retained as dispersed retention trees, compared to 8 (Table 4 and Table 5). Roughly 28 percent of the units will be retained under the VRH prescription, compared to 17 percent under the NWFP. Looking at the constrained accounting columns -- overall retention levels more remain the same or increase in all of the VRH units, compared to NWFP regeneration harvest; in 28-2-32A, 32B, 32C, and 32C retention levels increase multiples of 3-4 (**Table 4** and Table 5). Under the NWFP aggregate retention declines in all units except 28-3-23A (Table 4 and Table 5).

Table 4. Predicted retenion levels immediately post-harvest under variable retention harvest.

Group	**Unit #**	**Retention** (% of unit equivalent acres) Unconstrained Accounting[1]			**Retention** (% of unit equivalent acres) Constrained Accounting[2]		
		Aggregate[3]	**Dispersed[4]**	**Total**	**Aggregate[3]**	**Dispersed[4]**	**Total**
A	31AB	14	10	24	14	10	24
B	32A	27	1	28	19	1	20
B	32B	69	6	75	14	6	20
C	23A	63	0	63	63	0	63
C	25A	32	9	41	32	9	41
C	32C	17	4	21	17	4	21
C	32D	16	5	21	16	5	21
D	17A	44	5	49	15	5	20
D	17B	33	4	37	18	4	22
D	17C	43	3	46	21	3	24

Group	Unit #	Retention (% of unit equivalent acres) Unconstrained Accounting[1]			Retention (% of unit equivalent acres) Constrained Accounting[2]		
		Aggregate[3]	**Dispersed[4]**	**Total**	**Aggregate[3]**	**Dispersed[4]**	**Total**
Weighted Totals		35	6	41	23	6	28

[1] all stand acres considered in calculating percentages
[2] limited Riparian Reserve acres considered in calculating percentages per Franklin and Johnson Retention
[3] Percent Aggregate Retention is expressed as a percentage of total unit area.
[4] Dispersed Retention is expressed as a percentage of total stand Basal Area (pre-harvest).
Marking Guidelines (4-24-2011)

Table 5. Prediction levels immediately post-harvest, under a NWFP regeneration harvest.

Group	Unit #	Retention (% of unit equivalent acres) Unconstrained Accounting			Retention (% of unit equivalent acres) Constrained Accounting		
		Aggregate[3]	**Dispersed[4]**	**Total**	**Aggregate[3]**	**Dispersed[4]**	**Total**
A	31AB	7	11	18	7	11	18
B	32A	18	4	22	1	4	5
B	32B	65	7	72	0	7	7
C	23A	63	0	63	63	0	63
C	25A	25	10	35	15	10	25
C	32C	0	5	5	0	5	5
C	32D	4	5	9	2	5	7
Weighted Totals		26	8	34	9	8	17

[1] all stand acres considered in calculating percentages
[2] limited Riparian Reserve acres considered in calculating percentages per Franklin and Johnson Retention
[3] Percent Aggregate Retention is expressed as a percentage of total unit area.
[4] Dispersed Retention is expressed as a percentage of total stand Basal Area (pre-harvest).
Marking Guidelines (4-24-2011)

Snags and Large Down Wood

Snags 20 inches or greater in diameter breast height would be reserved where operationally practical and not a safety concern, to contribute toward the analytical assumption of providing an average of 1.2 snags per acre to support cavity nesting birds at 40 percent of potential population levels (USDA Forest Service and USDI Bureau of Land Management 1994a). This may include establishing aggregate retention around concentrations of snags and clumping trees around individual scattered snags. It is assumed that additional snags would be created by yarding damage to retention trees, wind breakage, and mortality caused by burning. Additional snags could be created by mechanical treatment where post-harvest assessment indicates a deficit in the desired numbers of snags.

An average of 120 linear feet per acre of large down wood in Decay Classes 1 and 2 would be provided, initially described in the Northwest Forest Plan(USDA Forest Service and USDI Bureau of Land Management 1994a) as pieces greater than or equal to 16 inches in diameter and 16 feet long.

In addition to natural events such as windfall, or purposely felling retention trees, additional down wood may occur due to breakage from felling. Existing large down wood in Decay Classes 3, 4 and 5 would also be reserved under contract provisions.

Density Management

Density management would be applied on 21 acres of riparian reserves where such treatments would benefit riparian health. A variable density prescription would be applied outside of the "no-treatment" areas within the Riparian Reserves based on a combination of basal area and number of trees per acre to encourage development of structural diversity. An average minimum canopy cover[3] of 50 percent would be retained outside of the "no treatment" areas to maintain effective stream shading.

Gaps and skips would be employed, with the placement of skips focused on structural and habitat components such as snags, patches of hardwood trees, and deposits of down wood. Thinning would be from below, removing the suppressed and sub-canopy trees first. Trees selected for retention would generally have a live crown ratio of at least 30 percent in order to increase the likelihood of release and increased growth after density management (Daniel, et. al. 1979). As a means of promoting greater structural diversity, selection of trees for retention may include trees with broken or deformed boles and crowns.

Conifers such as western hemlock, western red cedar, incense-cedar, and pines would be retained in numbers reflecting historic percentages of stand composition, whenever possible. Hardwood trees greater than ten (10) inches diameter breast height would be selected for retention where present and considered likely to survive thinning operations.

Trees and snags felled in Riparian Reserves to clear yarding roads or provide for operational safety would be left on site to provide coarse wood for potential instream recruitment.

Yarding

Timber harvest will be accomplished with a combination of cable and ground based systems (225 and 80 acres, respectively).

Density management in Riparian Reserves would utilize skyline cable yarding systems capable of maintaining a minimum of one-end log suspension, and a lateral yarding capacity of at least 100-feet to minimize the number of yarding corridors required and the overall area subject to soil disturbance and displacement. Waterbars would be constructed in the yarding corridors if deemed necessary by the contract administrator in coordination with the soil scientist, to prevent erosion and channeling of runoff to streams.

Activity Fuels Reduction and Site Preparation

Prescribed fire would be applied to all of the harvest units except for Unit 28-3-17A where the high proportion of Category 1 soils, consisting of both steep slopes and high proportion of granitic parent material, would pose an unacceptable risk for soil damage and loss of site productivity.

The objectives of prescribed burning would be to reduce activity fuels created by timber harvest, prepare the units for replanting, create additional snags, and emulate the effects of natural disturbance to attain and enhance ecological processes and functions associated with normal and periodic return of wildfire.

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[3] Canopy cover, also referred to as crown cover, is the ground area covered by the crowns of trees or woody vegetation as delimited by the vertical projection of crown perimeters, commonly expressed as a percentage of total ground area (Helms 1998).

Perimeter control lines would be provided by roads and hand-constructed fire trails generally three to five feet in width. Fire trails would not be constructed at the perimeter of Riparian Reserves. Retention aggregates would also be fire-trailed where the objective is to exclude fire to preserve current structural character and components. Pull-back of fuels from fire control lines would be where necessary to improve the safety of the control lines.

Landings would be burned in the first wet season (late-autumn or early-winter) following completion of harvest.

Units would be broadcast burned using hand ignition methods in order to control rate of spread, and as a means of selectively burning some areas while excluding others.

For Units 28-3-17B and C, and Unit 28-2-32B under-burning would be conducted with ignition to the outer boundaries of the "no-treatment" areas within the Riparian Reserves, and allowed to back downslope from there. In all other cases, under-burning would be conducted with ignition to the outer boundaries of the Riparian Reserves and allowed to back downslope.

The seasonality of burning would be influenced by a number of factors. Historically, fires would be ignited by lightning in July and August. It would not be likely that permission to burn could be obtained at this time of year, during the normal fire season, or that resource objectives could be met in a controlled manner. The potential for fall burning would exist after measurable precipitation, with results closely resembling a summer burn. Large fuels would be at their driest, however, and a higher percentage of large wood would be consumed.

Occasionally, weather conditions provide a suitable window for winter burning, but given the elevation of the project area the absence of snow would be highly unlikely.

Spring burning, typically between April and July, is more manageable in that there are more opportunities to burn based on weather restrictions, fire behavior is more likely to achieve the majority of resource objectives, there is a decreased risk of dispersed retention tree mortality, and less risk for escape from the burn unit. Fuel moistures are such that there is little likelihood for erratic fire behavior, fuels less than three inches in diameter are largely consumed, and large fuels have sufficient moisture content to minimize consumption.

In the event that the necessary windows for broadcast burning did not materialize, there would still be a need to treat the logging residues to decrease fire risk and facilitate planting. In areas of ground-based harvest, an excavator would be brought in to pile slash for burning. In other instances, slash would be hand-piled and burned within 100 feet of through-roads and within 50 feet of secondary roads.

Reforestation and Stand Maintenance

Reforestation would utilize both artificial (planting) and natural regeneration. Planting would consist of a mixture of species at an average density of approximately 200 trees per acre. It is expected that some amount of natural regeneration would supplement stocking over time. The species composition of natural regeneration would depend on tree species adjacent to harvested areas, seed bed conditions, timing and abundance of seed crops, seed predation, and weather conditions.

Treatments to maintain survival and long-term dominance of tree species including mulching to reduce competition from grasses on drier south and west aspects, protection from herbivory (browsing), limited brushing, and stand density control are anticipated. Treatment types and timing would be determined from follow-up evaluation exams conducted post-harvest.

Stand density would be monitored and density control treatments applied as needed to promote an extended period of less than complete tree canopy cover. Stand density targets at age ten to 20 years are approximately 150 to 250 trees per acre (200±25%), based on land use allocation (ROD/RMP, p. 64).

Non-coniferous Revegetation

Contrary to standard harvest operations where the subsoiling of roads would be followed with the seeding with native, or sterile, grasses and mulching: under this prescription, where soil depth and character allow, the road beds would be seeded and planted with native grasses, forbs, and deciduous shrubs appropriate to site conditions. Some conifer species such as western red-cedar could also be planted consistent with specific wildlife objectives.

Some native forbs such as wild strawberry (*Fragaria virginiana*), black raspberry (*Rubus leucodermis*), Oregon bedstraw (*Gallium oreganum*), wild ginger (*Asarum caudatum*), twinflower (*Linnaea borealis*), and kinnikinnik (*Arctostaphylos uva-ursa*) are expected to re-colonize the road beds in a timely manner and would not be the focus of the treatments.

Supplemental seeding or planting, if needed, could include: native grasses such as Romer's fescue (*Festuca roemer*), western fescue (*Festuca occidentalis*) and Columbian brome (*Bromus vulgaris*); native forbs such as false Solomon's seal (*Smilacina racemosa*), harebell (*Campanula scouleri*), inside-out flower (*Vancouveria hexandra*), and queen's cup (*Clintonia uniflora*); and native, deciduous shrubs such as red huckleberry (*Vaccinium parvifolium*), red and blue elderberry (*Sambucus racemosa* and *S. cerulean*), and wild rose (*Rosa gymnocarpa*).

Opportunistic native planting(s) could occur within units after harvest and post-management activities have taken place to re-establish representative non-conifer species in small pockets or riparian areas. Examples could include: red-osier dogwood (*Cornus stolonifera*), Pacific dogwood (*Cornus nuttallii*), and chokecherry (*Prunus virginiana*).

Project Design Criteria

Project design criteria (PDC) are mitigation measures applied to project activities designed to minimize potential detrimental effects to listed species. Use of PDC may result in a determination of "*no effect*" (NE) for a project which would have otherwise been a "*may affect, not likely to adversely affect*" (NLAA). In other cases PDC have resulted in a determination of NLAA for a project which might have otherwise been determined to be a "*may affect, likely to adversely affect*" (LAA).

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 District 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.

The following PDCs, designed to mitigate impacts to the northern spotted owl, will be implemented:

1) Operations within applicable disruption threshold distances of known northern spotted owl sites, estimated sites or unsurveyed suitable habitat would be prohibited from March 1 to July 15, both dates inclusive. If

two years of protocol surveys do not detect owl presence or activity, restrictions may be waived until March 1 of the following year subject to spot checks prior to or concurrent with operations.

2) Removal of suitable nesting, roosting and foraging habitat within one-quarter mile of known northern spotted owl sites, estimated sites, or unsurveyed suitable habitat would be prohibited from March 1 to September 30, both dates inclusive. If two years of protocol surveys do not detect owl presence or activity, restrictions may be waived until March 1 of the following year subject to spot checks prior to or concurrent with operations.

3) Broadcast burning within one-quarter mile of known northern spotted owl sites, estimated sites, or unsurveyed suitable habitat would be prohibited from March 1 to July 15, both dates inclusive. If two years of protocol surveys do not detect owl presence or activity, restrictions may be waived until March 1 of the following year subject to spot checks prior to or concurrent with operations.

4) With respect to the three preceding seasonal restrictions (above, 1-3), if two years of protocol surveys have been completed, then spot checks are not required if the following four conditions have been met:

   a. No territorial northern spotted owls are detected during protocol survey visits,
   b. No northern spotted owl activity centers are known to occur in the survey area,
   c. No barred owls are detected in the survey area during protocol surveys or are otherwise known to occur in the survey area, and
   d. All northern spotted owl habitat within the survey area has been completely covered during protocol surveys (i.e. there is no habitat that was omitted due to inaccessibility, landowner restrictions, incomplete survey, or other constraints).

If any of the preceding conditions (above, a-d) are not met, then spot checks are necessary in order to grant early waiver of seasonal restrictions. Projects may be initiated during the breeding season, concurrent with spot checks, if:

- No territorial northern spotted owls are detected during protocol surveys and there are no known northern spotted owl sites in the survey area, but barred owls are known to occur in the survey area, or
- No territorial northern spotted owls are detected during protocol surveys, but known northern spotted owl sites do occur in the survey area.

Spot checks would be required prior to initiation of operations occurring after February 1, if:

- No territorial northern spotted owls are detected during protocol surveys and no known northern spotted owl sites are known to occur within the survey area, but portions of northern spotted owl habitat within the survey area was unsurveyed during protocol surveys due to inaccessibility, landowner restrictions, incomplete survey, or other constraints and
- If territorial northern spotted owls are detected during protocol surveys.

Description of the Action Area

The action area[4] associated with this proposed timber sale encompasses approximately 19,800 acres of federal and private timberlands (15,130 acres – federal, 4670 acres – private) in the Roseburg District, BLM and the Umpqua National Forest (Table 10, **Figure 2**). There are four, historic northern spotted owl activity centers and two predicted sites within the action area. Northern spotted owl critical habitat accounts for 137 acres of the action area (Table 10, **Figure 2)**

Suitable habitat for the northern spotted owl occurs on approximately 9596 acres, of the 15,230 acres of federal lands (63 percent) (Table 10). Suitable habitat for the northern spotted owl comprises approximately 134 acres of the private forest lands (3%) within the action areas; dispersal habitat on private lands comprises approximately 2,000 acres (42%) (Table 10).

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[4] The Action Area is defined as the area encompassed with a 1.2 mile radius around all treatment units and all known and predicted northern spotted owl activity centers within 1.2 miles of the treatment units.

III. STATUS OF THE NORTHERN SPOTTED OWL

Legal Status

The spotted owl was listed as threatened on June 26, 1990 due to widespread loss and adverse modification of suitable habitat across the owl's entire range and the inadequacy of existing regulatory mechanisms to conserve the owl (USDI FWS 1990a, p. 26114). The Service recovery priority number for the spotted owl is 12C (USDI FWS 2011, p. I6), on a scale of 1C (highest) to 18 (lowest). This number reflects a moderate degree of threat, a low potential for recovery, the spotted owl's taxonomic status as a subspecies and inherent conflicts with development, construction, or other economic activity given the economic value of older forest spotted owl habitat. A moderate degree of threat equates to a continual population decline and threat to its habitat, although extinction is not imminent. While the Service is optimistic regarding the potential for recovery, there is uncertainty regarding our ability to alleviate the barred owl impacts to spotted owls and the techniques are still experimental, which matches our guidelines' "low recovery potential" definition (USDI FWS 1983a p.43101-43104, b p.51985). The spotted owl was originally listed with a recovery priority number of 3C, but that number was changed to 6C in 2004 during the 5-year review of the species (USDI FWS 2004, p. 55) and to 12C in the Revised Recovery Plan for the Northern Spotted Owl (USFWS 2012 pI-6).

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, pp.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 Nevadas, appears to be stable (Barrowclough et al. 2005, p. 1116).

Physical Description

The northern spotted owl is a medium-sized owl and is the largest of the three subspecies of spotted owls (Gutiérrez 1996, p. 2). It is approximately 46 to 48 centimeters (18 inches to 19 inches) long and the sexes are dimorphic, with males averaging about 13 percent smaller than females. The mean mass of 971 males taken during 1,108 captures was 580.4 grams (1.28 pounds) (out of a range 430.0 to 690.0 grams) (0.95 pound to 1.52 pounds), and the mean mass of 874 females taken during 1,016 captures was 664.5 grams (1.46 pounds) (out of a range 490.0 to 885.0 grams) (1.1 pounds to 1.95 pounds) (P. Loschl and E. Forsman, pers. comm. cited in USDI FWS 2008b, p. 43). 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 (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 (Figure 2) based on recognized landscape subdivisions exhibiting different physical and environmental features (USDI FWS 1992a, p. 31). 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 1992b, p. 1799).

Behavior

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. Territorial defense is primarily effected by hooting, barking and whistle type calls. Some spotted owls are not territorial but either remain as residents within the territory of a pair or move among territories (Gutiérrez 1996, p. 4). These birds are referred to as "floaters." Floaters have special significance in spotted owl populations because they may buffer the territorial population from decline (Franklin 1992, p. 822). Little is known about floaters other than that they exist and typically do not respond to calls as vigorously as territorial birds (Gutiérrez 1996, p. 4).

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

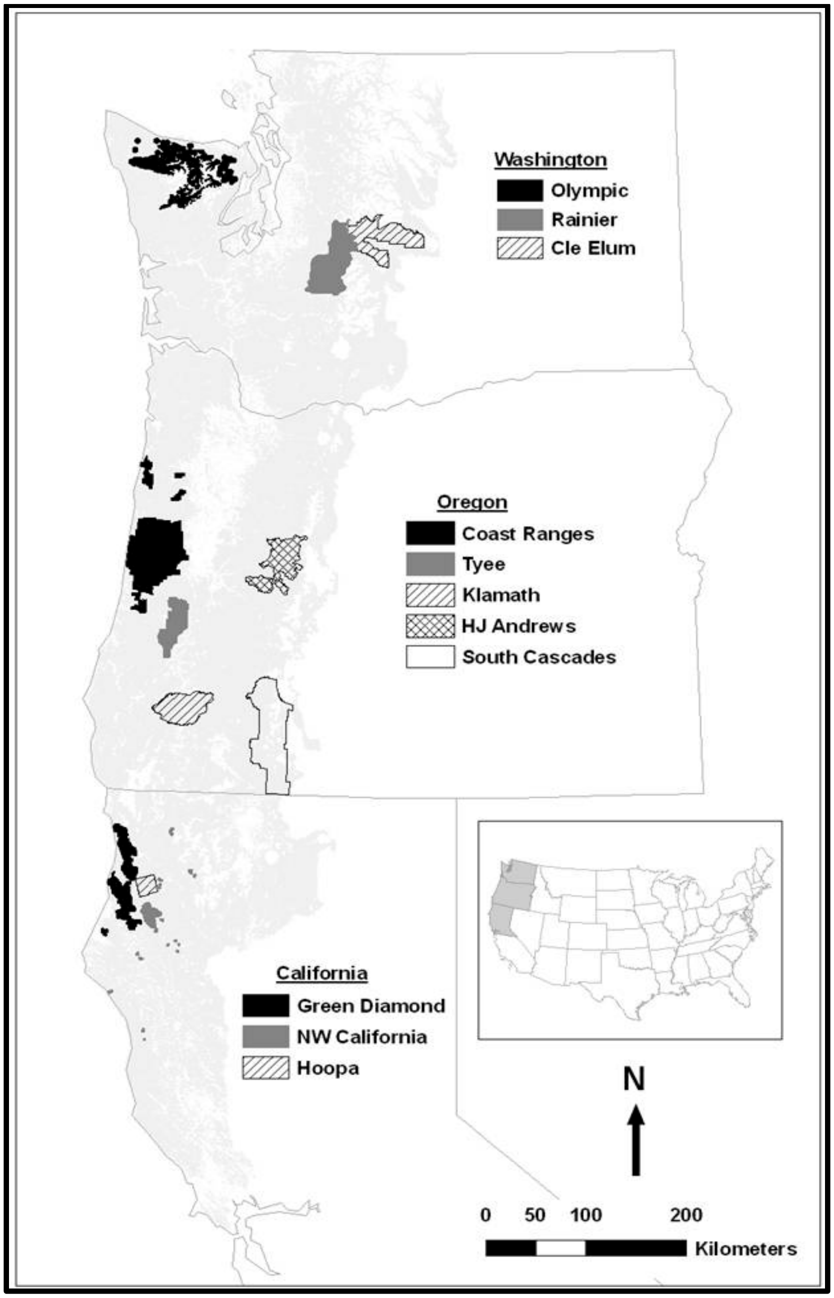

Figure 3. Spotted owl demographic study areas (Forsman et al 2011a).

Habitat Relationships

Home Range. Home-range sizes vary geographically, generally increasing from south to north, which is likely a response to differences in habitat quality (USDI FWS 1990a, p. 26117). Estimates of median size of their annual home range (the area traversed by an individual or pair during their normal activities (Thomas and Raphael 1993, p. IX-15) vary by province and range from 2,955 acres in the Oregon Cascades (Thomas et al. 1990, p. 194) to 14,211 acres on the Olympic Peninsula (USDI FWS 1994a, p. 3). Zabel et al. (1995, p. 436) showed that these provincial home ranges are larger where flying squirrels are the predominant prey and smaller where wood rats are the predominant prey. Home ranges of adjacent pairs overlap (Forsman et al. 1984, p. 22; Solis and Gutiérrez 1990, p. 746), suggesting that the defended area is smaller than the area used for foraging. Within the home range there is a smaller area of concentrated use during the breeding season (~20% of the home range), often referred to as the core area (Bingham and Noon 1997, pp. 133-135). Spotted owl core areas vary in size geographically and provide habitat elements that are important for the reproductive efficacy of the territory, such as the nest tree, roost sites and foraging areas (Bingham and Noon 1997, p. 134). Spotted owls use smaller home ranges during the breeding season and often dramatically increase their home range size during fall and winter (Forsman et al. 1984, pp. 21-22; Sisco 1990, p. iii).

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

Habitat Use. 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).

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

Spotted owls nest almost exclusively in trees. Like roosts, nest sites are found in forests having complex structure dominated by large diameter trees (Forsman et al. 1984, p.30; Hershey et al. 1998, p.1402). Even in forests that have been previously logged, spotted owls select forests having a structure (i.e., larger trees, greater canopy closure) different than forests generally available to them (Folliard 1993, p. 40; Buchanan et al. 1995, p.1402; Hershey et al. 1998 p. 1404).

Foraging habitat is the most variable of all habitats used by territorial spotted owls (USDI FWS 1992a, p. 20). Descriptions of foraging habitat have ranged from complex structure (Solis and Gutiérrez 1990, pp. 742-744) to forests with lower canopy closure and smaller trees than forests containing nests or roosts (Gutiérrez 1996, p.5).

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

Foraging habitat for spotted owls provides a food supply for survival and reproduction. Foraging activity is positively associated with tree height diversity (North et al. 1999, p. 524), canopy closure (Irwin et al. 2000, p. 180; Courtney et al. 2004, p. 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, p. 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. 2005, 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, p. 56-57).

Dispersal habitat is essential to maintaining stable populations by facilitating movement of spotted owls across landscapes to fill territorial vacancies when resident spotted owls die or leave their territories, and for 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. 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 1992b, p. 1798). Forsman et al. (2002, p. 22) found that spotted owls could disperse through highly fragmented forest landscapes. However, the stand-level and landscape-level attributes of forests needed to facilitate successful dispersal have not been thoroughly evaluated (Buchanan 2004, p. 1341).

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

In the Western Washington Cascades, spotted owls roosted in mature forests dominated by trees greater than 50 centimeters (19.7 inches) dbh with greater than 60 percent canopy closure more often than expected for roosting during the non-breeding season. Spotted owls also used young forest (trees of 20 to 50 centimeters (7.9 inches to 19.7 inches) dbh with greater than 60 percent canopy closure) less often than expected based on this habitat's availability (Herter et al. 2002, p. 437).

In the Coast Ranges, Western Oregon Cascades and the Olympic Peninsula, radio-marked spotted owls selected for old-growth and mature forests for foraging and roosting and used young forests less than predicted based on availability (Forsman et al. 1984, pp. 24-25; Carey et al. 1990, pp. 14-15; 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 with spotted owls generally selecting mature and older conifer and broadleaf forest types.

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

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

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 (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 (Forsman et al. 1984, pp. 32-34, Anthony et al. 2006, p. 28), and renesting after a failed nesting attempt is rare (Gutiérrez 1996, p. 4). The small clutch size, temporal variability in nesting success, and delayed onset of breeding all contribute to the relatively low fecundity of this species (Gutiérrez 1996, p. 4).

Courtship behavior usually begins in February or March, and females typically lay eggs in late March or April. The timing of nesting and fledging varies with latitude and elevation (Forsman et al. 1984, p. 32). After they leave the nest in late May or June, juvenile spotted owls depend on their parents until they are able to fly and hunt on their own. Parental care continues after fledging into September (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).

Dispersal Biology

Natal dispersal of spotted owls typically occurs in September and October with a few individuals dispersing in November and December (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 (Miller 1989, pp. 32-41). Known or suspected causes of mortality during dispersal include starvation, predation, and accidents (Miller 1989, pp. 41-44; 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).

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 (Hamer et al. 2001, p. 224) 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). 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, p. 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*) ($r^2 = 0.68$), 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).

Population Dynamics

The spotted owl is relatively long-lived, has a long reproductive life span, invests significantly in parental care, and exhibits high adult survivorship relative to other North American owls (Gutiérrez 1996, 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 and Zabel et al. 1996, p.81 *In*: Forsman et al. 1996) and fluctuation in prey abundance (Zabel et al. 1996, p.437-438).

A variety of factors may regulate spotted owl population levels. These factors may be density-dependent (e.g., habitat quality, habitat abundance) or density-independent (e.g., climate). Interactions may occur among factors. For example, as habitat quality decreases, density-independent factors may have more influence on survival and reproduction, which tends to increase variation in the rate of growth (Franklin et al. 2000, pp. 581-582). Specifically, weather could have increased negative effects on spotted owl fitness for those owls occurring in relatively lower quality habitat (Franklin et al. 2000, pp. 581-582). A consequence of this pattern is that at some point, lower habitat quality may cause the population to be unregulated (have negative growth) and decline to extinction (Franklin et al. 2000, p. 583).

Olson et al. (2005, pp. 930-931) used 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

Reasons for Listing

The spotted owl was listed as threatened throughout its range "due to loss and adverse modification of suitable habitat as a result of timber harvesting and exacerbated by catastrophic events such as fire, volcanic eruption, and wind storms" (USDI FWS 1990a, p. 26114). More specifically, threats to the spotted owl included low populations, declining populations, limited habitat, declining habitat, inadequate distribution of habitat or populations, isolation of provinces, predation and competition, lack of coordinated conservation measures, and vulnerability to natural disturbance (USDI FWS 1992b, pp. 33-41). These threats were characterized for each province as severe, moderate, low or unknown (USDI FWS 1992b, p. 33-41) (The range of the spotted owl is divided into 12 provinces from Canada to northern California and from the Pacific Coast to the eastern Cascades; see Figure 2). Declining habitat was recognized as a severe or moderate threat to the spotted owl throughout its range, isolation of populations was identified as a severe or moderate threat in 11 provinces, and a decline in population was a severe or moderate threat in 10 provinces. Together, these three factors represented the greatest concerns about range-wide conservation of the spotted owl. Limited habitat was considered a severe or moderate threat in nine provinces, and low populations were a severe or moderate concern in eight provinces, suggesting that these factors were also a concern throughout the majority of the spotted owl's range. Vulnerability to natural disturbances was rated as low in five provinces.

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

New Threats

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

- "Although we are certain that current harvest effects are reduced, and that past harvest is also probably having a reduced effect now as compared to 1990, we are still unable to fully evaluate the current levels of threat posed by harvest because of the potential for lag effects…In their questionnaire responses…6 of 8 panel member identified past habitat loss due to timber harvest as a current threat, but only 4 viewed current harvest as a present threat" (Courtney and Gutiérrez 2004, p. 11-7)
- "Currently the primary source of habitat loss is catastrophic wildfire, although the total amount of habitat affected by wildfires has been small (a total of 2.3% of the range-wide habitat base over a 10-year period)." (Courtney and Gutiérrez 2004, p. 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, p. 11-8)

Barred Owls (Strix varia). With its recent expansion to as far south as Marin County, California (Gutiérrez et al. 2004, pp. 7-12-7-13), the barred owl's range now completely overlaps that of the northern spotted owl. Barred owls may be competing with spotted owls for prey (Hamer et al. 2001, p.226) or habitat (Hamer et al. 1989, p.55; Dunbar et al. 1991, p. 467; Herter and Hicks 2000, p. 285; Pearson and Livezey 2003, p. 274). In addition, barred owls physically attack spotted owls (Pearson and Livezey 2003, p. 274), and circumstantial evidence strongly indicated that a barred owl killed a spotted owl (Leskiw and Gutiérrez 1998, p. 226). Evidence that barred owls are causing negative effects on spotted owls is largely indirect, based primarily on retrospective examination of long-term data collected on spotted owls (Kelly et al. 2003, p. 46; Pearson and Livezey 2003, p. 267; Olson et al. 2005, p. 921). It is widely believed, but not conclusively confirmed, that the two species of owls are competing for resources. However, given that the presence of barred owls has been identified as a negative effect while using methods designed to detect a different species (spotted owls), it seems safe to presume that the effects are stronger than estimated. Because there has been no research to quantitatively evaluate the strength of different types of competitive interactions, such as resource partitioning and competitive interference, the particular mechanism by which the two owl species may be competing is unknown.

Barred owls were initially thought to be more closely associated with early successional forests than spotted owls, based on studies conducted on the west slope of the Cascades in Washington (Hamer et al 1989, p. 34; Iverson 1993, p.39). However, recent studies conducted in the Pacific Northwest show that barred owls frequently use mature and old-growth forests (Pearson and Livezey 2003, p. 270; Schmidt 2006, p. 13). In the fire prone forests of eastern Washington, a telemetry study conducted on barred owls showed that barred owl home ranges were located on lower slopes or valley bottoms, in closed canopy, mature, Douglas-fir forest, while spotted owl sites were located on mid-elevation areas with southern or western exposure, characterized by closed canopy, mature, ponderosa pine or Douglas-fir forest (Singleton et al. 2005, p. 1).

The only study comparing spotted owl and barred owl food habits in the Pacific Northwest indicated that barred owl diets overlap strongly (76 percent) with spotted owl diets (Hamer et al. 2001, p. 226). However, barred owl diets are more diverse than spotted owl diets and include species associated with riparian and other moist habitats, along with more terrestrial and diurnal species (Hamer et al. 2001, pp. 225-226).

The presence of barred owls has been reported to reduce spotted owl detectability, site occupancy, reproduction, and survival. Olson et al. (2005, p. 924) found that the presence of barred owls had a significant negative effect on the detectability of spotted owls, and that the magnitude of this effect did not vary among years. The occupancy of historical territories by spotted owls in Washington and Oregon was significantly lower ($p < 0.001$) after barred owls were detected within 0.8 kilometer (0.5 miles) of the territory center but was "only marginally lower" ($p = 0.06$) if barred owls were located more than 0.8 kilometer (0.5 miles) from the spotted owl territory center (Kelly et al. 2003, p. 51). Pearson and Livezey (2003, p. 271) found that there were significantly more barred owl site-centers in unoccupied spotted owl circles than occupied spotted owl circles (centered on historical spotted owl site-centers) with radii of 0.8 kilometer (0.5 miles) ($p = 0.001$), 1.6 kilometer (1 mile) ($p = 0.049$), and 2.9 kilometer (1.8 miles) ($p = 0.005$) in Gifford Pinchot National Forest. In Olympic National Park, Gremel (2005, p. 11) found a significant decline ($p = 0.01$) in spotted owl pair occupancy at sites where barred owls had been detected, while pair occupancy remained stable at spotted owl sites without barred owls. Olson et al. (2005, p. 928) found that the annual probability that a spotted owl territory would be occupied by a pair of spotted owls after barred owls were detected at the site declined by 5 percent in the HJ Andrews study area, 12 percent in the Coast Range study area, and 15 percent in the Tyee study area.

Olson et al. (2004, p. 1048) found that the presence of barred owls had a significant negative effect on the reproduction of spotted owls in the central Coast Range of Oregon (in the Roseburg study area). The conclusion that barred owls had no significant effect on the reproduction of spotted owls in one study (Iverson 2004, p. 89) was unfounded because of small sample sizes (Livezey 2005, p. 102). It is likely that all of the above analyses underestimated the effects of barred owls on the reproduction of spotted owls because spotted owls often cannot be relocated after they are displaced by barred owls (E. Forsman, pers. comm., cited in USDI FWS 2008b, p. 65). 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). More recently, Forsman et al. (2011a) documented negative effects of barred owls on apparent survival at 5 study areas and negative effects of barred owls on fecundity at 4 of 11 study areas. They attributed the equivocal results for most of their study areas to the coarse nature of their barred owl covariate.

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).

The preponderance of evidence suggests that barred owls are exacerbating the spotted owl population decline, particularly in Washington, portions of Oregon, and the northern coast of California (Gutiérrez et al. 2004, pp. 739-740; Olson et al. 2005, pp. 930-931). There is no evidence that the increasing trend in barred owls has stabilized in any portion of the spotted owl's range in the western United States, and "there are no grounds for optimistic views suggesting that barred owl impacts on northern spotted owls have been already fully realized" (Gutiérrez et al. 2004, pp. 7-38).

Wildfire. Studies indicate that the effects of wildfire on spotted owls and their habitat are variable, depending on fire intensity, severity and size. Within the fire-adapted forests of the spotted owl's range, spotted owls likely have adapted to withstand fires of variable sizes and severities. Bond et al. (2002, p. 1025) examined the demography of the three spotted owl subspecies after wildfires, in which wildfire burned through spotted owl nest and roost sites in varying degrees of severity. Post-fire demography parameters for the three subspecies were similar or better than long-term demographic parameters for each of the three subspecies in those same areas (Bond et al. 2002, p. 1026).

In a preliminary study conducted by Anthony and Andrews (2004, p. 8) in the Oregon Klamath Province, their sample of spotted owls appeared to be using a variety of habitats within the area of the Timbered Rock fire, including areas where burning had been moderate.

In 1994, the Hatchery Complex fire burned 17,603 hectares in the Wenatchee National Forest in Washington's eastern Cascades, affecting six spotted owl activity centers (Gaines et al. 1997, p. 125). Spotted owl habitat within a 2.9-kilometer (1.8-mile) radius of the activity centers was reduced by 8 to 45 percent (mean = 31 percent) as a result of the direct effects of the fire and by 10 to 85 percent (mean = 55 percent) as a result of delayed mortality of fire-damaged trees and insects. Direct mortality of spotted owls was assumed to have occurred at one site, and spotted owls were present at only one of the six sites 1 year after the fire (Gaines et al. 1997, p. 126). In 1994, two wildfires burned in the Yakama Indian Reservation in Washington's eastern Cascades, affecting the home ranges of two radio-tagged spotted owls (King et al. 1998, pp. 2-3). Although the amount of home ranges burned was not quantified, spotted owls were observed using areas that burned at low and medium intensities. No direct mortality of spotted owls was observed, even though thick smoke covered several spotted owl site-centers for a week. It appears that, at least in the short term, spotted owls may be resilient to the effects of wildfire—a process with which they have evolved. More research is needed to further understand the relationship between fire and spotted owl habitat use.

At the time of listing there was recognition that large-scale wildfire posed a threat to the spotted owl and its habitat (USDI FWS 1990a, p. 26183). New information suggests fire may be more of a threat than previously thought. In particular, the rate of habitat loss due to fire has been expected with over 102,000 acres of late-successional forest lost on Federal lands from 1993-2004 (Moeur et al. 2005, p. 110). Currently, the overall total amount of habitat loss from wildfires has been relatively small, estimated at approximately 1.2 percent on federal lands (Lint 2005, p. v). It may be possible to influence through silvicultural management how fire prone forests will burn and the extent of the fire when it occurs. Silvicultural management of forest fuels are currently being implemented throughout the spotted owl's range, in an attempt to reduce the levels of fuels that have accumulated during nearly 100 years of effective fire suppression. However, our ability to protect spotted owl habitat and viable populations of spotted owls from large fires through risk-reduction endeavors is uncertain (Courtney et al. 2004, pp. 12-11). The NWFP recognized wildfire as an inherent part of managing spotted owl habitat in certain portions of the range. The distribution and size of reserve blocks as part of the NWFP design may help mitigate the risks associated with large-scale fire (Lint 2005, p. 77).

West Nile Virus. WNV has killed millions of wild birds in North America since it arrived in 1999 (Caffrey 2003, p. 12; 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). One captive spotted owl in Ontario, Canada, is known to have contracted WNV and died (Gancz et al. 2004, p. 2137), but there are no documented cases of the virus in wild spotted owls.

Health officials expect that WNV eventually will spread throughout the range of the spotted owl (Blakesley et al. 2004, p. 8-31), but it is unknown how the virus will ultimately affect spotted owl populations. Susceptibility to infection and the mortality rates of infected individuals vary among bird species (Blakesley et al. 2004, p. 8-33), but most owls appear to be quite susceptible. For example, eastern screech-owls breeding in Ohio that were exposed to WNV experienced 100 percent mortality (T. Grubb pers. comm. in Blakesley et al. 2004, p. 8-33). Barred owls, in contrast, showed lower susceptibility (B. Hunter pers. comm. *in* Blakesley et al. 2004, p. 8-34).

Blakesley et al. (2004, p. 8-35) offer two possible scenarios for the likely outcome of spotted owl populations being infected by WNV. One scenario is that a range-wide reduction in spotted owl population viability is unlikely because the risk of contracting WNV varies between regions. 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. WNV remains a potential threat of uncertain magnitude and effect (Blakesley et al. 2004, p. 8-34).

Sudden Oak Death. Sudden oak death was recently identified as a potential threat to the spotted owl (Courtney and Guttierez 2004, p. 11-8). This disease is caused by the fungus-like pathogen, *Phytopthora ramorum* that was recently introduced from Europe and is rapidly spreading. At the present time, sudden oak death is found in natural stands from Monterey to Humboldt Counties, California, and has reached epidemic proportions in oak (*Quercus* spp.) and tanoak (*Lithocarpus densiflorus*) forests along approximately 300 km of the central and northern California coast (Rizzo et al. 2002, p. 733). It has also been found near Brookings, Oregon, killing tanoak and causing dieback of closely associated wild rhododendron (*Rhododendron* spp.) and evergreen huckleberry (*Vaccinium ovatum*) (Goheen et al. 2002, p. 441). It has been found in several different forest types and at elevations from sea level to over 800 m. Sudden oak death poses a threat of uncertain proportion because of its potential impact on forest dynamics and alteration of key prey and spotted owl habitat components (e.g., hardwood trees - canopy closure and nest tree mortality); especially in the southern portion of the spotted owl's range (Courtney and Guttierez 2004, p. 11-8).

Inbreeding Depression, Genetic Isolation, and Reduced Genetic Diversity. Inbreeding and other genetic problems due to small population sizes were not considered an imminent threat to the spotted owl at the time of listing. Recent studies show no indication of significantly reduced genetic variation in Washington, Oregon, or California (Barrowclough et al. 1999, p. 922; Haig et al. 2001, p. 36). However, in Canada, the breeding population is estimated to be less than 33 pairs and annual population decline may be as high as 35 percent (Harestad et al. 2004, p. 13). 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, p. 11-9). 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.

Climate change. Climate change, a potential additional threat to northern spotted owl populations, is not explicitly addressed in the NWFP. Climate change could have direct and indirect impacts on spotted owls and their prey. However, the emphasis on maintenance of seral stage complexity and related organismal diversity in the Matrix under the NWFP should contribute to the resiliency of the Federal forest landscape to the impacts of climate change (Courtney et al. 2004, p. 9-15). There is no indication in the literature regarding the direction (positive or negative) of the threat.

Based upon a global meta-analysis, Parmesan and Yohe (2003, pp. 37-42) discussed several potential implications of global climate change to biological systems, including terrestrial flora and fauna. Results indicated that 62 percent of species exhibited trends indicative of advancement of spring conditions. In bird species, trends were manifested in earlier nesting activities. Because the spotted owl exhibits a limited tolerance to heat relative to other bird species (Weathers et al. 2001, p. 685), subtle changes in climate have the potential to affect this. However, the specific impacts to the species are unknown.

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

Although information specific to behavioral responses of spotted owls to disturbance is limited, research indicates that close proximity to recreational hikers can cause Mexican spotted owls (*S. o. lucida*) to flush from their roosts (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).

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 spotted owls indicate that low intensity noise of short duration and minimal repetition does not elicit a physiological stress response (Tempel & Gutiérrez 2003, p. 698; Tempel & Gutiérrez 2004, p. 538). However, prolonged activities, such as those associated with timber harvest, may increase fecal corticosterone levels depending on their proximity to spotted owl core areas (Wasser et al. 1997, p.1021; Tempel & Gutiérrez 2004, p. 544).

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

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 suitable habitat to support 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 to facilitate survival and movement;

3. Suitable habitat distributed across a variety of ecological conditions within the 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.

Needs in Addition to Habitat

1. A coordinated research and adaptive management effort to better understand and manage competitive interactions between spotted and barred owls; and

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

Conservation Strategy

Since 1990, various efforts have addressed the conservation needs of the spotted owl and attempted to formulate conservation strategies based upon these needs. These efforts began with the ISC's Conservation Strategy (Thomas et al. 1990); they continued with the designation of critical habitat (USDI FWS 1992b), the Draft Recovery Plan (USDI FWS 1992a), and the Scientific Analysis Team report (Thomas et al. 1993), report of the Forest Ecosystem Management Assessment Team (Thomas and Raphael 1993); and they culminated with the NWFP (USDA FS/USDI BLM 1994a). Each conservation strategy was based upon the reserve design principles first articulated in the ISC's report, which are summarized as follows.

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

Federal Contribution to Recovery

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

The NWFP with its rangewide system of LSRs was based on work completed by three previous studies (Thomas et. al. 2006, pp. 279-280): the 1990 Interagency Scientific Committee (ISC) Report (Thomas et. al. 1990), the 1991 report for the Conservation of Late-successional Forests and Aquatic Ecosystems (Johnson et. al. 1991), and the 1993 report of the Scientific Assessment Team (Thomas et. al. 1993). In addition, the 1992 Draft Recovery Plan for the Northern Spotted Owl (USDI FWS 1992a) was based on the ISC report.

The Forest Ecosystem Management Assessment Team predicted, based on expert opinion, the spotted owl population would decline in the Matrix land use allocation over time, while the population would stabilize and eventually increase within LSRs as habitat conditions improved over the next 50 to 100 years (Thomas and Raphael 1993, p. II-31, USDA FS/USDI BLM 1994b, pp. 3&4-229). Based on the results of the first decade of monitoring, Lint (2005, p. 18) could not determine whether implementation of the NWFP would reverse the spotted owl's declining population trend because not enough time had passed to provide the necessary measure of certainty. However, the results from the first decade of monitoring do not provide any reason to depart from the objective of habitat maintenance and restoration as described in the NWFP (Lint 2005, p. 18; Noon and Blakesley 2006, p. 288). Bigley and Franklin (2004, pp. 6-34) suggested that more fuels treatments are needed in east-side forests to preclude large-scale losses of habitat to stand-replacing wildfires. Other stressors that occur in suitable habitat, such as the range expansion of the barred owl (already in action) and infection with WNV (which may or may not occur) may complicate the conservation of the spotted owl. Recent reports about the status of the spotted owl offer few management recommendations to deal with these emerging threats. The arrangement, distribution, and resilience of the NWFP land use allocation system may prove to be the most appropriate strategy in responding to these unexpected challenges (Bigley and Franklin 2004, pp. 6-34).

Under the NWFP, the agencies anticipated a decline of spotted owl populations during the first decade of implementation. Recent reports (Forsman *et al*. 2011) identified greater than expected spotted owl declines in Washington and northern portions of Oregon, and more stationary populations in southern Oregon and northern California. The reports did not find a direct correlation between habitat conditions and changes in vital rates of spotted owls at the meta-population scale. However, at the territory scale, there is evidence of negative effects to spotted owl fitness due to reduced habitat quantity and quality. Also, there is no evidence to suggest that dispersal habitat is currently limiting (Courtney et al. 2004, p. 9-12, Lint 2005, p. 87). Even with the population decline, Courtney et al (2004, p. 9-15) noted that there is little reason to doubt the effectiveness of the core principles underpinning the NWFP conservation strategy.

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

In June, 2011, the Service published the Revised Recovery Plan for the Northern Spotted Owl (USDI FWS 2011). The revised recovery plan identifies competition with barred owls, ongoing loss of spotted owl habitat as a result of timber harvest, loss or modification of habitat from uncharacteristic wildfire, and loss of amount and distribution of spotted owl habitat as a result of past activities and disturbances as the most pressing threats to the spotted owl (USDI FWS 2011, p. II-2). To address these threats, the current recovery strategy includes five basic steps:

1. Development of a range-wide habitat modeling framework;
2. Barred owl management;
3. Monitoring and research;
4. Adaptive management; and
5. Habitat conservation and active forest restoration (USDI FWS 2011, p. II-2).

The revised recovery plan lists recovery actions that address all five steps of the recovery strategy and further states that a habitat conservation network designed using the best available science is necessary to recover the spotted owl. The revised recovery plan indicates that the NWFP reserve network, in addition to other habitat conservation recommendations in the revised recovery plan (*e.g.,* Recovery Actions 10, 32 and 6), meet that need in the near term (USDI FWS 2011, p. II-3). Acknowledging that barred owls have reduced spotted owl site occupancy, reproduction, and survival, and that addressing this threat depends on initiating action as soon as possible, the revised recovery plan describes recovery actions which address research involving the competition between spotted and barred owls, experimental control of barred owls and, if recommended by research, management of barred owls (USDI FWS 2011, p. II-4).

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

Conservation Efforts on Non-Federal Lands

In the report from the Interagency Scientific Committee (Thomas et al. 1990, p. 3), the draft recovery plan (USDI FWS 1992a, p. 272), and the report from the Forest Ecosystem Management Assessment Team (Thomas and Raphael 1993, pp. IV-189), it was noted that limited Federal ownership in some areas constrained the ability to form a network of old-forest reserves to meet the conservation needs of the spotted owl. In these areas in particular, non-Federal lands would be important to the range-wide goal of achieving conservation and recovery of the spotted owl. The U.S. Fish and Wildlife Service's primary expectations for private lands are for their contributions to demographic support (pair or cluster protection) to Federal lands, or their connectivity with Federal lands. In addition, timber harvest within each state is governed by rules that provide protection of spotted owls or their habitat to varying degrees.

There are 17 current or completed Habitat Conservation Plans (HCPs) that have incidental take permits issued for spotted owls—eight in Washington, three in Oregon, and four in California (USDI FWS 2008a, p. 55). The HCPs range in size from 40 acres to more than 1.6 million acres, although not all acres are included in the mitigation for spotted owls. In total, the HCPs cover approximately 2.9 million acres (9.1 percent) of the 32 million acres of non-Federal forest lands in the range of the spotted owl. The period of time that the HCPs will be in place ranges from 5 to 100 years; however, most of the HCPs are of fairly long duration. While each HCP is unique, there are several general approaches to mitigation of incidental take:

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

Washington. In 1996, the State Forest Practices Board adopted rules (Washington Forest Practices Board 1996) that would contribute to conserving the spotted owl and its habitat on non-Federal lands. Adoption of the rules was based in part on recommendations from a Science Advisory Group that identified important non-Federal lands and recommended roles for those lands in spotted owl conservation (Hanson et al. 1993, pp. 11-15; Buchanan et al. 1994, p. ii). The 1996 rule package was developed by a stakeholder policy group and then reviewed and approved by the Forest Practices Board (Buchanan and Swedeen 2005, p. 9). Spotted owl-related HCPs in Washington generally were intended to provide demographic or connectivity support (USDI FWS 1992a, p. 272).

Oregon. The Oregon Forest Practices Act provides for protection of 70-acre core areas around sites occupied by an adult pair of spotted owls capable of breeding (as determined by recent protocol surveys), but it does not provide for protection of spotted owl habitat beyond these areas (Oregon Department of Forestry 2007, p. 64). In general, no large-scale spotted owl habitat protection strategy or mechanism currently exists for non-Federal lands in Oregon. The three spotted owl-related HCPs currently in effect cover more than 300,000 acres of non-Federal lands. These HCPs are intended to provide some nesting habitat and connectivity over the next few decades (USDI FWS 2008b, p. 56).

California. The California State Forest Practice Rules, which govern timber harvest on private lands, require surveys for spotted owls in suitable habitat and to provide protection around activity centers (California Department of Forestry and Fire Protection 2007, pp. 85-87). Under the Forest Practice Rules, no timber harvest plan can be approved if it is likely to result in incidental take of federally listed species, unless the take is authorized by a Federal incidental take permit (California Department of Forestry and Fire Protection 2007, pp. 85-87). The California Department of Fish and Game initially reviewed all timber harvest plans to ensure that take was not likely to occur; the U.S. Fish and Wildlife Service took over that review function in 2000. Several large industrial owners operate under spotted owl management plans that have been reviewed by the U.S. Fish and Wildlife Service and that specify basic measures for spotted owl protection. Four HCPs authorizing take of spotted owls have been approved; these HCPs cover more than 669,000 acres of non-Federal lands. Implementation of these plans is intended to provide for spotted owl demographic and connectivity support to (NWFP) lands (USDI FWS 2008b, p. 56).

Current Condition of the Spotted Owl

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

Range-wide Habitat and Population Trends
Habitat Baseline. The 1992 Draft Spotted Owl Recovery Plan estimated approximately 8.3 million acres of spotted owl habitat remained range-wide (USDI FWS 1992a, p. 37). However, reliable habitat baseline information for non-Federal lands is not available (Courtney et al. 2004, p. 6-5). The Service has used information provided by the Forest Service, Bureau of Land Management, and National Park Service to update the habitat baseline conditions on Federal lands for spotted owls on several occasions since the spotted owl was listed in 1990. The estimate of 7.4 million acres used for the NWFP in 1994 (USDA and USDI 1994b, p. G-34) was believed to be representative of the general amount of spotted owl habitat on these lands. This baseline has been used to track relative changes over time in subsequent analyses, including those presented here.

In 2005 a new map depicting suitable spotted owl habitat throughout the range of the spotted owl was produced as a result of the NWFP's effectiveness monitoring program (Lint 2005, pp. 21-82). However, the spatial resolution of this new habitat map currently makes it unsuitable for tracking habitat effects at the scale of individual projects. The Service is evaluating the map for future use in tracking habitat trends. Additionally, there continues to be no reliable estimates of spotted owl habitat on non-Federal lands; consequently, consulted-on acres can be tracked, but not evaluated in the context of change with respect to a reference condition on non-Federal lands. The production of the monitoring program habitat map does, however, provide an opportunity for future evaluations of trends in non-Federal habitat.

NWFP Lands Analysis 1994 – 2001. In 2001, the Service conducted an assessment of habitat baseline conditions, the first since implementation of the NWFP (USDI FWS 2001, p. 1). This range-wide evaluation of habitat, compared to the FSEIS, was necessary to determine if the rate of potential change to spotted owl habitat was consistent with the change anticipated in the NWFP. In particular, the Service considered habitat effects that were documented through the section 7 consultation process since 1994. In general, the analytical framework of these consultations focused on the reserve and connectivity goals established by the NWFP land-use allocations (USDA FS and USDI BLM 1994a, p. 6), with effects expressed in terms of changes in suitable spotted owl habitat within those land-use allocations. The Service determined that actions and effects were consistent with the expectations for implementation of the NWFP from 1994 to June, 2001 (USDI FWS 2001, p. 32).

Range-wide Analysis 1994 – October 21, 2011. This section updates the information considered in USDI FWS (2001), relying particularly on information in documents the Service produced pursuant to section 7 of the Act and information provided by NWFP agencies on habitat loss resulting from natural events (e.g., fires, windthrow, insect and disease). To track impacts to northern spotted owl habitat, the Service designed the Consulted on Effects Database which records impacts to northern spotted owls and their habitat at a variety of spatial and temporal scales. Data are entered into the Consulted on Effects Database under various categories including, land management agency, land-use allocation, physiographic province, and type of habitat affected.

In 1994, about 7.4 million acres of suitable northern spotted owl habitat were estimated to exist on Federal lands managed under the NWFP. As of October 11, 2011, the Service had consulted on the proposed removal/downgrading of approximately 191,301 acres (Table 1) or nearly 2.6 percent of 7.4 million acres (Table 2) of northern spotted owl suitable habitat on Federal lands. Of the total Federal acres consulted on for removal/downgrading, approximately 191,301 acres or 2.6 percent of 7.4 million acres of northern spotted owl habitat were removed/downgraded as a result of timber harvest (Table 6). These changes in suitable northern spotted owl habitat are consistent with the expectations for implementation of the NWFP (USDA FS and USDI BLM 1994a).

Habitat loss from Federal lands due to management activities has varied among the individual provinces with most of the impacts concentrated within the Non-Reserve relative to the Reserve land-use allocations (**Table 7**). When habitat loss is evaluated as a proportion of the affected acres range-wide, the most pronounced losses have occurred within Oregon (77*%)**,*** especially within its Klamath Mountains (39%) and Cascades (East and West) (37%) Provinces (Table 7.), followed by much smaller habitat losses in Washington (10%) and California (13%) (**Table 7**). When habitat loss is evaluated as a proportion of provincial baselines, the Oregon Klamath Mountains (20.3%), Cascades East (13%), and the California Cascades (5.85%) all have proportional losses greater than the loss of habitat across all provinces (5.55%) (**Table 7**).

From 1994 through October 11, 2011, habitat lost due to natural events was estimated at approximately 219,469 acres range-wide (**Table 7**). About two-thirds of this loss was attributed to the Biscuit Fire that burned over 500,000 acres in southwest Oregon (Rogue River basin) and northern California in 2002. This fire resulted in a loss of approximately 100,000 acres of northern spotted owl habitat (Table 2[7]), including habitat within five LSRs. Approximately 18,630 acres of northern spotted owl habitat were lost due to the B&B Complex and Davis Fires in the East Cascades Province of Oregon (**Table 7**).

Because there is no comprehensive northern spotted owl habitat baseline for non-NWFP Federal lands and non-Federal lands, there is little available information regarding northern spotted owl habitat trends on these lands. Yet, we do know that Service consultations conducted since 1992, have documented the eventual loss of 472,772 acres (**Table 6**) acres of habitat on non-NWFP Federal lands and non-Federal lands. Approximately 63 percent of these losses have yet to be realized because they are part of large-scale, long-term HCPs/SHAs. Combining effects on Federal and non-Federal lands, the Service had consulted on the proposed removal/downgrading of approximately 664,073 acres of northern spotted owl habitat range-wide, resulting from all management activities, as of October 11, 2011 (**Table 6**).

Table 6. Range-wide Aggregate of Changes to NRF[1] Habitat Acres from Activities Subject to Section 7 Consultations and Other Causes; Tue Oct 11 18:11:06 MDT 2011 – Consultation # 13420-2011-F-0216.

Land Ownership	Consulted On Habitat Changes[2]		Other Habitat Changes[3]	
	Removed/ Downgraded	Maintained	Removed/ Downgraded	Maintained
NWFP (FS,BLM,NPS)	191,301	513,434	219,469	39,051
Bureau of Indian Affairs / Tribes	108,210	28,372	2,398	0
Habitat Conservation Plans/Safe Harbor Agreements	295,889	14,430	N/A	N/A
Other Federal, State, County, Private Lands	68,673	21,894	279	0
Total Changes	664,073	578,130	222,146	39,051

1. Nesting, roosting, foraging (NRF) habitat. In California, suitable habitat is divided into two components; nesting - roosting (NR) habitat, and foraging (F) habitat. The NR component most closely resembles NRF habitat in Oregon and Washington. Due to differences in reporting methods, effects to suitable habitat compiled in this, and all subsequent tables include effects for nesting, roosting, and foraging (NRF) for 1994-6/26/2001. After 6/26/2001 suitable habitat includes NRF for Washington and Oregon but only nesting and roosting (NR) for California.
2. Includes both effects reported in USFWS 2001 and subsequent effects reported in the Northern Spotted Owl Consultation Effects Tracking System (web application and database.)
3. Includes effects to suitable NRF habitat (as generally documented through technical assistance, etc.) resulting from wildfires (not from suppression efforts), insect and disease outbreaks, and other natural causes, private timber harvest, and land exchanges not associated with consultation.

Table 7. Aggregate Results of All Adjusted, Suitable Habitat (NRF) Acres Affected by Section 7 Consultation on NWFP Lands for the Northern Spotted Owl; Baseline and Summary of Effects by Stat, Physiographic Province and Land Use Function; Tue Oct 11 18:11:45 MDT 2011 – Consultation # 13420-2011-F-0216.

Physiographic Province[2]		Evaluation Baseline[3]	Habitat Removed/Downgraded[4]					% Provincial Baseline Affected	% Range-wide Effects
			Land Use Allocations			Habitat Loss to Natural Events[7]	Total		
		Total	Reserves[5]	Non-Reserves[6]	Total				
WA	Eastern Cascades	706,849	4,522	6,392	10,914	14,307	25,221	3.57	6.14
	Olympic Peninsula	560,217	869	1,711	2,580	299	2,879	0.51	0.7
	Western Cascades	1,112,480	1,681	10,870	12,551	3	12,554	1.13	3.06
OR	Cascades East	443,659	2,500	14,249	16,749	40,884	57,633	12.99	14.03
	Cascades West	2,046,472	3,862	65,946	69,808	24,583	94,391	4.61	22.98
	Coast Range	516,577	447	3,844	4,291	66	4,357	0.84	1.06
	Klamath	785,589	2,631	55,430	58,061	101,676	159,737	20.3	38.89

Physiographic Province[2]		Evaluation Baseline[3]	Habitat Removed/Downgraded[4]					% Provincial Baseline Affected	% Range-wide Effects
			Land Use Allocations			Habitat Loss to Natural Events[7]	Total		
		Total	Reserves[5]	Non-Reserves[6]	Total				
	Mountains								
	Willamette Valley	5,658	0	0	0	0	0	0	0
CA	Cascades	88,237	10	4,820	4,830	329	5,159	5.85	1.26
	Coast	51,494	464	79	543	100	643	1.25	0.16
	Klamath	1,079,866	1,546	9,428	10,974	37,222	48,196	4.46	11.73
Total		7,397,098	18,532	172,769	191,301	219,469	410,770	5.55	100

1. Nesting, roosting, foraging (NRF) habitat. In California, suitable habitat is divided into two components; nesting - roosting (NR) habitat, and foraging (F) habitat. The NR component most closely resembles NRF habitat in Oregon and Washington. Due to differences in reporting methods, effects to suitable habitat compiled in this, and all subsequent tables include effects for nesting, roosting, and foraging (NRF) for 1994-6/26/2001. After 6/26/2001 suitable habitat includes NRF for Washington and Oregon but only nesting and roosting (NR) for California.
2. Defined by the Northwest Forest Plan as the twelve physiographic provinces, as presented in Figure 3&4-1 on page 3&4-16 of the FSEIS. The WA Western Lowlands and OR Willamette Valley provinces are not listed as they are not expected to contribute to recovery.
3. 1994 FSEIS baseline (USDA and USDI 1994).
4. Includes both effects reported in USFWS 2001 and subsequent effects reported in the Northern Spotted Owl Consultation Effects Tracking System (web application and database.)
5. Land-use allocations intended to provide large blocks of habitat to support clusters of breeding pairs. (LSR, MLSA, CRA)
6. Land-use allocations intended to provide habitat to support movement of spotted owls among reserves. (AWA, AMA, MX)
7. Acres for all physiographic provinces, except the Oregon Klamath Mountains, are from the Scientific Evaluation of the Status of the Northern Spotted Owl (Courtney et al. 2004) and subsequent effects entered into the Northern Spotted Owl Consultation Effects Tracking System. Acres for the Oregon Klamath Mountains province are from the biological assessment entitled: Fiscal year 2006-2008 programmatic consultation: re-initiation on activities that may affect listed species in the Rogue-River/South Coast Basin, Medford BLM, and Rogue-Siskiyou National Forest and from subsequent effects entered into the Northern Spotted Owl Consultation Effects Tracking System.

Other Habitat Trend Assessments. In 2005, the Washington Department of Wildlife released the report, "An Assessment of Spotted Owl Habitat on Non-Federal Lands in Washington between 1996 and 2004" (Pierce et al. 2005). This study estimates the amount of spotted owl habitat in 2004 on lands affected by state and private forest practices. The study area is a subset of the total Washington forest practice lands, and statistically-based estimates of existing habitat and habitat loss due to fire and timber harvest are provided. In the 3.2-million acre study area, Pierce et al. (2005, p. 88) 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 and others (2005, p. 98) 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, p. 91). Approximately 77 percent of the harvested habitat occurred on private lands and about 15 percent occurred on State lands. Pierce and others (2005, p. 80) 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, p. 90).

Moeur et al. 2005 (p. 110) 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 Northwest Forest Plan area between 1994 and 2003. The increase occurred primarily in the lower end of the diameter range for older forest. The net area in the greater than 30 inch dbh size class increased by only an estimated 102,000 to 127,000 acres (Moeur et al. 2005, p. 100). The estimates were based on change-detection layers for losses due to harvest and fire and remeasured 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.

Spotted Owl Numbers, Distribution, and Reproduction Trends. There are no estimates of the size of the spotted owl population prior to settlement by Europeans. Spotted owls are believed to have inhabited most old-growth forests or stands throughout the Pacific Northwest, including northwestern California, prior to beginning of modern settlement in the mid-1800s (USDI FWS 1989, pp. 2-17). According to the final rule listing the spotted owl as threatened (USDI FWS 1990a, p. 26118), approximately 90 percent of the roughly 2,000 known spotted owl breeding pairs were located on Federally managed lands, 1.4 percent on State lands, and 6.2 percent on private lands; the percent of spotted owls on private lands in northern California was slightly higher (USDI FWS 1989, pp. 4-11; Thomas et al. 1990, p. 64).

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 (Figure 2) based on recognized landscape subdivisions exhibiting different physical and environmental features (USDI FWS 1992a, p. 31). The spotted owl has become rare in certain areas, such as British Columbia, southwestern Washington, and the northern coastal ranges of Oregon.

As of July 1, 1994, there were 5,431 known site-centers of spotted owl pairs or resident singles: 851 sites (16 percent) in Washington, 2,893 sites (53 percent) in Oregon, and 1,687 sites (31 percent) in California (USDI FWS 1995, p. 9495). By June 2004, the number of territorial spotted owl sites in Washington recognized by the Washington Department of Fish and Wildlife was 1,044 (Buchanan and Swedeen 2005, p. 37). The actual number of currently occupied spotted owl locations across the range is unknown because many areas remain unsurveyed (USDI FWS 2008b, p. 44). 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 in USDI FWS (1995, p. 9495) represent the cumulative number of locations recorded in the three states, not population estimates.

Because the existing survey coverage and effort are insufficient to produce reliable range-wide estimates of population size, demographic data are used to evaluate trends in spotted owl populations. Analysis of demographic data can provide an estimate of the finite rate of population change (λ) (lambda), which provides information on the direction and magnitude of population change. A λ of 1.0 indicates a stationary population, meaning the population is neither increasing nor decreasing. A λ of less than 1.0 indicates a decreasing population, and a λ of greater than 1.0 indicates a growing population. Demographic data, derived from studies initiated as early as 1985, have been analyzed periodically (Anderson and Burnham 1992; Burnham et al. 1994: Forsman *et al.* 1996; Anthony *et al*. 2006 and Forsman et al. 2011a) to estimate trends in the populations of the spotted owl.

In January 2009, two meta-analyses modeled rates of population change for up to 24 years using the re-parameterized Jolly-Seber method (λ_{RJS}). One meta-analysis modeled the 11 long-term study areas (**Table 8)**, while the other modeled the eight study areas that are part of the effectiveness monitoring program of the NWFP (Forsman et al. 2011a).

Table 8. Spotted owl demographic study areas (adapted from Forsman et al., 2011a) – Consultation # 13420-2011-F-0216.

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

[1] Apparent survival calculations are based on model average.
[2] Population trends are based on estimates of realized population change, which differs slightly from $\boldsymbol{\lambda_{RJS}}$.

Point estimates of λ_{RJS} were all below 1.0 and ranged from 0.929 to 0.996 for the 11 long-term study areas. There was strong evidence that populations declined on 7 of the 11 areas (Forsman *et al.* 2011a), these areas included Rainier, Olympic, Cle Elum, Coast Range, HJ Andrews, Northwest California and Green Diamond. On other four areas (Tyee, Klamath, Southern Cascades, and Hoopa), populations were either stable, or the precision of the estimates was not sufficient to detect declines.

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

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

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

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

There are few spotted owls remaining in British Columbia. Chutter et al. (2004, p. *v*) suggested immediate action was required to improve the likelihood of recovering the spotted owl population in British Columbia. So, in 2007, personnel in British Columbia captured and brought into captivity the remaining 16 known wild spotted owls (USDI FWS 2008b, p. 48). Prior to initiating the captive-breeding program, the population of spotted owls in Canada was declining by as much as 10.4 percent per year (Chutter et al. 2004, p. *v*). The amount of previous interaction between spotted owls in Canada and the United States is unknown.

Physiographic Provinces

The Action Area lies in the southern portion of the Western Cascades physiographic province (**Figure 1**). The Oregon Western Cascades Province is located in the geographic center of the spotted owl's range and provides links with the Washington Cascades Physiographic Province, Oregon Coast Range Province, and Klamath Mountain Province. The 1994 FSEIS baseline (USDA FS and USDI BLM 1994b) was 2,015,763 acres of spotted owl NRF habitat on federal lands within the Oregon Western Cascades Province, although 94,999 acres have been removed or downgraded through February 2, 2010, resulting in a decrease of 4.71 percent of the provincial baseline (**Table 7**).

Northwest Forest Plan (NWFP)

The Roseburg District is located within lands managed under the NWFP, which established the current conservation strategy for the spotted owl on federal lands. It is designed around the conservation needs of the spotted owl and based on the designation of a variety of land-use allocations whose objectives are either to provide for population clusters (i.e., demographic support) or to maintain connectivity between population clusters. Several land-use allocations are intended to contribute primarily to supporting population clusters: LSRs, Managed Late-Successional Areas (MLSAs), Congressionally Reserved Areas (CRAs), Managed Pair Areas and Reserve Pair Areas. The remaining LUAs [Matrix, AMAs, Riparian Reserves (RRs), General Forest Management Area, and Connectivity Blocks] provide connectivity between habitat blocks intended for demographic support.

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

It has been seventeen years since the adoption of the NWFP. Thomas et al. (1990) argued that the spotted owl population trend should stabilize at a lower equilibrium size sometime within the next 100 years. During the interim, there was an expectation the rate of decline would slowly decrease as habitat loss was arrested and new habitat regenerated in the habitat conservation areas. Similarly, the NWFP predicted a continuing decline of spotted owls until such time as new habitat developed (over a course of decades) (Appendix J of FSEIS) (Courtney et al. 2004). Lint (2005) concluded that during the first ten years of the NWFP, the spotted owl habitat prognosis is seemingly correct. Anthony et al. (2006a) stated spotted owl populations appeared to be stationary in several study areas as a result of high survival and stable fecundity rates, although federal study areas appear more stationary than those composed largely of private land. While the habitat provision of the NWFP is a necessary condition for spotted owls, it may not be a wholly sufficient provision (Courtney et al. 2004), given the spotted owl population declines observed in Washington (Anthony et al. 2006a, Forsman et al. 2011a). Information collected during the first decade of the NWFP, affirms protecting habitat is very important to the survival and recovery of the spotted owl, and the reserve network prescribed under the NWFP has been effective in maintaining and restoring spotted owl habitat (Lint 2005).

Status within adjacent Spotted Owl Demography Study Areas

Three long-term spotted owl demographic study areas (DSA) (**Figure 3**) Information from these areas helps inform the possible condition of spotted owls in the Action Area. It is important to draw a distinction between conclusions drawn from range-wide demographic analyses, in particular Anthony *et al* 2006 and Forsman et al. 2011a, and the trends apparent in local data from individual DSAs. Whereas the range-wide estimates of population change (λ) (**Table 8)** are largely based on individual spotted owl survival probabilities, the annual reports from the individual DSAs focus on individual spotted owl nest site/territory occupancy trends. It is quite plausible that in declining populations of long-lived K-selected species the high re-capture probabilities of aging individuals, and the population trend estimates derived from them, will somewhat mask, or lag behind site occupancy trends for pairs, which are much more responsive to year-to-year decreases (J. Reid 2011, pers. Comm.).

Tyee Demography Study Area
The Tyee Study Area (TYE DSA) is located mostly on the western portion of the Roseburg District BLM. It was established to provide spotted owl demographic information for the Oregon Coast Ranges (Forsman *et al* 2011b). On this study area in 2010, although pair occupancy increased slightly (48 pairs) from the lowest level observed during the 20+-year study, 2009 - 44 pairs, the total number of non-juvenile spotted owls on the study area was

again the lowest ever observed – 113 individuals were documented (Forsman *etal* 2011b). These changes in occupancy levels continue long-term trends apparent in the TYE DSA data and may reflect a decrease in population size. Whereas the number of nesting females fledging young in 2010 (28) was above the annual average of 21 for this study area, in 2011 there were only three nests and only 2 young were documented (J. Reid 2011, pers. Comm.).

Relative to the thirteen other spotted owl study areas represented in the 2009 meta-analysis, the demographic parameters estimated for the spotted owl population in the TYE DSA were at intermediate levels (Forsman et al. 2011a). The greatest population declines were reported in the Oregon Coast Range and in all Washington study areas. These study areas had negative time trends in fecundity and/or survival. In contrast, spotted owl populations in southwestern Oregon and northern California appeared to be relatively stationary based on the 95 percent confidence intervals. However, as described previously, data collected since 1990 indicates downward trends in many areas, including all three of the study areas surrounding the Action Area. For example, the 113 spotted owls located within the TYE DSA in 2010. This represents approximately 80% of the number of individuals documented in 1990 and was the lowest number of spotted owls detected since the study began. Barred owl numbers continue to increase in the study area (**Figure 4**).

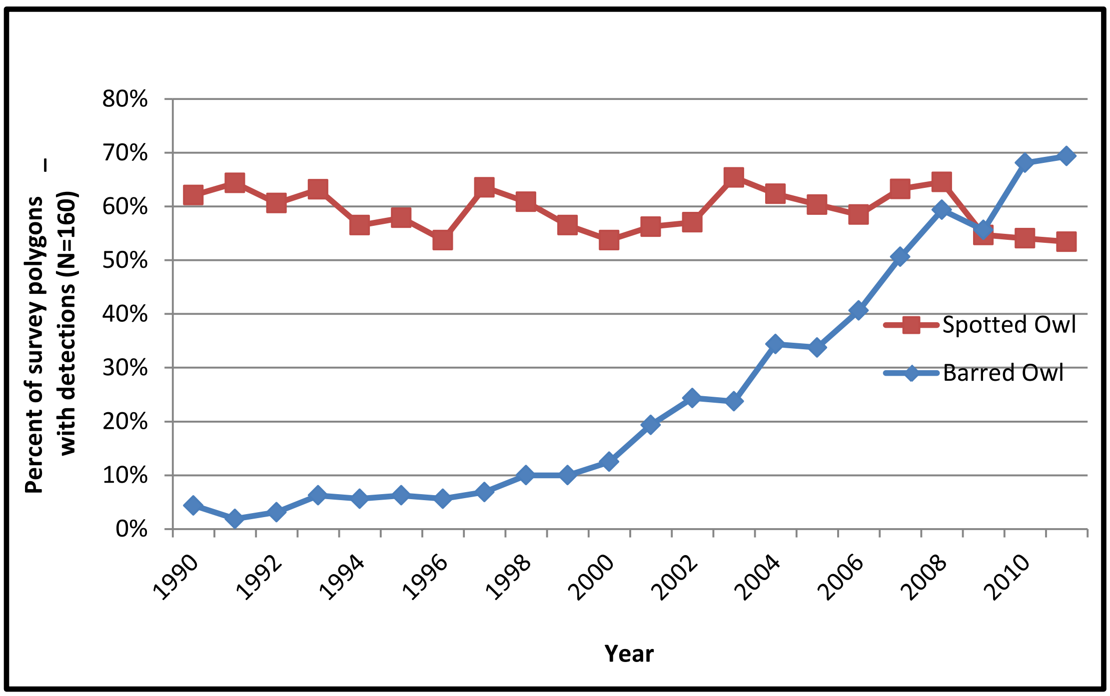

Figure 4. Spotted owl and Barred owl detection trends on the Tyee Density Study Area.

Central Cascades Demography Study Area – H.J. Andrews

The Central Cascades Study Area (HJA DSA) is centered on the H.J. Andrews Experimental Forest, on the McKenzie Ranger District, Willamette National Forest (WNF). It was established to provide spotted owl demographic information for the Central west Oregon Cascades Mountains. Forsman et al 2011a (p 64) presented evidence that spotted owl populations are declining on the HJA (along with 6 other DSAs). The Fiscal Year 2010 annual report for the HJA (Dugger et al. 2011), also noted a continuation of general declines in simple occupancy estimates – 2010 represented the lowest number of either a pair or resident single spotted owl per site surveyed since the study began in 1987. The number of barred owl detections also continues to increase at the HJA DSA – the proportion of surveyed sites with barred owl detections (47%) was greater in 2010 than in any previous year. And in 2011, spotted owls reproduced on only one site (out of 174).

Klamath Study Area

The Klamath Study Area (KSA DSA), which is south of the Pilot Project Area, was also established to provide spotted owl demographic information but for the Oregon Klamath and southern west Oregon Cascades provinces. It is also located mostly within the south and southeast portions of the Roseburg District BLM. Forsman et al 2011a (p 64) also presented evidence that spotted owl populations are declining on the KSA DSA. Spotted owl detections in the Klamath study area are also steadily decreasing in number and percentage, and barred owl numbers continue to increase (Davis et al. 2011) (**Figure 5**).

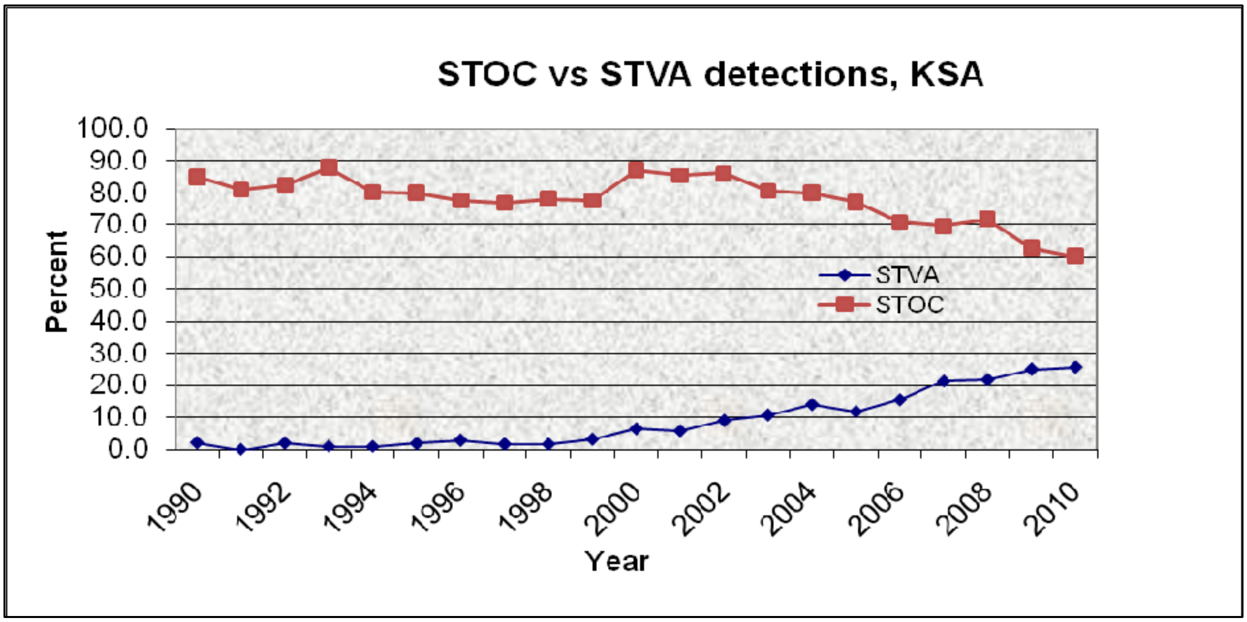

Figure 5. Spotted owl vs. Barred owl detection trends in the Klamath DSA.

Preliminary data summarizations for the 2011 field season on the KSA DSA indicate very low levels of reproduction and young produced – only 5 sites successfully reproduced, out of 158 sites surveyed (3 percent) and those five sites only fledged 7 young. The previous low value was 19 young fledged in 2007 (R. Horn pers. Comm. 2011), making 2011 the year of poorest reproduction ever on all three surrounding DSAs.

Late Successional Reserves (LSRs)

The occupancy and fecundity trends reported for the three surrounding DSAs are calculated differently in each case, making direct comparisons between DSAs problematic. However, there appear to be general downward trends in LSR contributions on two of the three DSAs. For example, the proportion of surveyed sites occupied in the LSRs for the TYE and HJA DSAs has been declining for several years (Forsman et al. 2011b, Dugger et al. 2011) (**Figure 6**). This downward trend is also apparent in the HJA DSA, where in 2010, 38 percent of the sites with pairs were in the LSRs (Dugger et al. 2011).

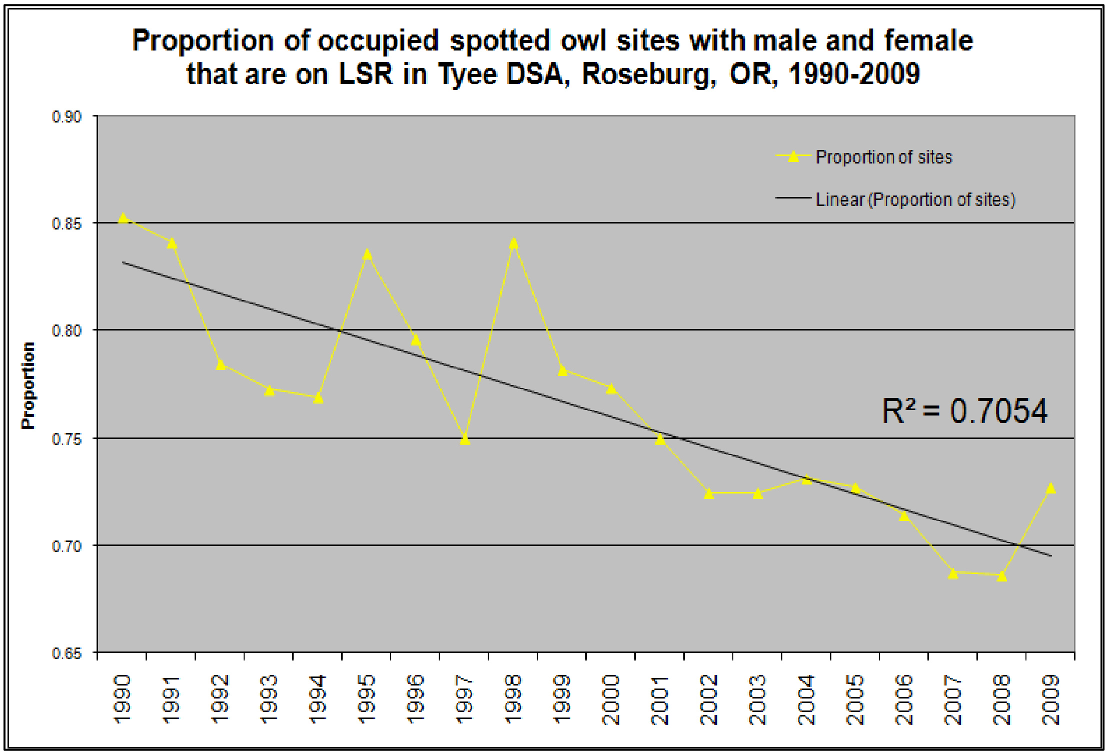

Figure 6. Tyee DSA on Late-Successional Reserves (This data is not available for survey years 2010 and 2011).

On the KSA DSA, although occupancy and fecundity rates are trending downward, these trends are very similar between LSR and non-LSR sites (Davis et al. 2011).

Status of the Species in the Action Area

As described above, three long-term spotted owl demographic study areas (Tyee, H.J. Andrews, and Klamath) surround the proposed Action Area (Figure 3). Information from these areas helps inform the possible condition of spotted owls in the Action Area. Given the similarity of land use and ownership patterns, we infer trends documented in the surrounding study areas are similar within the Action Area.

There are current spotted owl surveys for the Action Area. The quality of a spotted owl territory is related to the amount of NRF habitat available. Habitat fitness studies of spotted owls have found a relationship, at the territory scale (see Tyee study below) between spotted owl demographic performance and habitat (Dugger et al. 2005, Franklin et al. 2000, and Olson et al. 2005). For the analyses in this consultation, spotted owl territory condition was assessed using the provincial home range radius around each known and predicted activity center. The current conditions of the spotted owl territories associated with the Action Area are described in **Table 10**. The Service recommends a territory contain more than 50 percent NRF habitat within the core use area (the half-mile radius area around the activity center) and 40 percent NRF habitat within the home range area to adequately provide for reproductive success and survival of the pair (USDI FWS, USDI BLM and USDA FS 2008).

Table 9. Status of known northern spotted owl activity centers within the action area.

IDNO	Locname	Land Use Allocation	KOAC	Available Habitat with Nest Patch (acres)		Available Habitat within Core Area (acres)				Available Habitat with Home Range (acres)				NSO Status
				NRF	Dispersal	NRF	%	Dispersal	%	NRF	%	Dispersal	%	
0258O	Lucky Buck	GFMA	No	56	1	205	41	60	12	482	16	925	31	Pair 2011, 1 fledgling
0292O	High Riser	CONN	No	40	16	169	34	196	39	972	33	863	29	Pair 2010; unoccupied - 2011
2291O	Deadman Mountain	GFMA	Yes	56	9	318	64	113	23	1466	50	926	31	Pair 2010; male and female - 2011
2381O	Curtin Creek	CONN	Yes	70	0	495	99	0	0	2233	76	202	7	Surveyed unoccupied; last occupied by pair - 2007
9581	Blue Oyster Cultus	Matrix	No	57	6	412	82	45	9	2093	71	453	15	Resident female, floater male in 2011
EST9	Roseburg Estimated	GFMA	No	53	16	464	93	38	8	2256	76	414	14	Surveyed, unoccupied - 2011,
U0521	Cultus Estimated	Matrix	No	51	8	370	74	82	16	1976	67	555	19	Surveyed, unoccupied - 2011

Red shading indicate habitat amounts below threshold values.

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

The Action Area (**Figure 2**) covers about 19,800 acres, of which 15,130 acres (76%) are federally-administered (Table 10**)**. Of the federally-administered lands there are currently 9596 acres of spotted owl NRF habitat (Table 10). There are 6 known and predicted activity centers within the Roseburg District (Table 10). Approximately 12,487 acres of the federally-administered land in the Action Area (82%) are considered to be spotted owl habitat (including dispersal-only and NRF habitat) (Table 10). The Action Area includes approximately 137 acres of designated spotted owl critical habitat, of which 41 is currently NRF habitat and 39 is currently dispersal-only habitat (Table 10). The designated spotted owl critical habitat within the Action Area is entirely on Forest Service-administered land (**Figure 2**).

The action areas includes 11,125 acres of proposed spotted owl critical habitat in three subunits, within two critical habitat units (West Cascades South, subunit 5and Klamath East, subunits 1 and 2); 7,001 acres are currently NRF habitat and 2,248 acres are dispersal habitat (Table 10 and **Figure 7**). The functions of these critical habitat subunits are: WCS 5 – demographic support (primary) and both north-south and east-west connectivity; KLE 1 – demographic support (primary) and both north-south and east-west connectivity; and KLE 2 – east-west connectivity (primary) and demographic support (USDI FWS 2012).

Under the conservation strategy set forth in the NWFP, the Action Area is intended to provide: 1) habitat blocks reserved for breeding owls, and; 2) sufficient habitat amounts and distributions to facilitate spotted owl dispersal between the reserves. The breeding habitat blocks are primarily the LSRs, which total approximately 137 acres (31 %), 41 acres of which are currently NRF habitat (Table 10). The Matrix/Adaptive Management Areas were designated to provide for spotted owl dispersal between habitat blocks; these areas include approximately 9254 additional acres, of which approximately 6103 acres (66%) are currently NRF habitat (Table 10). Under the NWFP, certain types of timber harvest are allowed in the riparian reserves, but these do not include removal or downgrading of NRF habitat.

Although some proportion of the estimated 4 spotted owl activity centers in the Matrix and private or state lands in the Action Area are likely to be nesting and rearing young, the NWFP conservation strategy for the spotted owl does not rely on these nesting pairs and this nesting habitat to maintain the spotted owl population. The LSRs discussed above and distributed among the dispersed locations of the proposed action are intended to provide habitat blocks for the breeding population of spotted owls. However, as discussed above under the *Status of the Species* section, the NWFP assumed that about 2.5 percent of the Matrix would be subject to timber harvest per decade. At that rate, a large area of Matrix is expected to continue to support nesting spotted owls and the overall species' population while additional spotted owl NRF habitat is developing within the LSR system. In the first decade of the NWFP, consultation records show timber harvest in the Matrix was consistent with that assumption

Seventy-four percent (14,587 acres) of the federal lands in the Action Area are currently functional dispersal habitat (Table 10).

The final spotted owl recovery plan (USDI FWS 2011) ascribes a similar role for the Action Area, maintaining (1) historic and current genetic flow between spotted owl populations, (2) current and historic spotted owl population and habitat distributions, and (3) spotted owl meta-population dynamics.

Table 10. Environmental Baseline for the Secretarial Pilot Project Action Area.

NWFP	Area (ac)[4]		Suitable NSO Habitat[1] (%)[5]		Capable NSO Habitat (%)[5]		Dispersal Only NSO Habitat (%)[5]		Protected Area[2] (%)[5]		Unprotected Area (%)[5]	
1. Ownership												
All owners	19,800	(100)	9730	(49)	19628	(99)	4857	(25)				
Private	4670	(24)	134	(3)	4611	(99)	1966	(42)				
BLM	9816	(50)	6205	(63)	9724	(99)	1750	(18)	4136	(42)	5682	(58)
Forest Service	5314	(27)	3391	(64)	5293	(100)	1141	(21)	1719	(32)	3595	(68)
Total Federal	**15,130**	**(76)**	**9596**	**(63)**	**15,017**	**(99)**	**2891**	**(19)**	**5855**	**(39)**	**9276**	**(61)**
2. Land Allocation - Federal (hierarchal, no acres double-counted)												
Congressional Reserve	0	(0)	0	(0)	0	(0)	0	(0)				
Late-Successional Reserves	137	(1)	41	(30)	137	(100)	39	(28)				
KOAC[3]	585	(4)	569	(97)	585	((100)	13	(2)				
District Designated Reserves	0	(0)	0	(0)	0	(0)	0	(0)				
Riparian Reserves	5136	(34)	2891	(56)	5074	(99)	1232	(24)				
Matrix/AMA	9254	(61)	6103	(66)	9203	(99)	1601	(17)				
3. Northern Spotted Owl Critical Habitat												
Total	137	(100)							137	(100)	0	(0)
Capable	137	(100)							137	(100)	0	(0)
Suitable	41	(31)							41	(100)	0	(0)
Dispersal Only	39	(29)							39	(100)	0	(0)
4. Proposed Northern Spotted Owl Critical Habitat												
Total	11,125	(100)							4715	(42)	6,410	(58)
Capable	11,013	(99)							4650	(42)	6,363	(58)
Suitable	7,001	(63)							2746	(39)	4,255	(61)
Dispersal Only	2,248	(20)							1083	(48)	1,165	(52)

1. Suitable habitat on BLM and Private lands defined as stands greater than 80 years of age. Suitable habitat on Forest Service defined by Umpqua National Forest.
2. Area not programmed for timber harvest.
3. Known Owl Activity Center refers to the 100-acre KOACs from the 1995 ROD/RMP.
4. Percentage calculated for column.
5. Percentage calculated for row.

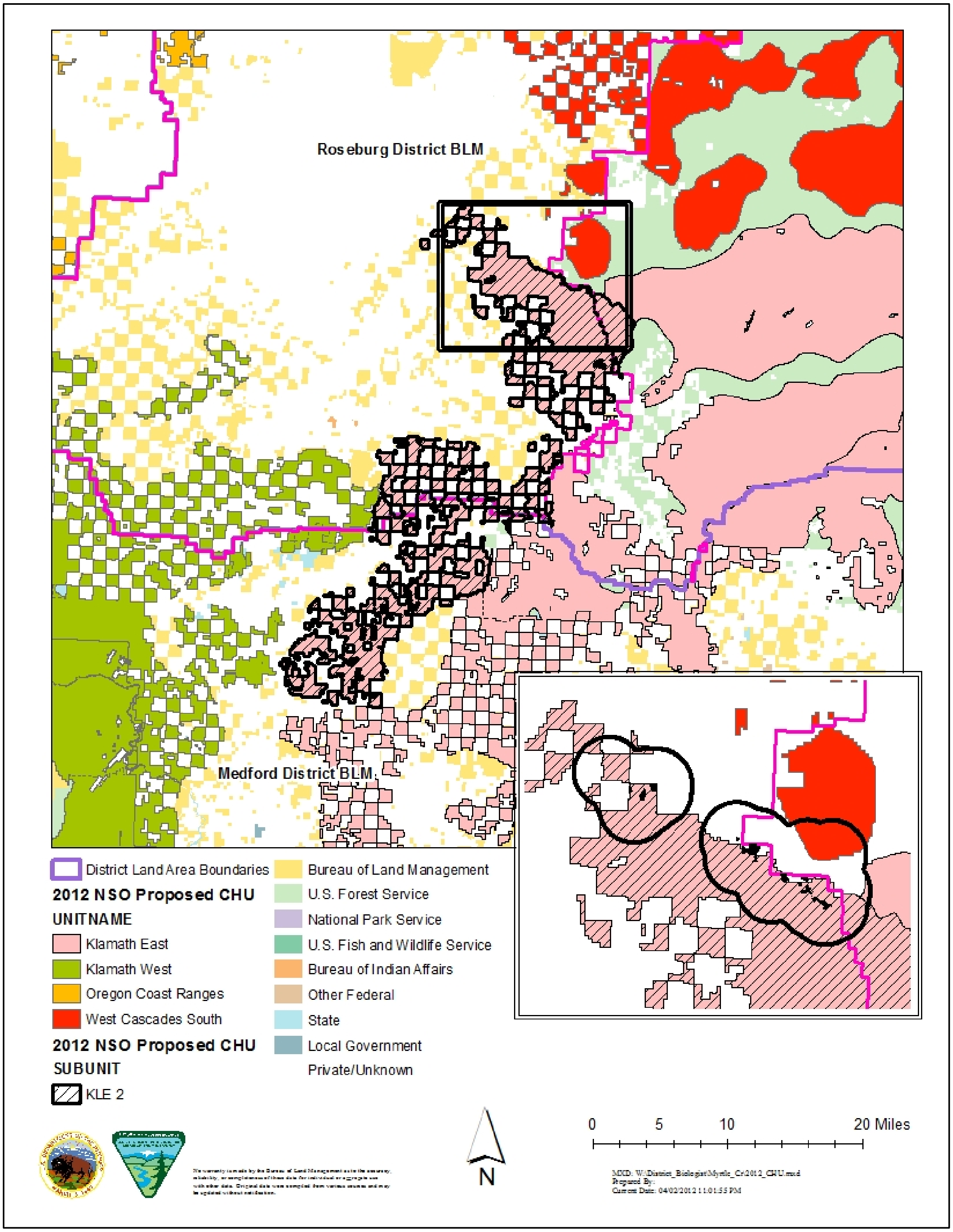

Figure 7. Proposed critical habitat for the northern spotted owl adjacent to the Secretary's Pilot Project action area.

Spotted Owl Critical Habitat

Although 137 acres of designated spotted owl critical habitat occurs within the Action Area, none of the proposed activities are within critical habitat (**Table 11**). Thus there will be no effect to critical habitat due to implementation of the proposed action.

Table 11. Status of northern spotted owl Critical Habitat unit that overlaps the Action Area.

CHU Name	CHU Number	MOCA Number[1]	Total CHU Acres (%)	Action Area CHU Acres	Percent of CHU in Action Area
Western Oregon Cascades	12	12	77,732	137	0
		Suitable Habitat	44,215 (48)	41	0
		Dispersal-Only	470 (1)	39	0

[1] MOCA identified as sub-division of the Critical Habitat Unit

The Western Oregon Cascades South Unit consists of approximately 448, 100 ac (181,300 ha) in Jackson, Douglas, Lane, and Linn Counties, Oregon, and is comprised of lands managed by the Willamette, Umpqua, and Rogue River National Forests (448,000 ac (181,300 ha)) and Eugene BLM Districts (100 ac (40 ha)). This unit includes five areas that, with approximately 184,000 ac (74,500 ha) of habitat or habitat-capable areas in the adjacent Wilderness, meet the size requirement of large habitat blocks and three areas wholly within critical habitat that meet the size requirement of large habitat blocks.(page 47355, in USFWS 2008).

Proposed Critical Habitat

Three hundred and thirty-two (332) acres of the proposed Secretarial Pilot Project occur within proposed critical habitat for the northern spotted owl. The proposed project occurs within subunit 2 (KLE 2) of the Klamath East critical habitat unit (KLE) (USDI FWS 2012). The Klamath East CHU is 1,111,790 acres in size; KLE 2 contains 110,477 acres of federal and state forest lands in Douglas and Josephine Counties. The description of the proposed Critical Habitat subunit is provided below (Table 12).

Table 12. Environmental baseline for proposed northern spotted owl Klamath East critical habitat unit, subunit KLE 2.

NSO Habitat Value	Primary Constituent Element (PCE)	Area (acres)
Gross Area (acres)		**110,477**
NRF Habitat (acres)	2 + 3	61,833
Dispersal Only Habitat (acres)	4	19,217
Capable Area (acres)	1	25,261
Total Federal Habitat (acres)		**106,311**
Unknown Habitat Quality (acres)		1262

(OR Dept. Forestry Lands)		

Critical Habitat Unit 10: Klamath East (KLE) [The italicized language below is quoted from the proposed 2012 northern spotted owl critical habitat designation (USFWS 2012).

Unit 10 contains 1,111,790 ac (449,926 ha) and seven subunits. This unit consists of the eastern portion of the Klamath Mountains Ecological Section M261A, based on section descriptions of forest types from Ecological Subregions of the United States (McNab and Avers 1994b, Section M261A), and portions of the Southern Cascades Ecological Section M261D in Oregon. This region is characterized by a Mediterranean climate, greatly reduced influence of marine air, and steep, dissected terrain. Franklin and Dyrness (1988, pp. 137-149) differentiate the mixed-conifer forest occurring on the "Cascade side of the Klamath from the more mesic mixed evergreen forests on the western portion (Siskiyou Mountains)," and Kuchler (1977) separates out the eastern Klamath based on increased occurrence of ponderosa pine. The mixed-conifer/evergreen hardwood forest types typical of the Klamath region extend into the southern Cascades in the vicinity of Roseburg and the North Umpqua River, where they grade into the western hemlock forest typical of the Cascades. High summer temperatures and a mosaic of open forest conditions and Oregon white oak (Q. garryana) woodlands act to influence spotted owl distribution in this region. Spotted owls occur at elevations up to 1,768 m. Dwarf mistletoe provides an important component of nesting habitat, enabling spotted owls to nest within stands of relatively younger, small trees.

KLE–2. The KLE–2 subunit consists of approximately 110,477 ac (44,709ha) in Josephine and Douglas Counties, Oregon, and comprises Federal lands managed by the Forest Service and the BLM under the NWFP (USDA and USDI 1994, entire). Special management considerations or protection are required in this subunit to address threats 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 junction primarily for east-west connectivity between subunits and CHUs, but also for demographic support. This subunit facilitates spotted owl movements between the western Cascades and coastal Oregon and the Klamath Mountains.

Our [USFWS] *evaluation of sites known to be occupied at the time of listing indicates that approximately 92 percent of the area of KLE–2 was covered by verified spotted owl home ranges at the time of listing. When combined with likely occupancy of suitable habitat and occupancy by non-territorial owls and dispersing subadults, we consider this subunit to have been largely occupied at the time of listing. In addition, there may be some smaller areas of younger forest within the habitat mosaic of this subunit that were unoccupied at the time of listing. We* [USFWS] *have determined that all of the unoccupied and likely occupied areas in this subunit are essential for the conservation of the species to meet the recovery criterion that calls for the continued maintenance and recruitment of spotted owl habitat (USFWS 2011, p. ix). The increase and enhancement of spotted owl habitat is necessary to provide for viable populations of spotted owls over the long term by providing for population expansion, successful dispersal, and buffering from competition with the barred owl.*

Based on current research on the life history, biology, and ecology of the northern spotted owl and the requirements of the habitat to sustain its essential life history functions, the Service has identified the following primary constituent elements (PCEs) for the spotted owl (USDI FWS 2012):

1. *Forest types that may be in early, mid, or late-seral states and support the spotted owl across its geographical range*

2. *Habitat that provides for nesting and roosting (NR). This habitat must provide:*
    a. *Sufficient foraging habitat to meet the home range needs of territorial pairs of northern spotted owls throughout the year.*

b. *Stands for nesting and roosting that are generally characterized by:*
    i. *Moderate to high canopy closure (60 to over 80 percent),*
    ii. *Multilayered, multispecies canopies with large (20- 30 in (51-76 cm) or greater dbh) overstory trees,*
    iii. *High basal area (greater than 240 ft2/acre (55 m2/ha)),*
    iv. *High diversity of different diameters of trees,*
    v. *High incidence of large live trees with various deformities (e.g., large cavities, broken tops, mistletoe infections, and other evidence of decadence)*
    vi. *Large snags and large accumulations of fallen trees and other woody debris on the ground, and*
    vii. *Sufficient open space below the canopy for northern spotted owls to fly.*

3. *Habitat that provides for foraging (F), which varies widely across the northern spotted owl's range, in accordance with ecological conditions and disturbance regimes that influence vegetation structure and prey species distributions (see specific description for the Klamath province below).*

4. *Habitat to support the transience and colonization phases of dispersal (D), 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, and foraging habitat. In cases where nesting, roosting, or foraging habitats are insufficient to provide for dispersing or nonbreeding owls, the specific dispersal habitat PCEs for the northern spotted owl may be provided by the following:*
    a. *Habitat supporting the transience phase of dispersal, which includes:*
        i. *Stands with adequate tree size and canopy closure to provide protection from avian predators and minimal foraging opportunities; in general this may include, but is not limited to, trees with at least 11 in (28 cm) dbh and a minimum 40 percent canopy closure; and*
        ii. *Younger and less diverse forest stands than foraging habitat, such as even-aged, pole-sized stands, if such stands contain some roosting structures and foraging habitat to allow for temporary resting and feeding during the transience phase.*

    b. *Habitat supporting the colonization phase of dispersal, which is generally equivalent to nesting, roosting, and foraging habitat as described in PCEs (2) and (3), but may be smaller in area than that needed to support nesting pairs.*

Specific Klamath Province Foraging Habitat PCEs:

Stands of nesting and roosting habitat; in addition, other forest types with mature and old-forest characteristics;

- *Presence of the conifer species, incense-cedar, sugar pine, Douglas-fir, and hardwood species such as big leaf maple, black oak, live oaks, and madrone, as well as shrubs;*
- *Forest patches within riparian zones of low-order streams and edges between conifer and hardwood forest stands;*
- *Brushy openings and dense young stands or low-density forest patches within a mosaic of mature and older forest habitat;*
- *High canopy cover (87 percent at frequently used sites);*
- *Multiple canopy layers;*
- *Mean stand diameter greater than 21 in (52.5 cm);*
- *Increasing mean stand diameter and densities of trees greater than 26 in (66 cm) increases foraging habitat quality;*
- *Large accumulations of fallen trees and other woody debris on the ground;*
- *Sufficient open space below the canopy for northern spotted owls to fly.*

IV. EFFECTS OF THE PROPOSED ACTION

The proposed actions may impact the spotted owl and/or murrelet in varying ways and at differing levels, depending on where and when a project occurs. The following effects analysis addresses:

- Direct and indirect effects for each activity type,
- Interrelated and interdependent actions and Cumulative effects.

Effect Timing

Direct effects are the immediate consequences of an action, while **indirect effects** are reasonably certain to occur but take place later in time. For example, a direct effect of a thinning treatment is reduction in tree density and an indirect effect is accelerated tree growth.

Interrelated actions are part of a proposed action and depend on the larger action for their justification. **Interdependent** actions are those that might occur separately from the proposed action, but which have no independent utility apart from the action under consideration. Interdependent actions depend on the proposed federal action and would not be justified without it.

Cumulative effects are the effects of future State, tribal, local, or private actions that are reasonably certain to occur in the action area. This meaning should not be confused with cumulative effects as defined by the National Environmental Policy Act (NEPA).

Effect Determinations

Some actions may have **"no effect"** to the spotted owl, murrelet, or designated Critical Habitat. A "**may affect**" determination is required when a proposed action may cause any effect to a listed species or designated Critical Habitat. There are three types of "may affect" actions: beneficial effects, not likely to adversely affect, and likely to adversely affect. A **beneficial effect** occurs if effects are wholly positive and without any adverse effects. If possible adverse effects are expected to be discountable (extremely unlikely to occur) or insignificant (unable to be meaningfully measured, detected, or evaluated), an action is considered **"not likely to adversely affect."** When significant and non-discountable adverse effects may occur, a "**likely to adversely affect**" determination is warranted.

Effect Causes

Habitat Modification

Habitat modification may occur as the result of timber harvest (thinning, density management, or VRH), prescribed fire, or road building activities.

Disruption

Disruption occurs when noise, smoke, vibration, or visual stimuli cause impairment of normal behavior. Disruption may be determined to be "Likely to Adversely Affect" if reproduction or survival is compromised. Disruption during the reproductive period is most likely to have adverse impacts because adults have expended their energy into finding mates, building nests, and females have invested considerable energy reserves into egg production. While nesting and feeding/sheltering young, adults are less mobile than at other times of the year and less able to hunt. At the same time, the demand for food to feed young increases. Young are most vulnerable during the reproductive period and during the period of learning to survive on their own (pre-fledging in birds). They are less mobile, less experienced, and less able to defend themselves than they will be as when they are older and have developed flight ability and hunting experience.

Effects to Spotted Owls of the Secretarial Pilot Project

A general description of effects to the spotted owl, dispersal habitat, and suitable habitat will be provided initially, followed by specific effects for each action alternative. Direct impacts to dispersal and suitable habitats addressed herein, are those acres modified by treatments and do not include the no treatment areas referred to as aggregate retention areas. However, future stand conditions of the retained aggregates were modeled, analyzed, and are included in the discussion of overall impacts.

Habitat Modification

Stand ages in the Secretarial Pilot Project timber sale range from 40 to 108 years of age **(**Table 13**).**

Units 28-3-23A, 28-3-25A, 28-2-31A & B, and 28-2-32C & D: These units display typical characteristics as described above for late seral forests. Portions of these units are lacking in accumulations of large coarse downed wood, plant species diversity, and the relative historical abundance and distribution of hardwoods species. Some of these components will never be developed regardless of management techniques, and this is due to site productivity and south facing slopes that appear to have fire return intervals between 60-100 years. The portions of section 25 that appear to have fire intervals (stand replacement) of 400-750+ years, have well developed decadence associated with old growth characteristics such as large coarse downed wood, large broken top and live trees, snags with cavities, hardwood areas, and stratified vegetative layers..

Dispersal Habitat in Units 28-3-17 A, B & C and 28-2-32 A & B: Past management practices in Units 28-3-17A, B and C have utilized an even-aged management approach common to west-side production forests (Hall et al. 1985). Even-aged stand management is defined as a forest or stand composed of trees having little to no differences in age (within a 10- to 20-year range). This practice, also known as regeneration or plantation forestry, creates open conditions and uniform stands during succession. Forest managers using even-aged stand management techniques alter the forest community and habitat value, shortening the length of the growth cycle (affecting tree height and diameter). Snags and large downed wood on-site are typically decreased after typical management activities through snag falling due to safety concerns, and/ or destruction of both snags and downed wood, during harvest practices. On occasion snags and downed wood are eliminated from site-preparation techniques i.e. fire (Hall et al. 1985). These conditions are accurate descriptors of Units 28-3-17A, B, and C and provide dispersal habitat and some foraging opportunity for spotted owls.

Units 28-2-32A and B have been previously harvested with dominant trees removed and cull left. These residual stands contain coarse downed wood, snags, and some vertical stratification of vegetation, providing for dispersal, foraging, and roosting habitat for the northern spotted owl.

Table 13. Summary of current stand conditions.

EA Unit	Age	Total Trees/Acre	>6" DBH Trees/Acre	Basal Area (sq. ft./acre)	Quadratic Mean Diameter (>6" DBH)	Canopy Cover[1]
28-2-31A	103	646	276	180	10.9	80
28-2-31B	108	582	244	159	10.9	80
28-2-32A	68	675	282	223	12	85
28-2-32B	62	500	199	179	12.8	85
28-2-32C	89	350	284	249	12.7	80
28-2-32D	104	431	260	263	13.6	80
28-3-17A	50	394	212	212	13.5	95
28-3-17B	40	581	261	181	11.3	95
28-3-17C	52	383	255	197	11.9	95
28-3-23A	100	207	157	258	17.4	80
28-3-25A	98	204	151	269	18.1	80
28-3-25A (Thinned Area)	103	51	51	208	27.5	
1. Canopy cover derived for modeling groups as described in Table 14						

There are two stand treatments being implemented:

- Density Management – 21 acres, this will occur in the Treated Riparian Reserve areas in Units 28-3-17A, B, and C.
- Variable Retention Harvest – 438 acres, this will occur in the Harvest Area (284 acres) and Retention Area (133 acres) of each timber sale unit; this also includes the 21acres of density management.

The effects of each treatment type will be described individually.

Vegetation Modeling

The southwestern edition of the Organon growth and yield model was used to simulate stand development over the next 100 years for analysis of environmental consequences relative to changes in selected stand attributes. Organon is an individual-tree, distance-independent model developed by Oregon State University using data collected in western Oregon forest stands (Hann, 2009). The architecture of the model makes it applicable to simulations of traditional and non-traditional silviculture (Hann, 1998). Proposed units were grouped according to current stand structure, age and site productivity for simulation purposes (Table 14). Four modeling groups were created and future stand conditions will be described for each group.

Table 14. Grouping of timber sale units for growth and yield modeling purposes.

Model Group	Area (acres)	Units #	Site Productivity	Current Age Classes	Current Seral Stage[1]
A	41	28-2-31A and B	Low	100	Mature
B	116	28-2-32A and B	Moderate	60-70	Late
C	173	28-3-23A, 28-3-25A, 28-2-32C and D	Moderate	90-100	Mature
D	108	28-3-17A, B and C	High	40-50	Late

[1.] Defined in USDA and USDI (1994). Late refers to Late Seral, stands defined by suppression mortality and stand uniformity, ages up to 100 years. Mature refers to Mature Seral , stands defined by increasing diversity, up to 200 years of age.

Density Management—21 acres

A variable density prescription would be applied outside of the "no-treatment" areas within the Riparian Reserves based on a combination of basal area and number of trees per acre to encourage development of structural and species diversity. A minimum, stand average canopy cover of 50 percent would be retained outside of the "no treatment" areas to maintain effective stream shading.

Gaps and skips would be employed, with the placement of skips focused on structural and habitat components such as snags, patches of hardwood trees, and deposits of down wood. Trees selected for retention would generally have a live crown ratio of at least 30 percent in order to increase the likelihood of release and increased growth after density management (Daniel, et. al. 1979). As a means of promoting greater structural diversity, selection of trees for retention may include trees with broken or deformed boles and crowns.

Conifers such as western hemlock, western red cedar, incense-cedar, and pines would be retained in numbers reflecting historic percentages of stand composition, whenever possible. Hardwood trees greater than ten (10) inches diameter breast height would be prioritized for retention where present and considered likely to survive thinning operations.

Thinning increases tree diameter growth compared to unthinned controls. Diameter growth increases of 33 to 56 percent resulting from thinning over a twenty year period have been observed on very productive (SI_{50} >135) sites (Marshall *et al.*, 1992). A retrospective study of 40 to 100 year-old stands which had previously been commercially thinned found that radial growth rates averaged about 36 percent greater compared to unthinned stands at 10 to 23 years post-thinning (Bailey and Tappeiner, 1998).

Thinning can increase live crown ratios (Oliver and Larson 1990), maintain live crown ratios (Chan *et al.*, 2006), or reduce the rate of live crown recession (Marshall and Curtis, 2002). Maintenance of live crown ratios greater than 30 percent prevents a substantial reduction in vigor and diameter growth (Smith 1962). Thinning can also increase crown ratio through stimulation of epicormic branching in species such as Douglas-fir, true firs, and big-leaf maple (Tappeiner *et al.*, 2007)

Thinned overstory canopy cover[5] closes at a rate of about two-thirds of one percent a year based on simulation outputs. Canopy closure measured as skylight visible through the canopy has been shown to increase two percent per year in stands of generally higher productivity than those on the proposed project area (Chan *et al*., 2006). Adjusting for site productivity differences, the estimated canopy closure rate would be in the range of 33 to 80 percent of the rate observed in Chan *et al.* (2006), or 66-1.6 percent per year.

Thinning can stabilize or prevent height to diameter ratios from increasing above thresholds that predispose the stand to stem bending, windsnap, and windthrow (Wonn and O'Hara, 2001; Oliver and Larson, 1990).

Thinning can initially reduce the cover of shrubs and herbaceous vegetation due to disturbance caused by harvesting activities. However, cover and plant diversity would be expected to increase following thinning activities to levels exceeding pre-treatment conditions as canopy recloses (Chan *et al*., 2006; Bailey *et al*., 1998).

Natural regeneration of tree species is common after thinning, depending on availability of seed and other factors. Distribution and density are highly variable (Chan *et al*., 2006; Nabel, 2008), generally increasing with increased intensity of thinning (Bailey and Tappeiner, 1998; Nabel, 2008).

Weather-induced mortality from wind and snow would be expected to occur along the edges of aggregates bordering harvested areas, and along the edges of untreated stands (Maguire *et al*., 2006). Adjacent to thinned areas, however, no substantial effect on edge growth or mortality would be expected (Roberts and Harrington, 2008).

Among approximately a dozen studies that reported spotted owl responses to thinning or other timber harvest activities, four studies (Forsman *et al.* 1984, King 1993, Hicks *et al.* 1999, Meiman *et al.* 2003) found spotted owls were displaced by contemporary harvest or thinning near the nest or activity center. Based on observations of nine spotted owl territories where harvest occurred during the study, Forsman *et al.* (1984) suggested that negative effects (decreased reproduction, site abandonment) of thinning or selective harvest were most likely associated with higher-intensity thinning, timber harvest close to the nest area, and when the affected owl site had low amounts of alternative habitat available. Similarly, Meiman *et al.* (2003) reported that a male spotted owl expanded his home range and shifted foraging and roosting away from a thinning operation located close to the nest tree. Consequently, they recommended harvest operations not be conducted near spotted owl nest sites. More recent, preliminary research in southwest Oregon and northern California has indicated that spotted owls did not vacate their home ranges and generally foraged within thinned forest stands as applied on BLM timberlands (unpublished draft, NCASI, 2008). Given the small number of spotted owls studied, the information provided in these studies is insufficient for drawing firm conclusions about the effects of thinning prescriptions on spotted owls. Generally, research data supports the notion that spotted owls will continue to use thinned stands for foraging when overall canopy cover remains above 50 to 60 percent (Forsman 1994, Hanson et al., 1993) although treatment effects with core areas and nest patches may cause displacement of the owl and exacerbates problems associated with habitat deficiencies.

Although much of this work refers to treatments inside stands with nesting, roosting and foraging components, they illustrate the variability of responses of the owls to treatments. Where canopy cover exceeds 40 percent it is expected that those thinning units would continue to provide foraging and dispersal opportunities, although any modification of habitat within nest patches and core areas deficient in NRF may be problematic. Within those stands where post-harvest canopy cover is less than 40-50 percent, owls may avoid these stands until canopy cover

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[5] Canopy cover is a vertical projection of the tree crowns and represents the amount of ground that the canopy would occupy. Canopy closure is a hemispherical representation of the visible sky.

conditions recover to at least 40 percent. A conservative assumption based on the Organon model output is that crown cover will recover about one percent per year following treatment. However, closure as measured by percent skylight should recover faster, at about one to two percent per year.

Although general effects of thinning on the physical parameters of habitat can be quantified, actual effects on spotted owl behavior and use of habitat in nest patches and core areas are not fully known. Thinning opens the forest canopy, may change environmental conditions such as temperature and humidity, and may increase risk of predation.

Development of late-successional characteristics and suitable habitat from modified dispersal habitat would be expected in roughly 100 years sooner than through natural stand development. The development of suitable habitat components within the stands is dependent on the intensity of the treatments. More structural complexity and late-successional habitat components (i.e., large diameter and canopy diversity) would be expected to develop within those areas treated. Maintaining 50 percent canopy cover would insure that dispersal habitat is not lost; the density management treatment would cause an indirect beneficial effect in the long term by improving dispersal habitat conditions as canopy cover increases and multi-canopy and multi-species layers develop, creating more favourable roosting and foraging habitat conditions in as little as 15 – 30 years. As structural components used by spotted owls continue to develop, such as multiple canopy layers, large diameter trees and eventually large snags and coarse wood, the amount of nesting habitat would increase for the spotted owl over time.

Spotted owl prey species would also be affected by the proposed thinning. Studies of the effects of timber harvest on northern flying squirrels have generally found negative responses to thinning, although results have varied across studies. Several studies have suggested that forest thinning can temporarily (*e.g.*, up to 20 years) reduce the availability of truffles, which are a key food resource for northern flying squirrels and other small mammals on which spotted owls depend(Waters *et al.* 1994, Colgan *et al.* 1999, Luoma *et al.* 2003, Meyer *et al.* 2005). However, studies in British Columbia did not find any significant short-term differences in densities, movements or reproduction of flying squirrels in young, commercially-thinned stands versus unthinned young stands (Ransome and Sullivan 2002, Ransome *et al.* 2004). Carey (2000) found lower abundances of flying squirrels in recently-thinned (within 10 years) stands in Washington than in stands that were clear-cut 50 years prior to the study, with retention of both live and dead trees. He attributed his results to the apparently negative effects of commercial thinning on canopy connectivity, downed wood and truffle communities in the area. Wilson (2010) also reported most thinning is likely to suppress flying squirrel populations for several decades, but the long-term benefits of variable-density thinning for squirrels are likely to be positive. He emphasized that developing the next layer of trees is critical if the goal is to accelerate late-seral conditions and promote prey for spotted owl, and complex structure favorable to squirrels may be achieved sooner in younger stands where there is a shorter vertical distance between the ground and the bottom of the canopy.

Mixed results have also been reported in studies that examined effects of thinning on woodrats. Dusky-footed woodrats occur in a variety of conditions, including both old, structurally complex forests and younger seral stages, and are often associated with streams (Raphael 1987, Carey *et al.* 1992, 1999, Williams *et al.* 1992, Sakai and Noon 1993, Anthony *et al.* 2003, Hamm and Diller 2009). Research has suggested that thinning or associated practices (*e.g.*, burning slash piles) could be detrimental to dusky-footed woodrats if it reduces hardwoods, shrubs or downed wood, yet treatments could ultimately benefit woodrats if they result in growth of shrubs or hardwoods (Williams *et al.* 1992, Innes *et al.* 2007). Bushy-tailed woodrats may be more limited by abiotic features, such as the availability of suitable rocky areas for den sites (Smith 1997) or the presence of streams (Carey *et al.* 1992, 1999). Similar to dusky-footed woodrats, forms of thinning that reduce availability of snags, downed wood or mistletoe could negatively impact bushy-tailed woodrat populations (Lehmkuhl *et al.* 2006a). A study of dusky-footed woodrats in the redwood region of California, however, did not find an association between abundances of woodrats and different intensities of commercial thinning (Hamm and Diller 2009).

Results from these studies suggest that active management projects should explicitly evaluate the short-term impacts to spotted owls and their prey while considering the long-term ecological benefits of such projects, especially in spotted owl core-use areas. Spotted owl home ranges generally have a greater proportion of older forest within the core-use area and more diverse forest conditions on the periphery of their ranges (Swindle *et al.* 1999). The studies referenced above primarily described effects of commercial timber harvest; management designed under an ecological forestry framework should avoid existing high value habitat, if possible, while meeting long-term restoration goals.

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).

Density management 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).

Wilson (2010) suggests a few considerations to reduce short-term effects to flying squirrels while trying to create more forest complexity that would benefit them in the long-term. The action alternatives 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;
- improvement of foraging opportunities by promoting the development of understory and shade-tolerant tree species throughout the stand; and
- maintenance of canopy cover within the stands (e.g., lightly and moderately thinned areas) which would 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.

***<u>Conclusion:</u>* The application of density management treatments to 21 acres of dispersal habitat will result in the modification of, but not the downgrade of that habitat. The retention of a minimum, average stand canopy cover of 50 percent, post-treatment, is key to this determination.**

Variable Retention Harvest—438 acres

Dispersed retention treatments would be expected to follow a developmental sequence similar to that reported by Schoonmaker and McKee (1988) for similar sites that were clearcut in the western Cascades. The presence of adjacent aggregate retention areas and dispersed retention trees, however, would affect vegetative development due to shading and other retention affects (North *et al.* 1996). Schoonmaker and McKee (1988) reported that initial post-harvest cover of species found in pre-harvest stands was low, but rapidly increased over time. Residual species accounted for almost 40, 66, 73, 83, 90 and 97 percent of total species composition at ages 5, 10, 15, 20, 30 and 40 years respectively. After logging and burning, herbs first become established, followed by shrubs, with conifer dominance achieved within 20 to 30 years. In two years, 53 percent of relative ground cover was colonizing herbs and 72 percent was invading and residual herbs combined. At 15 years, relative cover was 24 percent herbs, 46 percent shrubs, and 28 percent conifers. In 20 years it was 15 percent herbs, 38 percent shrubs, and 43 percent conifers. Forty years after harvest and site preparation, absolute cover was 53 percent herbs, 57 percent shrubs, and 82 percent conifers. Species heterogeneity and composition peaked between 15 to 20 years post-harvest and site preparation and declined to low values by 40 years (Schoonmaker and McKee 1988).

Compared to this clearcut development scenario, it is possible that dispersed retention harvest areas may exhibit a higher diversity and more variable species composition than that found in clearcuts (North *et al*., 1996).

The degree of harvest induced ground disturbance and intensity of prescribed burning can influence vegetative development. Dyrness (1973) documented vegetative changes within western Cascades clearcuts for seven years post-harvest. These stands exhibited a mosaic of post-harvest/burning conditions. All units were prescribed burned after harvest; however, only about 50 percent of the area had been affected by fire. About 34 percent was disturbed by harvest activities, but not burned. The remaining 16 percent was harvested, but without ground disturbance.

Plant cover within the harvested area on the ground surface undisturbed by logging or burning tended to be dominated by residual (present before harvest) species. Disturbed but unburned area was characterized by a large number of species, both invaders and residuals. Cover on burned areas was dominated by both herbs and invading shrubs. Numbers of residual herbs were substantially lower compared to unburned areas. Few residual shrubs and trees were present on severely burned areas five years after logging, but were more abundant in lightly burned areas.

Similar general patterns of understory development as described above are expected to occur on the proposed project areas following harvest and site preparation.

Planted commercial conifer tree species would enhance the potential for the development of a conifer dominated forest stand (Tappeiner *et al.*, 2007). Mortality rates of planted conifers would be expected to range between 15 to 30 percent in the first three to four years following planting, declining to very low levels after that.

The rate of canopy closure (1-1.5 percent/year) depends on site productivity and the density of tree regeneration. Closure is most rapid on more productive sites; while some low productivity forest stands never achieve canopy closure (Franklin *et al*., 2002). Estimated time for canopy closure under the proposed project is 30 years or more.

Natural regeneration has often proven undependable for reforestation in a prompt manner (Stein 1955). However, some natural regeneration is likely to survive within the harvested units on undisturbed ground surface areas (Dyrness, 1973). Additionally, establishment of natural regeneration from adjacent aggregates and dispersed retention trees is likely, but not considered a reliable regeneration option for meeting agency reforestation goals on the Matrix land use allocations (Ketchum and Tappeiner, 2005).

Regeneration growth rates would be expected to be substantially less than that found with clearcut harvesting due to competition from both aggregated and dispersed retention (Acker *et al*. 1998; Lam and Maguire 2011).

Individual species growth would differ based on inherent growth capability and differences in their response to shading and root competition from retention trees, competition from other vegetation, and herbivory (Harrington, 2006). Growth rate reductions of regeneration compared to full potential is anticipated to be in the range of 30 to 50 percent based on green-tree retention amount and distribution at the individual unit level (Di Lucca and Goudie, 2004). Non-tree vegetation is also assumed to grow at rates below full potential due to shading and competition with other vegetation.

Subsequent to canopy closure at understory tree age 30-years or older, stand development would be similar to the processes occurring in aggregates.

After logging and burning, an abundance of herbs then shrubs would become naturally established, to be supplemented by the seeding and planting of native non-conifer vegetation. In concert with management of conifer density, early successional forest conditions un-dominated by conifers would be maintained for up to 30 years.

The stand development trajectories of aggregate retention areas (especially those over 2.5 acres) and riparian reserves are expected to be similar to those of unharvested stands. Absence treatment or substantial natural disturbance, stands would continue on their current developmental trajectories. Canopy cover and relative density would remain high. The crowns of less competitive trees would continue to recede (Chan *et al.*, 2006), resulting in increased suppression mortality and decreasing diameter growth as trees compete for water, nutrients, and sunlight (Oliver and Larson, 1990). Rates of change would vary between stands depending on current structure, age and site productivity.

Inter-tree suppression or regular mortality would occur in these unentered areas, primarily in the smaller size classes of trees. Non-suppression or irregular mortality from insects, disease, windthrow, and stem breakage could occur across all crown classes at any age. As stands age, regular mortality would become less significant and irregular mortality factors would become more important (Oliver and Larson, 1990). Mortality is the source of snags and down wood.

Shrub density and cover would be expected to remain stable in the short term in larger aggregates and riparian reserves (Chan *et al.*, 2006). Over the long-term, shrubs and tolerant tree species (e.g. western hemlock) would gradually increase in numbers as understory light increases due to receding overstory tree crowns and tree mortality (Oliver and Larson, 1990).

Without substantial disturbance, conditions within larger aggregates and riparian reserves would become more conducive to establishment and growth of shade-tolerant tree species on Units 28-3-17A, B, and C; 28-3-23A; 28-3-25A; and 28-2-32C and D. However, this process would be slow and unlikely to provide for understory tree development sufficient to cause a shift from a single-storied to a two-storied or layered structure within 100 years, given current conditions (Oliver and Larson, 1990; Munger, 1940). Portions of Units 28-2-32A and B, and 28-2-31A and B contain established understories of tolerant conifers that could potentially contribute to the development of a two-storied or multi-storied stand structure over the next 50 to 100 years.

Trees in the aggregates would be subject to the same processes of regular and irregular mortality previously discussed. Since trees would not be removed in the aggregate retention areas, it is likely that these areas would produce the highest amount of dead wood through passive recruitment, compared to treatment areas.

The aggregate retention areas/ residual stands following harvest will provide a pool of candidate trees for future snag and coarse wood recruitment. Additional coarse wood and snags would 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 would provide a continuous recruitment of snags and down wood. Although fewer snags would develop over time when compared to the No Action Alternative, they would be larger snags with more resiliency and limb structure (Reukema and Smith, 1987) than snags that develop under a more competitive stand condition (Nietro, 1985).

In the meantime, the action alternative would provide other ecological benefits by allowing trees to grow larger and faster, and to develop other suitable wildlife habitat characteristics, such as large limbs and crowns, especially those trees along the boundaries. These trees would then become a future source for large snags and downed wood.

Aggregates with low edge to area ratios ≥ 2.5 acres in extent would be expected to support core areas with micro-climates indistinguishable from interior forest, and also ameliorate microclimate in adjacent harvested areas (Heithecker and Halpern, 2007).

Weather-induced mortality from wind and snow would be expected to occur along the edges of aggregates bordering harvested areas, and along the edges of untreated stands (Maguire *et al.*, 2006).

Following the application of different treatments to a stand it is common to view each treatment area as a separate stand, based on the classical definition of a stand as a group of trees relatively homogenous in structure and composition.

Ecologically, however, it is more useful to view an entire treatment area, including aggregated retention as a functional stand consisting of a mosaic of structural units (Franklin *et al.* 2002). The effects analyses that are unique to each sub-alternative or reference analysis incorporate that concept of a synergism between treatments, although common effects are described separately for each treatment type.

Harvesting would change the current vegetation structure and composition to one resembling *early-seral* stage, outside of the aggregate retention/riparian reserve areas (ROD/RMP 1995, p. 112). Within the VRH dispersed retention areas 284 acres of NRF(153 ac.) and dispersal (131 ac) habitat will be lost due to the removal of the majority of the trees; from 189-650 down to 13-30 tpa, and canopy closures down to 10-15 percent and structural class resets to a stand establishment with legacy phase from young, high density and mature, single canopy (BLM 2008) (Table 15 and **Table 17**).

Within 100 years we would expect all stands develop into mature, either single canopy or multiple canopy conditions, spotted owl NRF habitat (Table 18). If left untreated these stands would develop into similar conditions, units 28-3-23A and 25A would develop into a structurally complex stand; but unlike the VRH units, the young, more homogeneous units in model groups B and D, would not have developed the multiple canopy condition the VRH treatment fostered (Table 16 and Table 18). Although there would be a greater number of larger diameter trees in a no treatment option, VRH accelerates the development of multiple canopies and the development of minor species component (Table 16 and Table 18). Average diameters, the numbers of large trees per acre, and canopy cover would be similar whether the units were treated under the VRH or NWFP, the only significant different in spotted owl habitat development would be in the increased levels of minor species (Table 18 and Table 19). Similarly, no treatment, VRH and NWFP harvest would create spotted of NRF in 100 years, obviously not treatment would also benefit by having no loss of habitat for any period of time. Overall VRH appears to create a more diversity stand than a NWFP treatment, a more open canopy and a higher percentage of minor species as expressed in the basal area calculation—compared to no treatment VRH is especially beneficial in the younger, more homogeneous stands. The composite effects of harvest types and distribution suggest that over the next 50 to 100 years, many attributes found in unmanaged mature and old-growth forest stands would be maintained or created, trending from stand establishment, with legacies to mature, multiple canopy structure. Unit-group A would be the exception, lagging considerably in development due to very low site productivity affecting the potential development of a substantial number of large trees within the time frame. Table 18 summarizes the projected stand conditions 100 years after harvest. The cumulative number of large snags, equal to or greater than 16 inches diameter breast height, is predicted to be roughly 40 to 75 percent of that predicted for a No action (Table 16). The cumulative volume of dead wood is predicted to be roughly 45 to 60 percent of that predicted for Alternative One after 100 years.

One of the biggest benefits of VRH compared to a NWFP harvest is the creation of early-successional conditions for an extended period of time. It is estimated that early-successional, open canopy conditions should exist within the VRH units for a 30 years, as opposed to 10-15 years under a traditional NWFP harvest. Post-treatment monitoring will identify if canopy closure will occur prior to 30 years and thinning treatments will be prescribed to insure this extended early-successional conditions. It is possible that early-successional conditions may extend beyond 30 years in portions or, or entire stands, if natural seedfall, site productivity, and/or herbivory combine to limit conifer establishment and/or development. This extended early-successional condition and planting of a diverse species provides for the development of minor tree species component that we see expressed so strong in 100 years when compared to a no action alternative and a traditional NWFP harvest (Table 16, Table 18, and Table 19). Residual trees in the dispersed retention areas have time to develop wider, deeper canopies and limb diameter increases in VRH versus NWFP treatments.

Table 15. Predicted current stand conditions within the variable retention harvest area (including aggregate retention areas and riparian reserves).

Unit-group	Area (acres)	Structural Class[1]	Trees/Acre		Basal Area (feet²/ac)	Basal Area (minor spp.)	# of Trees/Acre (≥ specified DBH)				Canopy Cover	Cumulative Mortality Trees/Acre ≥ 16" DBH	Cumulative Mortality (feet³/acre)
			All	≥ 6"			≥ 20"	≥ 30"	≥ 36"	≥ 40"			
A	41	MSC	646	276	202	30%	9	1	0	0	85%	n/a	n/a
B	116	YH	500	199	189	37%	8	0	0	0	80%	n/a	n/a
C	173	MSC	189	155	267	5%	43	7	4	2	80%	n/a	n/a
D	108	YH	394	212	214	3%	2	0	0	0	95%	n/a	n/a
1. Structural Class: YH – Young, high density; MSC – Mature, single canopy (BLM 2008)													

Table 16. Predicted stand conditions after 100 years if no VRH occurred.

Unit-group	Area (acres)	Structural Class[1]	Trees/Acre		Basal Area (feet²/ac)	Basal Area (minor spp.)	# of Trees/Acre (≥ specified DBH)				Canopy Cover	Cumulative Mortality Trees/Acre ≥ 16" DBH	Cumulative Mortality* (feet³/acre)
			All	≥ 6"			≥ 20"	≥ 30"	≥ 36"	≥ 40"			
A	41	MMC	303	266	297	12%	28	2	1	1	80%	12	2,500
B	116	MSC	166	165	375	27%	66	19	7	2	85%	34	6,200
C	173	SC	100	95	358	2%	59	24	11	6	90%	23	4,700
D	108	MSC	150	125	380	3%	83	17	2	0	90%	34	7,800
1. Structural Class: MMC – Mature, multiple canopy; MSC – Mature, single canopy; SC – Structurally complex (BLM 2008)													

Table 17. Predicted stand conditions immediately post-harvest within the variable retention harvest area (including aggregate retention areas and riparian reserves).

Aggregate Retention Areas									
Unit-group	Area (acres)	Structural Class[1]	Trees/Acre	Basal Area	Basal Area	# of Trees/Acre (≥ specified DBH)	Canopy Cover	Cumulative Mortality	Cumulative Mortality

			All	≥ 6”	(feet²/ac)	(minor spp.)	≥ 20”	≥ 30”	≥ 36”	≥ 40”		Trees/Acre ≥ 16” DBH	(feet³/acre)
A	6	*	646	276	202	30%	9	1	0	0	85%	n/a	n/a
B	53	*	500	199	189	37%	8	0	0	0	80%	n/a	n/a
C	55	*	189	155	267	5%	43	7	4	2	80%	n/a	n/a
D	42	*	394	212	214	3%	2	0	0	0	95%	n/a	n/a
Dispersed Retention Areas													
A	36	*	13	13	41	74%	9	1	0	0	15%	n/a	n/a
B	66	*	30	16	22	60%	4	0	0	0	15%	n/a	n/a
C	118	*	18	9	38	8%	4	4	4	2	10%	n/a	n/a
D	66	*	24	8	16	3%	2	0	0	0	10%	n/a	n/a
Combined Results													
A	41	SEL	108	53	65	67%	9	1	0	0	25%	n/a	n/a
B	116	SEL	232	95	94	50%	5	0	0	0	45%	n/a	n/a
C	173	SEL	73	56	111	7%	16	5	4	2	30%	n/a	n/a
D	108	SEL	168	87	93	3%	2	0	0	0	45%	n/a	n/a
Combined results reflect weighted averages 1. Structural Class: SEL – Stand Establishment with Legacy (BLM 2008)													

Table 18. Predicted stand conditions 100 years in the future within the variable retention harvest area (including aggregate retention areas and riparian reserves).

Aggregate Retention Areas													
Unit-group	**Area (acres)**	**Structural Class[1]**	**Trees/Acre**		**Basal Area (feet²/ac)**	**Basal Area (minor spp.)**	**# of Trees/Acre (≥ specified DBH)**				**Canopy Cover**	**Cumulative Mortality Trees/Acre ≥ 16” DBH**	**Cumulative Mortality (feet³/acre)**
			All	**≥ 6”**			**≥ 20”**	**≥ 30”**	**≥ 36”**	**≥ 40”**			
A	6	*	303	266	297	12%	28	2	1	1	80%	12	2,500
B	53	*	166	165	375	27%	66	19	7	2	85%	34	6,200
C	55	*	100	95	358	2%	59	24	11	6	90%	23	4,700
D	42	*	150	125	380	3%	83	17	2	0	90%	34	7,800
Dispersed Retention Areas													
A	36	*	128	123	78	31%	2	2	1	1	65%	9	1,300
B	66	*	163	163	257	18%	35	3	3	1	90%	6	1,300
C	118	*	156	156	168	13%	3	2	2	2	80%	2	900
D	66	*	160	152	278	9%	54	5	1	0	90%	11	2,200
Combined Results													
A	41	MSC	154	144	111	28%	6	2	1	1	70%	9	1,500
B	116	MMC	164	164	308	22%	48	10	5	1	90%	18	3,400
C	173	MMC	138	136	229	10%	21	9	5	3	80%	9	2,100
D	108	MMC	151	146	318	7%	66	9	1	0	90%	20	4,400
Combined results reflect weighted averages Structural Stages: MSC = Mature, Single Canopy; MMC = Mature, Multiple Canopy (BLM 2008)													

Table 19. Predicted stand conditions after 100 years with a standard NWFP regeneration harvest (including aggregate retention areas and riparian reserves).

Unit-group	Area (acres)	Structural Class[1]	Trees/Acre All	Trees/Acre ≥ 6"	Basal Area ($feet^2$/ac)	Basal Area (minor spp.)	# of Trees/Acre (≥ specified DBH) ≥ 20"	≥ 30"	≥ 36"	≥ 40"	Canopy Cover	Cumulative Mortality Trees/Acre ≥ 16" DBH	Cumulative Mortality ($feet^3$/acre)
Aggregate Retention Areas													
A	3	*	303	266	297	12%	28	2	1	1	80%	12	2,500
B	42	*	166	165	375	27%	66	19	7	2	85%	34	6,200
C	40	*	100	95	358	2%	59	24	11	6	90%	23	4,700
Dispersed Retention Areas													
A	38	*	222	212	108	11	5	1	0	0	80	3	500
B	74	*	189	189	308	7	42	4	2	0	90	6	1,300
C	134	*	208	205	242	3	5	5	2	1	90	3	800
Combined Results													
A	41	MSC	228	216	121	11	6	1	0	0	80	4	600
B	116	MMC	181	180	332	14	51	9	4	1	90	16	3,100
C	174	MMC	183	180	269	3	17	9	4	2	90	8	1,700

Combined results reflect weighted averages
1. Structural Class: MMC – Mature, multiple canopy; MSC – Mature, single canopy (BLM 2008)

Conclusion: Within the VRH dispersed retention areas 284 acres of NRF(153 ac.) and dispersal (131 ac) habitat will be lost due to the removal of the majority of the trees; from 189-650 down to 13-30 tpa, and canopy cover down to 10-15 percent (Table 17). No treatment within the aggregate retention blocks and riparian reserve would retain 133 acres of NRF (61 ac.) and dispersal (72 ac.) habitat; although 21 acres of dispersal habitat in Units 28-3-17A, 17B, and 17C would be degraded (canopy cover would remain above 50 percent) due to density management. Edge effects and isolation would probably limit the availability and suitability of all but the largest aggregate retention blocks.

Road Construction

Primary access would be provided by roads under the control of the BLM, the Umpqua National Forest, and Douglas County supplemented by the following:

- Construction of 14 spur roads with a combined length of 1.2 miles,
- Improvements to 0.16 miles of existing system and non-system[6] roads, and
- Maintenance/renovation to 7.44 miles of existing system and non-system roads.

[6] Non-system roads are roads that were constructed in the past, but for which no records of their authorization and construction exist. These may include truck roads for previous timber harvest, tractor roads constructed for fire suppression access, and way roads and jeep roads.

Best Management Practices would be applied in road construction, road improvement, road renovation, road use, and road decommissioning.

Road construction outside of timber sale units will result in the removal of up to 0.4 acre of capable habitat and 1.1 acres of dispersal habitat on federal lands from within the home ranges of 4 known and predicted owl sites. The improvement of one road segment may result in the loss of 0.08 acres of capable habitat from within the core area of 1 historic owl site. The removal of trees, shrubs, and down wood will cause the loss of roosting and foraging habitats. Overall, road construction is expected to create or maintain linear gaps averaging 40 feet in width. All newly constructed and improved roads will be decommissioned.

On inventoried, system roads proposed for renovation or improvements where the intent is to leave the road surfaces in a native (unsurfaced) state, decommissioning would take the form of waterbarring, covering with slash, and blocking to traffic. For roads and spurs that are to be surfaced with aggregate and retained for future management entries, decommissioning would also take the form of waterbarring, covering with slash, and blocking to traffic. This will help discourage illegal ATV access and use, aid in the protection of these areas to increased disturbance to flora/ fauna species, and mitigate non-native, invasive species introductions, colonization, and establishment, which roads are known vectors of.

Following sub-soiling of temporary natural surface roads, where soil depth and character allow, the road beds (both inside and outside of units) would be seeded and planted with native grasses, forbs, and deciduous shrubs appropriate to site conditions. Some conifer species such as western red-cedar may also be planted consistent with specific wildlife objectives such as aiding spotted owl prey items/species in depredation avoidance. This would be particularly helpful to flying squirrels as research conducted by Todd Wilson (2008) documented predation as the most significant factor on their populations. The non-coniferous plantings of diverse native grasses, forbs, and hardwood shrubs would also lend towards nutritional requirements and population maintenance and growth, of all spotted owl prey items such as woodrats and hares/rabbits, whom are all dependent in part or whole, on early seral habitats or species.

Supplemental seeding or planting of native vegetation may include such species as grasses; Romer's fescue (*Festuca roemer*), western fescue (*Festuca occidentalis*) and Columbian brome (*Bromus vulgaris*); forbs such as false Solomon's seal (*Smilacina racemosa*), harebell (*Campanula scouleri*), inside-out flower (*Vancouveria hexandra*), and queen's cup (*Clintonia uniflora*); and deciduous shrubs; red huckleberry (*Vaccinium parvifolium*), red and blue elderberry (*Sambucus racemosa* and *S. cerulean*), and wild rose (*Rosa gymnocarpa*). In addition to vegetation planting in units of decommissioned roads, other opportunistic native planting(s) could occur to reestablish representative non-conifer species in small pockets and riparian areas, complimenting the efforts being undertaken on the roads. Examples could include: red-osier dogwood (*Cornus stolonifera*), Pacific dogwood (*Cornus nuttallii*), and chokecherry (*Prunus virginiana*). Species such as wild strawberry (*Fragaria virginiana*), black raspberry (*Rubus leucodermis*), Oregon bedstraw (*Gallium oreganum*), wild ginger (*Asarum caudatum*), twinflower (*Linnaea borealis*), and kinnikinnik (*Arctostaphylos uva-ursa*) are expected to re-colonize the road beds in a timely manner and would not be the focus of the treatments.

Table 20. Road construction outside of timber sale units.

Road Number	IDNO	Analytical Scale	Spotted Owl Habitat[1] Loss (ac)				
			Not Capable	Capable	Dispersal	NRF	Total
Road Improvement							

29-2-4.2	1931	Core Area	0	0.08	0	0	0.08
Road Construction							
BR4	0292O	Home Range	0	0.3	0	0	0.3
WC9	1931O	Home Range	0	0.1	0	0	0.1
WC12	1931O	Home Range	0	0	1.1	0	1.1
	9581	Home Range	0	0	1.1	0	1.1
	Est9	Home Range	0	0	1.1	0	1.1
1. NSO Habitat: Not Capable – not able to grow trees of sufficient size and quantity to provide spotted owl habitat; Capable – able to grow trees of sufficient size and quantity to provide spotted owl habitat at some time in the future; Dispersal – forest of sufficient size and structure to permit spotted owl movement through the stand; NRF – forest of sufficient size and structure to provide for nesting, roosting, and foraging needs.							

Fire

The objectives of prescribed burning would be to reduce activity fuels created by timber harvest, prepare the units for replanting, create additional snags, and emulate the effects of natural disturbance to attain and enhance ecological processes and functions associated with normal and periodic return of wildfire. Spring burning, typically between April and July, is more manageable in that there are more opportunities to burn based on weather restrictions, fire behavior is more likely to achieve the majority of resource objectives, there is a decreased risk of dispersed retention tree mortality, and less risk for escape from the burn unit. The proposed and likely low intensity burn and anticipated moisture conditions of fuels on-site, would protect larger pieces of wood and consume wood less than three inches in diameter. This is a result of large fuels having sufficient moisture content to minimize consumption. Retention aggregates would be fire-trailed where the objective is to exclude fire to preserve current habitat structural character and components, as determined by BLM Wildlife Biologist and input from USFWS.

Fire would be expected to have short-term and indirect effects to spotted owls. Some of their prey species, particularly small mammals, may be directly impacted due to smoke or the inability to escape. Other small mammals may not be affected if they are mobile, protected within large downed coarse wood, or able to move underground or up a tree. The timing of the burn may directly affect some spotted owl prey on a limited scale, both in numbers and on a temporal scale, although long-term a low intensity burn would likely benefit those species through increased plant vigor, forage production, and tree mortality resulting in cavity creation and denning opportunities. Another benefit would be the likely decrease in potential for a stand replacement event, particularly in the drier forest found within the action area.

Conclusions

Habitat

Within Nest Patch***. No Secretarial Pilot Project harvest units occur within any nest patch (Figure 2).***

Within Core Area.

Nesting, Roosting, and Foraging Habitat

VRH would result in the loss of 52 acres of NRF habitat from within the core areas of three known or predicted owl activity centers (Table 21).

Dispersal Habitat

Fifteen acres of dispersal habitat will be lost from within the core areas of two known owl activity centers due to VRH activities **(Figure 2** and Table 21).

Dispersal habitat further than 300 meters from a nest site is thought to be less important in providing spotted owl roosting and foraging functions but may be able to compensate for low levels of those habitat components (where there are <250 acres with 0.5 miles of an activity center ((USDI Fish and Wildlife Service, USDI Bureau of Land Management, and USDA Forest Service, 2008)).

Density Management in in unit 28-3-17A, 17B, and 17C will not limit spotted owl movement through these stands if at least 40 percent canopy closure is maintained – the District intends to maintain at least 50 percent stand average, canopy closure within treated stands. These projects will also reserve large remnant trees, and snags and coarse woody material will be protected to the extent practicable. Density management will occur within the core area of one known spotted owl activity center.

Density management activities on 1 acres will occur within the core area of one known spotted owl site.

Road Buildling

Road building associated with this project would not result in the loss of any NRF or dispersal habitat from within any NSO core area (outside of a nest patch) (**Table 20,** Table 21).

Core Area – not habitat limited

Nesting, Roosting, and Foraging Habitat

VRH would result in the loss of 52 acres of NRF habitat from within the core areas (habitat not limited) of three known or predicted owl activity centers.

Dispersal Habitat

Density Management will not occur within any core area containing more than 250 acres of NRF. Such projects may affect, but are not likely to adversely affect spotted owls when there are more than 250 acres of suitable habitat within the core area and they are outside of nest patches.

Core Area – habitat limited

Nesting, Roosting, and Foraging Habitat

VRH would not result in the loss of any NRF habitat from within a habitat-limited core area.

Dispersal Habitat

The loss of dispersal habitat (two acres) will occur within the habitat limited core area of one owl activity center due to VRH (**Table 21).** The modification of dispersal habitat due to density management may affect, and is likely to adversely affect spotted owls when less than 250 acres of NRF habitat is maintained within the core area.

Within Home Range

Nesting, Roosting, and Foraging Habitat

Activities will occur within the home range of seven known predicted spotted owl activity centers. In total, 155 acres of suitable habitat will be downgraded within those five of home range (Table 21**)**. No NRF habitat will be lost from the home range of any known or predicted owl activity center that contains less than 40% NRF (Table 21).

Effects determinations are made owl site, by owl site, at each of three distinct analytical scales: nest patch, core area, and home range based upon the ability of the habitat to function post-treatment. Any modification of dispersal or NRF habitat is construed as a '"may affect" action. It is the outcome and scale of the action that dictates whether the activity may adversely affect the NSO or not.

As discussed above, variable retention harvest results in the removal of standing timber and reduction of canopy cover within the dispersed retention areas to between 10-15 percent -- well below the 40 percent canopy cover necessary to provide dispersal habitat (USDI FWS 2012) and the 60-70 percent necessary to provide NRF habitat (USDI FWS 2012). It is the loss of this NRF habitat within the home ranges of the Curtin Creek, Blue Oyster Cultus, Deadman Mountain, Est 9, and Cultus known and predicted owl sites that cause the proposed action to be identified as **may affect, likely to adversely affect**. Additionally, as central place foragers, nesting spotted owls are very sensitive to activities that occur within their core areas and especially their nest patch (USDI FWS and USDI BLM 2008).

When NRF habitat is limited, any activity, in either dispersal or NRF is likely to cause an adverse effect within a NRF deficient core area (USDI FWS and USDI BLM 2008). The loss and modification of dispersal area within the NRF deficient core area of the High Riser site triggers a determination of **may affect, likely to adversely affect**.

As stated above the loss/modification of dispersal habitat is of significance in NRF deficient core areas and in nest patches; at the home range scale dispersal habitat plays a very small role in the survival and reproduction of the resident owls (USDI FWS and USDI BLM 2008). The loss of dispersal habitat within the home range of the Lucky Buck owl site may affect those owls, but those effects are not believe to measurable affect either the survival or reproduction of the pair; the VRH and density management treatments **may affect**, but are **not likely to adversely affect** the Lucky Buck site.

Therefore, modification or loss of dispersal habitat within one habitat limited core area and the loss of 155 acres of NRF from five home ranges <u>may affect</u>, and is <u>likely to adversely affect</u> the northern spotted owl site (Table 21).

Table 21. Summary of effects of the Secretarial Pilot Project within the home range and core areas of known and predicted northern spotted owl activity centers.

Physiographic Province[1]	IDNO	Available NRF Habitat (ac)								Available Dispersal Habitat (ac)								Road Construction[4]	Road Construction Occurs within		Effects Determin.[2]
		Pre-Treatment				Post-Treatment				Pre-Treatment				Post-Treatment							
		Core Area	(%)	Home Range	(%)	Core Area	(%)	Home Range	(%)	Core Area	(%)	Home Range	(%)	Core Area	(%)	Home Range	(%)		Core[3]	Nest Patch	
WC	0258O	205	41	482	16	205	41	482	16	60	12	925	31	60	12	912	31				NLAA
	02920	169	34	972	33	169	34	972	33	196	39	863	29	183	37	798	27	n	x		LAA
	2291O	318	64	1466	50	317	63	1450	49	113	23	926	31	111	23	862	29	n	y		LAA
	2381O	467	92	2235	75	425	84	2139	72	19	3	227	45	19	3	227	7				LAA
	9581	412	82	2093	71	412	82	2039	69	45	9	453	15	45	9	444	15	n			LAA
	EST9	464	93	2256	76	457	91	2193	74	38	8	414	14	38	8	410	14	n			LAA
	U0521	370	74	1976	67	370	74	1973	67	82	16	555	19	82	16	555	19				LAA

1. Physiographic Province: **CR** - Coast Range; **KL**- Klamath; **WC** - Western Cascades
2. Effects Determination: **LAA** - Likely to Adversely Affect; **NE** - No Effect; **NLAA** - Not Likely to Adversely Affect; **NO** - Not Occupied
3. Activity occurs in Core Area: **x** - ct/dm only; **y** - ct/dm and road building.
4. Road Construction: **x** - occurs, loss of NRF; **n** - occurs, no loss of NRF; **z** - occurs, loss of less than 1 acre of NRF.
5. Green highlight signifies difference from pre-treatment amount; Red highlight signifies amount below threshold values.

Disruption

Disruption associated with Regeneration and Commercial Thinning, and their associated road building, will be minimized by application of PDC that impose operating restrictions during the critical breeding season within disruption distances of unsurveyed suitable habitat, known spotted owl sites, and estimated spotted owl sites.

Therefore, adverse effects to breeding spotted owls are unlikely to occur within the disruption threshold distance of this activity (USDI 2004b). As a result, disruption associated with regeneration (variable retention) harvest and commercial thinning (density management), and their associated road building, **may affect**, but is **not likely to adversely affect** spotted owls.

Proposed Spotted Owl Critical Habitat (USDI FWS 2012)

Within the VRH dispersed retention areas 218 acres of NRF(89 ac.) and dispersal (129 ac) habitat will be lost due to the removal of the majority of the trees, from 189-650 down to 13-30 tpa, and canopy cover down to 10-15 percent (**Table 17**). No treatment within the aggregate retention blocks and riparian reserve would retain 93 acres of NRF (23 ac.) and dispersal (70 ac.) habitat; although 21 acres of dispersal habitat in Units 28-3-17A, 17B, and 17C would be degraded (canopy cover would remain above 50 percent) due to density management. Edge effects and isolation would probably limit the availability and suitability of all but the largest aggregate retention blocks.

The primary function of subunit KLE 2 is to provide east-west connectivity, a secondary function is to provide demographic support. The majority of the project occurs in one of the few blocks of contiguous BLM ownership in the District. By placing the project here we are better able to minimize the further fragmentation of NRF habitat in the otherwise checkerboard landscape we typically manage. It is our belief, that a large block of relatively contiguous habitat is better able to withstand the impact of fragmentation that a landscape that is already highly fragmented—we are less likely to be at, or near, any threshold values that may make this landscape unsuitable for spotted owl movement. These timbersale units occur on the edge of the CHU subunit; in those positions impacts to the overall viability of the federal landscape to provide connectivity in a east-west direction should be minimized. The proposed project occurs on the northern edge of KLE 2 and east-west movements are limited here because they would lead to the valley. Work by Forsman, et al (2002) indicate that owl disperse around the valley and cross over into the western Klamath Mountains and the southern Coast Range further to the south. Connectivity through this large block of habitat will be maintained. Connectivity should be maintained between the Western Cascades South critical habitat unit to the north and to the remainder of Klamath East unit to the east.

Other ecological factors to consider-- regeneration harvests have not been conducted in this watershed in over 10 years. Early successional habitat on federal lands is rapidly diminishing. A number of studies indicate that quality early-successional habitat may be beneficial to spotted owls under certain conditions (Carroll and Johnson 2008, Dugger *et al.* 2005, Olson *et al.* 2004, Franklin *et al.* 2000). One of the goals of this demonstration is to illustrate how a more natural early-successional habitat can be placed back on the BLM landscape; creating a whole landscape and setting the stage for a more natural development of the subsequent successional stages. Demonstrating how, and then implementing on a larger scale would be beneficial to the northern spotted owl by adding habitat value to the intermediate stages, nesting habitat for prey species, providing for the development of northern spotted owl nesting structure sooner, and by giving habitat value to otherwise unfavorable seral stages. The stands selected are less than 110 years old, although there are older components (single trees and small clumps) within the units; many if not all of these will be protected in aggregate retention blocks or with dispersed retention. Project design features to incorporate the tenets of ecological forestry include:

- retention of existing large decadent trees and snags;

- retention of retained aggregates and riparian no-treatment areas to provide travel corridors from adjacent late seral habitats and across the landscape;
- retention of a range of tree size classes throughout the stand;
- improvement of foraging opportunities by promoting the development of understory and shade-tolerant tree species throughout the stand; and
- maintenance of canopy cover within the stands (e.g., skips, lightly and moderately thinned areas) which would 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.

Ecologically base forest management aimed to restore or maintain ecological processes and landscape resiliency.

A secondary role of this critical habitat subunit is to contribute to the demographic stability of the area. The proposed actions occur within home ranges of seven known or predicted owl activity centers (Appendix 2). The habitat loss/modification proposed will not reduce the amount of NRF habitat within the any one home range or core area to below threshold levels. Furthermore, we believe that we took a reasonable tact to situate our project so as to minimize impacts to the northern spotted owl; we made one assumption: NSO sites near the thresholds (+/- approximately10 percent) are those sites at which it is most critical to maintain habitat conditions. All of our sites that began above the home range and core area thresholds remained above those thresholds, by at least, 9-10 percent. The two sites that began the project below core area and home range thresholds had no loss of NRF. High Riser had less than 50 percent NRF in its core area (34 percent), pre-harvest; unit 28-3-17B removed dispersal habitat at the periphery of the core area and as the figure in Appendix 2 illustrates, this action did not restrict movement to any stand of NRF habitat-there are no mapped NRF beyond this unit, within the home range of the High Riser owl site. In terms of being able to meet the survival and reproductive requirement of the northern spotted owl the proposed VRH will remove NRF and dispersal habitat from within the home range and core areas of seven known and predicted activity centers, however the ability of the landscape to meet the survival and reproductive requirement of those activity centers will not be impair.

In conclusion, we believe that the loss of 89 acres of NRF and 129 acres of dispersal habitat **may affect**, and will **likely adversely affect** proposed critical habitat for the northern spotted owl due to the loss of Primary Constituent Elements 2, 3, and 4.

Spotted Owl Recovery Plan Compliance

BLM is directed to manage their lands consistent with approved federal recovery plans for threatened and endangered species. The Revised Recovery Plan for the Northern Spotted Owl was released June 30, 2011 (USFWS 2011). This project was initiated in December 2010 and unit selection was completed by Spring of 2011. To the extent possible, the planning of the Secretarial Pilot Project was conducted with consideration of the draft of that plan (USFWS 2010) and the overall goals to maintain extant northern spotted owl sites and to maintain landscape connectivity. Below are discussions of how this project fits with individual Recovery Actions: 6, 10, and 32. We believe that given the complexity of the BLM landscape, the complexity of the management direction, and the timelines given that the Secretary's Pilot Project is consistent with the management strategies of the northern spotted owl recovery plan (USFWS 2011).

Recovery Action 6

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.

The primary goal for the management of moist forests is to "conserve older stands that are either occupied or contain high-value spotted owl habitat[7]"; managing the landscape to emulate natural disturbance patterns; managing younger and less diverse to promote ecological goals, including spotted owl recovery; restoring more natural early successional forest conditions that provide more ecological benefits to spotted owls (and other native forest species) than do traditional regeneration efforts. The Recovery Plan (USFWS 2011) recommends "application of disturbance-based principles" put forth by a number of authors including Johnson and Franklin (2009). The USFWS (2011) puts forth five recommendations:

- Conserve older stands that have occupied or high-value spotted owl habitat as defined in Recovery Actions 10 and 32.
- Management emphasis needs to be placed on meeting spotted owl recovery goals <u>and</u> long-term ecosystem restoration and conservation (emphasis theirs).
- Continue to manage for large, continuous blocks of late-successional forests.
- Regeneration harvest, if carried out, should apply ecological forest principles…
- Use pilot projects and applied management to test or demonstrate techniques and principles. Locate pilot projects in Matrix and Adaptive Management Areas.

The Secretarial Pilot Project does occur within the home ranges of five known owl activity centers, by definition it does occur within the high-value spotted owl habitat. But, as we will discuss below in regards to Recovery Actions 10 and 32 this project should have minimal impacts to those sites.

Ecologically, this project is a single demonstration, at the direction of the Secretary of the Interior, to implement a demonstration of the ecological forest principles put forth in Johnson and Franklin (2009). An additional goal is to demonstrate if an ecological forestry project can be economically successful, acceptable to the public and the USFWS in meeting the goals and objectives of the spotted owl recovery plan. The Myrtle Creek 5^{th}-field watershed was selected as the site for the Roseburg Demonstration Pilot to illustrate treatments in a moist interior forest. The watershed contains approximately 76,000 acres. BLM-administered lands account for roughly 31,000 acres, approximately 26,730 of which are considered forest lands. To meet the needs of this demonstration project we were looking for approximately 300 acres of moist-forest types. Geographical information systems analysis and forest operational inventories were used for initial stand selection, resulting in the following acreage reductions:

- Stands in age-classes less than 50-years-old were eliminated because they were considered too young-resulting in the removal of 9,000 acres from the base.
- Stands in age-classes from 110-to-150 years-old, and those considered old-growth were eliminated because harvest of these stands was considered too controversial –resulting in the removal of 13,300 acres from the base.
- "Dry site" forest stands –resulting in the removal of 4,100 acres from the base..

[7] High-Value Habitat = Habitat that is important for maintaining spotted owls on landscapes. Includes areas meeting definition of high-quality habitat, but also area with current and historic use by spotted owls that may not meet the definition of high-quality habitat (USFWS 2011, p. G-2).

The remaining pool of 4,600 acres was reduced to 1,500 acres by elimination of: stands with major access needs, stands within the home range of known reproducing northern spotted owl pairs (partially in response to Recovery Action 10), stands with a quadratic mean diameter[8] of less than ten inches, and stands with a projected volume per acre of less than 20 thousand board feet. The remaining acres were further reduced to 800 acres by elimination of isolated stands, and units where the extent of Riparian Reserves made them operationally infeasible.

Field reconnaissance and stand exams were used to further verify the suitability of the stands proposed for harvest. Delineation of units by stand type extended some proposed unit boundaries into the Little River and Middle South Umpqua River-Dumont Creek 5th-field watersheds. Additional units in these adjoining watersheds were added based on proximity, existing access and suitability for harvest given the criteria described above. Younger stands in Section 17, T. 28 S., R. 3 W., Willamette Meridian (W.M.) were selected to contrast treatments in managed plantations with those in native stands.

The stands selected are less than 110 years old, although there are older components (single trees and small clumps) within the units; many if not all of these will be protected in aggregate retention blocks or with dispersed retention. Project design features to incorporate the tenets of ecological forestry include:

- retention of existing large decadent trees and snags;
- retention of retained aggregates and riparian no-treatment areas to provide travel corridors from adjacent late seral habitats and across the landscape;
- retention of a range of tree size classes throughout the stand;
- improvement of foraging opportunities by promoting the development of understory and shade-tolerant tree species throughout the stand; and
- maintenance of canopy cover within the stands (e.g., skips, lightly and moderately thinned areas) which would 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 majority of the project occurs in one of the few blocks of contiguous BLM ownership in the District. By placing the project here we are better able to minimize the further fragmentation of NRF habitat in the otherwise checkerboard landscape we typically manage. It is our belief, that a large block of relatively contiguous habitat is better able to withstand the impact of fragmentation that a landscape that is already highly fragmented—we are less likely to be at, or near, any threshold values that may make this landscape unsuitable for spotted owl movement. Connectivity through this large block of habitat will be maintained. Other ecological factors to consider, regeneration harvests have not been conducted in this watershed in over 10 years. Early successional habitat on federal lands is rapidly diminishing. A number of studies indicate that quality early-successional habitat may be beneficial to spotted owls under certain conditions (Carroll and Johnson 2008, Dugger *et al.* 2005, Olson *et al.* 2004, Franklin *et al.* 2000). One of the goals of this demonstration is to illustrate how a more natural early-successional habitat can be placed back on the BLM landscape; creating a whole landscape and setting the stage for a more natural development of the subsequent successional stages. Demonstrating how, and then implementing on a larger scale would be beneficial to the northern spotted owl by adding habitat value to the intermediate stages, nesting

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[8] Quadratic mean diameter corresponds to the mean basal area of a stand. Basal area is the cross sectional area of a single stem, including the bark, measured at breast height (4.5 feet above the ground) Society of American Foresters. 1998. The quadratic mean diameter is used in place of a simple arithmetic mean because it is found to have a better relationship to stand volume estimation. Arithmetic mean diameter (AMD) =

habitat for prey species, providing for the development of northern spotted owl nesting structure sooner, and by giving habitat value to otherwise unfavorable seral stages.

Conclusion: This is a demonstration of ecological forestry principles. BLM is proposing to treat 428 acres, 1.6 percent of the watershed. The northern spotted owls within the watershed, and the quality of their home ranges were considered in selecting the demonstration units.

Recovery Action 10

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

BLM initiated this project prior to the finalization of the recovery plan. The draft version of Recovery Action 10 talked about maintaining "extant: sites upon the landscape. There was not interim guidance for prioritizing sites. At the time of project design BLM's overriding goal in regard to managing northern spotted owl sites was to maintain them, on the landscape. To that extent, we identified those sites with high percentages of NRF within their home (≥50 percent) and those areas with sub-threshold totals (≤40 percent). Five of the known and predicted owl activity centers had more than 50 percent NRF within their home range and 60 percent within their core area (Table 9), The other two site had less than 35 percent NRF within their home range and 45 percent within their core areas (Table 9). Additionally, none of the NSO sites to be impacted had fledged young from 2006-2010; Lucky Buck subsequently fledged one young in 2011.

Barred owls (*S. varia*) have been located within the home ranges of six of the seven known or predicted home ranges, within the last 5 years. More than 10 detection have occurred with the High Riser, Curtin Creek, and Est 9 home ranges; less than 10 detections have occurred with the Deadman Mountain home range; and less than 10 detections have occurred in the Cultus, Blue Oyster Cultus, and Lucky Buck (no detections), although surveys at these sites have been limited to 2010 and 2011. Probable barred owl pairs occur in the High Riser and Curtin Creek home ranges.

BLM is planning initiate a process with the USFWS to prioritize northern spotted owl activity centers, relevant to Recovery Action 10,

Conclusion: We believe that we have met the intent of Recovery Action 10 by not reducing the amount of NRF habitat within the any one home range or core area to below threshold levels. Furthermore, we believe that we took a reasonable tact to situate our project so as to minimize impacts to the northern spotted owl; we made one assumption: NSO sites near the thresholds (+/- approximately10 percent) are those sites at which it is most critical to maintain habitat conditions. All of our sites that began above the home range and core area thresholds remained above those thresholds, by approximately 9-10 percent. The two sites that began the project below core area and home range thresholds had no loss of NRF. High Riser had less than 50 percent NRF in its core area (34 percent), pre-harvest; unit 28-3-17B removed dispersal habitat at the periphery of the core area and as the figure in Appendix 2 illustrates, this action did not restrict movement to any stand of NRF habitat-there are no mapped NRF beyond this unit, within the home range of the High Riser owl site.

Recovery Action 32

Because spotted owl recovery requires well distributed, older and more structurally complex multilayered conifer forests on Federal and Non-federal lands across its range, land should work with the Service as described below to maintain and restore such habitat while allowing for other threats, such as fire and insects, to be addressed by restoration management actions. These high-quality spotted owl habitat stands area 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 project has been designed to avoid what has been termed "RA 32" habitat. All stands treated are less than 110 years of age, as a stand they are not considered to be RA 32 habitat. Wildlife biologists with the BLM and USFWS have conducted several field visits to identify habitat components needing protection, additional field visits will occur in order to finalize and adjust aggregate retention block boundaries and dispersed retention tree selection to maximize the protection of these components.

Within units 28-2-32C, 32D, 31A, and 31B and units 28-3-23A and 25A there are aggregates of residual habitat, or individual components, that may contain structure that in a larger extent may be considered RA 32 habitat. These aggregates are protected within our aggregate retention areas; individual components, to the greatest extent possible are protected as dispersed retention trees.

Conclusion: No stands of RA 32 habitat will be harvest in this demonstration project. Those aggregates or individual components of RA 32 habitat that occur within the VRH treatment area will be protected within aggregate retention blocks or as dispersed retention trees. No RA 32 habitat will be impacted by this action.

Cumulative Effects to Northern Spotted Owls

Cumulative effects are the effects of past and future state or private actions that are reasonably certain to occur within the action area (50 CFR 402.02). Cumulative effects analysis provides greater insight into current environmental factors and likely trends that might affect a species.

Within the action area, private and state lands comprise approximately 4163 (25 percent of area). State and private lands within the action area provide some late-seral habitat for the spotted owl and murrelet; they also provide substantial amounts of spotted owl dispersal habitat which provides some foraging opportunities and connectivity between blocks of late-seral habitat on federal land. However, 98,672 acres of spotted owl suitable and dispersal habitat have been removed from private lands, across the Roseburg District, since 1993 (current as of spring 2008), a trend that appears to apply to the action area as well. Habitat conditions can reasonably be expected to continue to decline based on typical private forest management practices (i.e. short rotation, brush control, and low levels of snag and down wood retention) in the action area.

Cumulative adverse effects to spotted owls will likely continue within the action area and elsewhere in the State of Oregon. Currently, the Oregon Forest Practices Act requires protection of a 70-acre area around occupied nest sites, and does not provide any protection or conservation of other surrounding habitat. Removal of suitable and dispersal habitat on private lands across the District may also increase the risk to the persistence of the species in the action area.

V. BIOLOGICAL ASSESSMENT CONCLUSIONS

It is the conclusion of this Biological Assessment that proposed Secretarial Pilot Project may affect the northern spotted owl, as documented above. Overall, it has been determined that the proposed timber sale **may affect, likely to adversely affect** the northern spotted owl. Additionally, the proposed timber sale **may affect, likely to adversely affect** proposed critical habitat for the northern spotted owl. A summary of effects determinations are below (Table 22).

This timber sale is currently in development and it final implementation may differ from that described in this assessment; for example, acres implemented may change if units are dropped or reconfigured to accommodate BLM Special Status Species. However, neither total acres treated, trees harvested, nor effects to listed species will exceed those described above. This Assessment neither anticipates nor addresses any action that does not meet the definitions provided, does not comply with the standards presented, or exceeds the anticipated effects summarized above. The total incidental take that results from adverse effects shall be tracked and reported to the interagency team with the *Project Implementation & Monitoring Form*. Before exceeding an anticipated level of incidental take, the District shall inform the interagency team and re-initiate formal consultation with the Service.

Table 22. Summary of effect of the Secretarial Pilot Project on the northern spotted owl.

Species	Element	Effects Determination
Northern Spotted Owl	Habitat	May Affect, Likely to Adversely Affect
	Disturbance	May Affect, Not Likely to Adversely Affect
	Proposed Critical Habitat	May Affect, Likely to Adversely Affect

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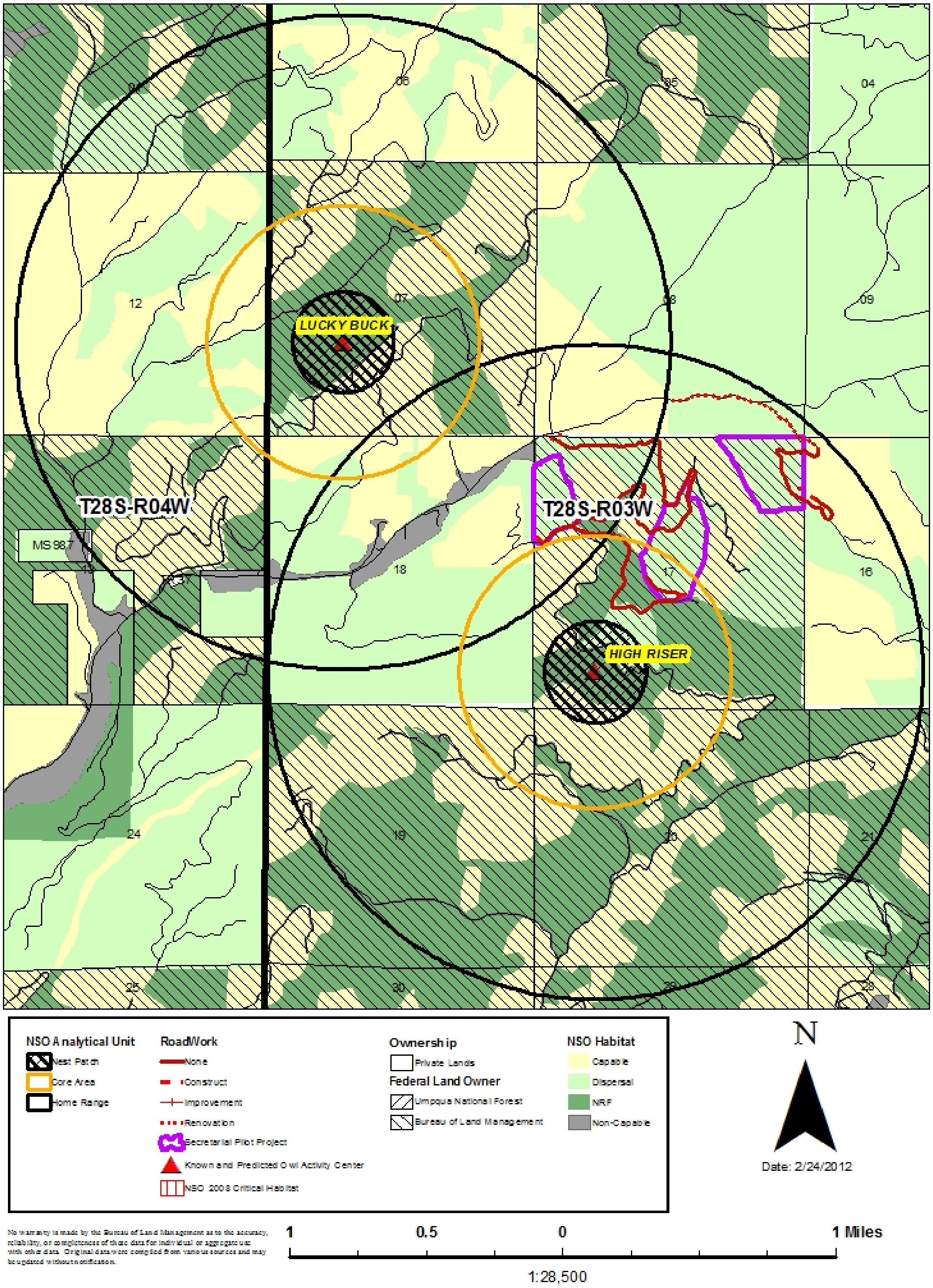
APPENDIX 1. Environmental baseline for the Roseburg District (Table 7. Environmental baseline for consultation # 13420-2011-F-0012).

Roseburg District	Area (ac)	Suitable NSO Habitat (%)		Capable NSO Habitat (%)		Protected Area[1] (%)		Unprotected Area (%)	
1. Ownership									
All owners	1,470,028								
Non-BLM	1,043,600								
BLM	426,428	212,683	(50)	409,199	(96)	285,825	(67)	140,604	(33)
2. Land Allocation - Federal (hierarchal, no acres double-counted)									
Congressional Reserve	28	19	(68)	19	(68)				
Late-Successional Reserves	175,301	102,944	(59)	169,085	(96)				
Known Owl Activity Centers	12,129	11,246	(93)	11,927	(98)				
District Designated Reserves	6,844	102	(1)	4,998	(73)				
Riparian Reserves	91,523	36,448	(40)	88,806	(97)				
Matrix/AMA	140,604	61,923	(44)	135,825	(97)				
3. Critical Habitats									
Northern Spotted Owl									
Total	150,643					126,840	(84)	23,803	(16)
Capable	146,532					122,854	(84)	22,693	(15)
Suitable	82,085					71,902	(88)	10,183	(12)
Dispersal Only	24,695					18,555	(75)	6,139	(25)
Marbled Murrelet									
Total	78,551					78,495	(100)	55	(0)
Zone 1	24,234					24,240	(100)	6	(0)
Zone 2	54,316					54,267	(100)	49	(0)
Total Suitable	46,253					46,232	(100)	17	(0)
Zone 1	14,108					14,105	(100)	3	(0)
Zone 2	32145					32,131	(100)	14	(0)

1. Area not programmed for timber harvest

APPENDIX 2. Figures displaying the juxtaposition of NSO Analytical units and proposed treatment areas for the Secretarial pilot project.



LUCKY BUCK
HIGH RISER
T28S-R04W
T28S-R03W
MS 987
NSO Analytical Unit
Nest Patch
Core Area
Home Range
RoadWork
None
Construct
Improvement
Renovation
Secretarial Pilot Project
Known and Predicted Owl Activity Center
NSO 2008 Critical Habitat
Ownership
Private Lands
Federal Land Owner
Umpqua National Forest
Bureau of Land Management
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Capable
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Date: 2/24/2012
No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of these data for individual or aggregate use with other data. Original data were compiled from various sources and may be updated without notification.
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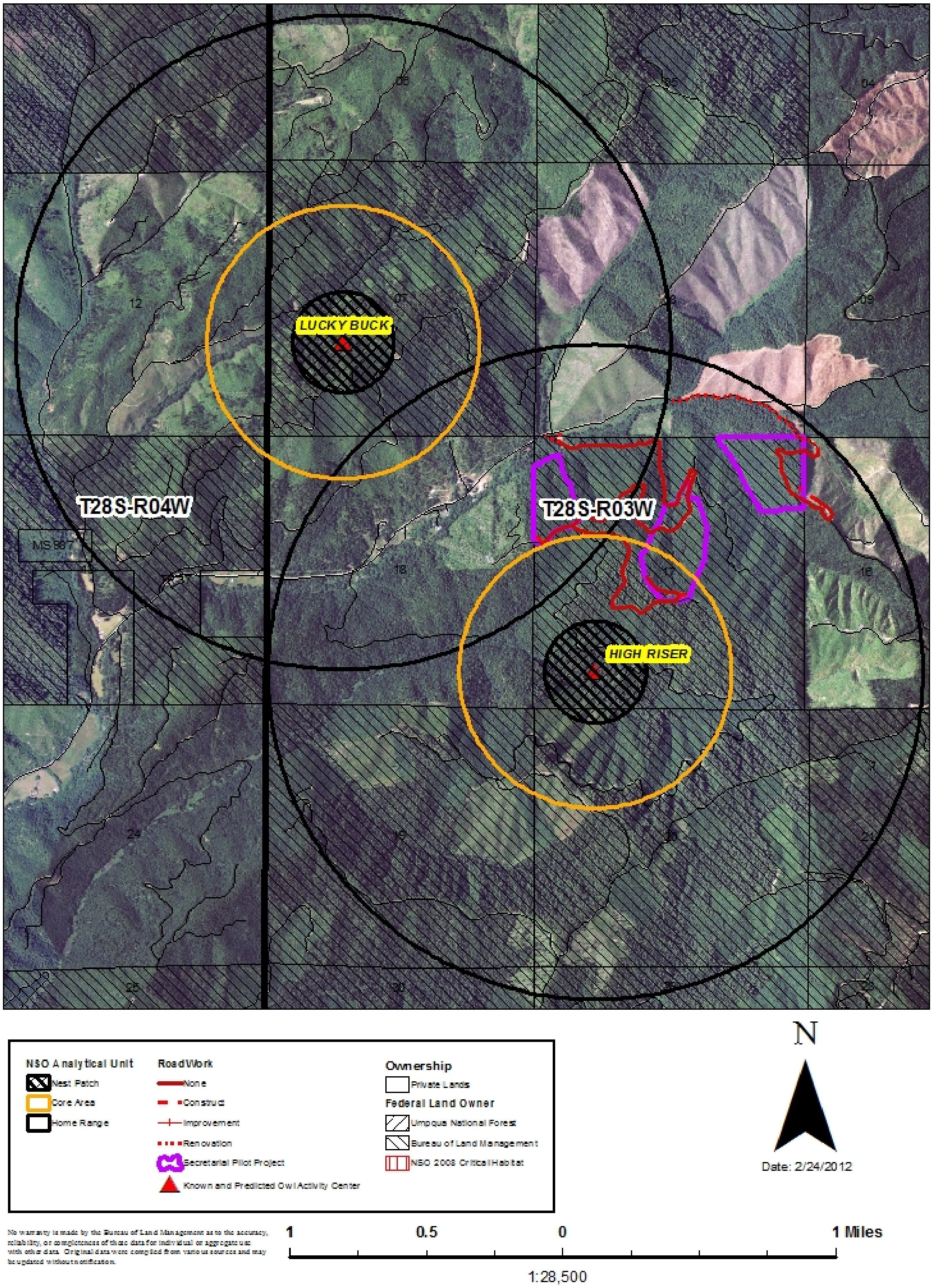
LUCKY BUCK
HIGH RISER
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T28S-R03W
NSO Analytical Unit
Nest Patch
Core Area
Home Range
Road Work
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Construct
Improvement
Renovation
Secretarial Pilot Project
Known and Predicted Owl Activity Center
Ownership
Private Lands
Federal Land Owner
Umpqua National Forest
Bureau of Land Management
NSO 2008 Critical Habitat
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Date: 2/24/2012
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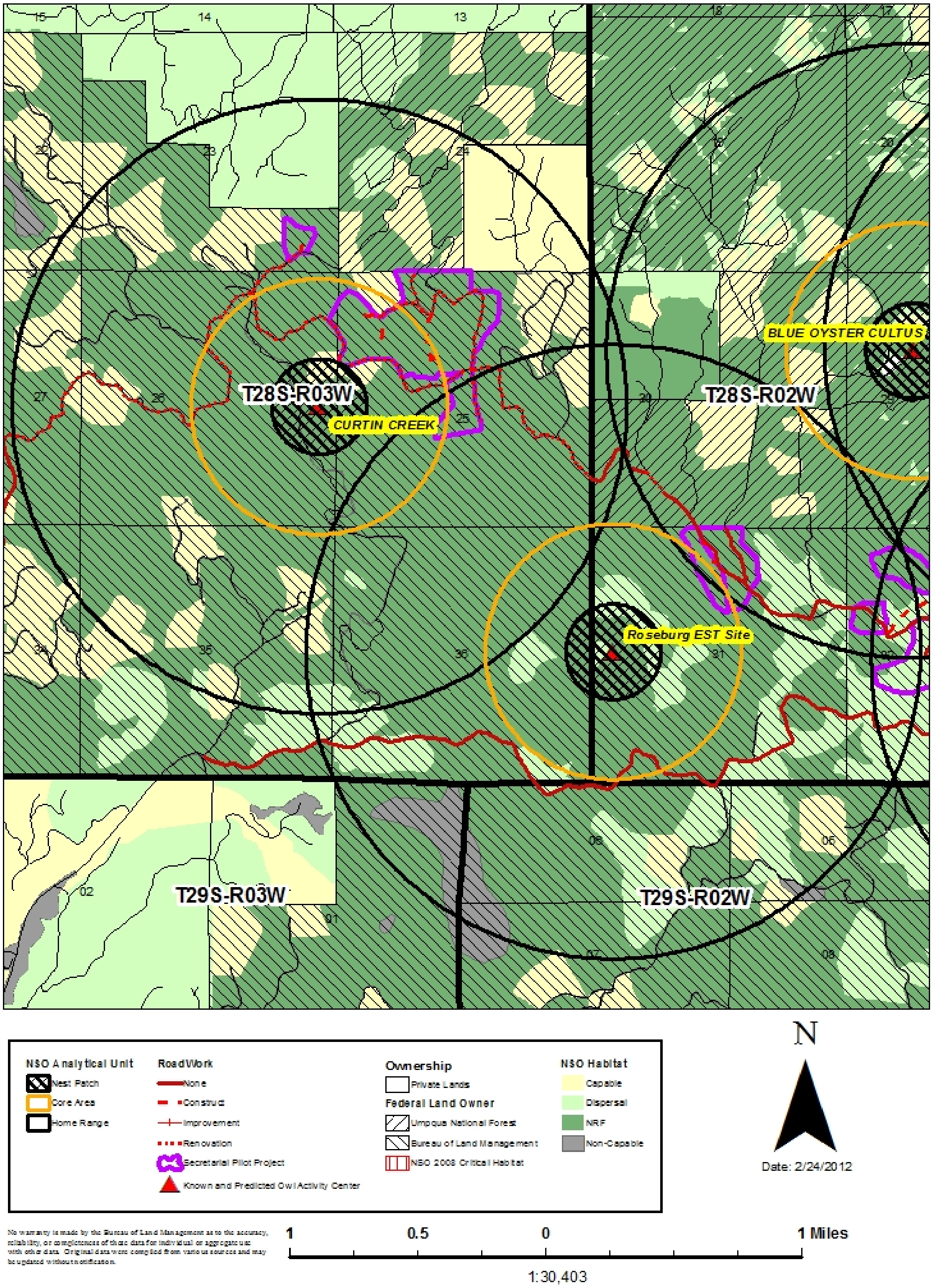

T28S-R03W
T28S-R02W
T29S-R03W
T29S-R02W
CURTIN CREEK
BLUE OYSTER CULTUS
Roseburg EST Site
NSO Analytical Unit
Nest Patch
Core Area
Home Range
RoadWork
None
Construct
Improvement
Renovation
Secretarial Pilot Project
Known and Predicted Owl Activity Center
Ownership
Private Lands
Federal Land Owner
Umpqua National Forest
Bureau of Land Management
NSO 2008 Critical Habitat
NSO Habitat
Capable
Dispersal
NRF
Non-Capable
N
Date: 2/24/2012
No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of these data for individual or aggregate use with other data. Original data were compiled from various sources and may be updated without notification.
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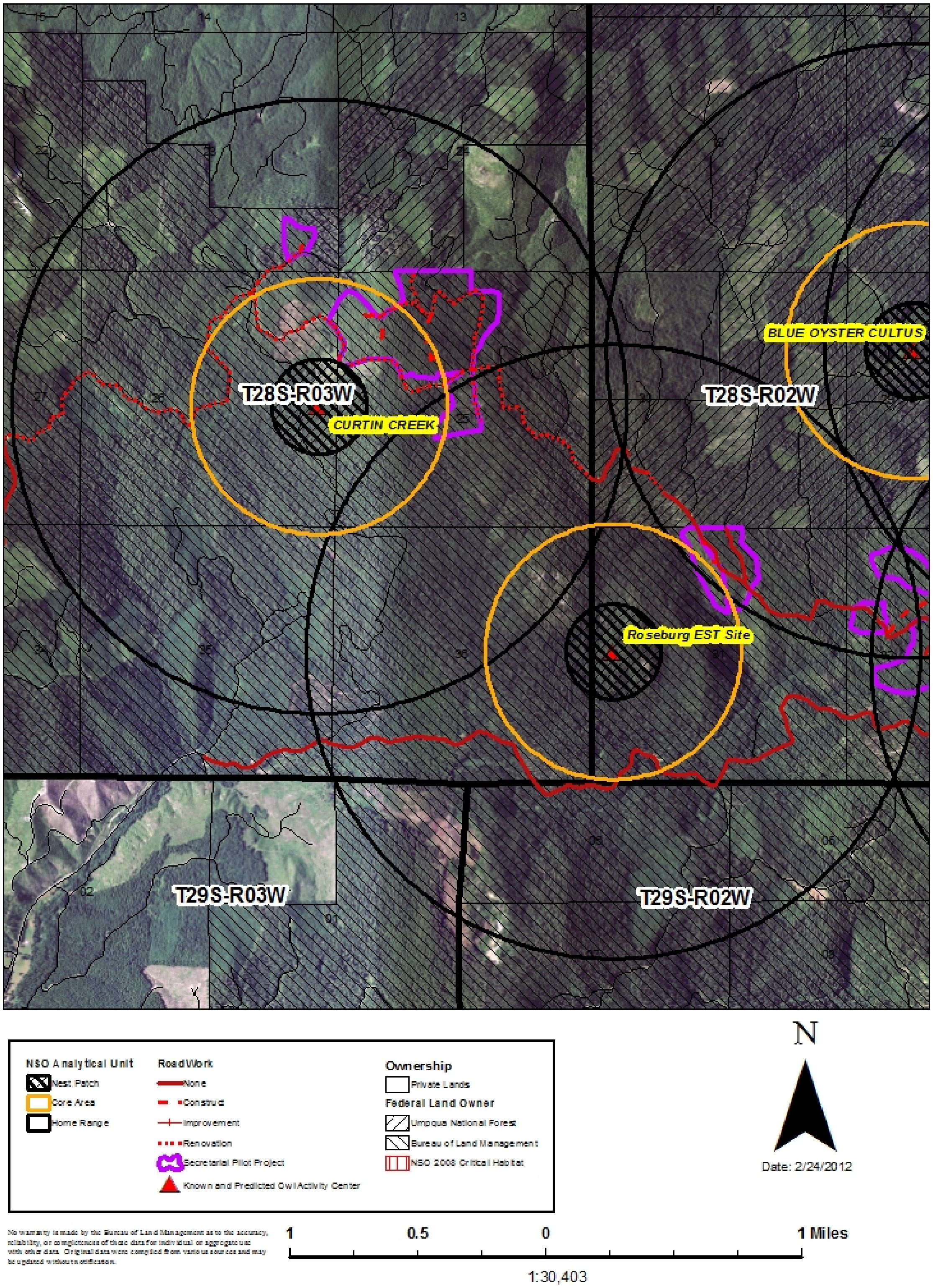

T28S-R03W
T28S-R02W
T29S-R03W
T29S-R02W
CURTIN CREEK
BLUE OYSTER CULTUS
Roseburg EST Site
NSO Analytical Unit
Nest Patch
Core Area
Home Range
Road Work
None
Construct
Improvement
Renovation
Secretarial Pilot Project
Known and Predicted Owl Activity Center
Ownership
Private Lands
Federal Land Owner
Umpqua National Forest
Bureau of Land Management
NSO 2008 Critical Habitat
N
Date: 2/24/2012
No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of these data for individual or aggregate use with other data. Original data were compiled from various sources and may be updated without notification.
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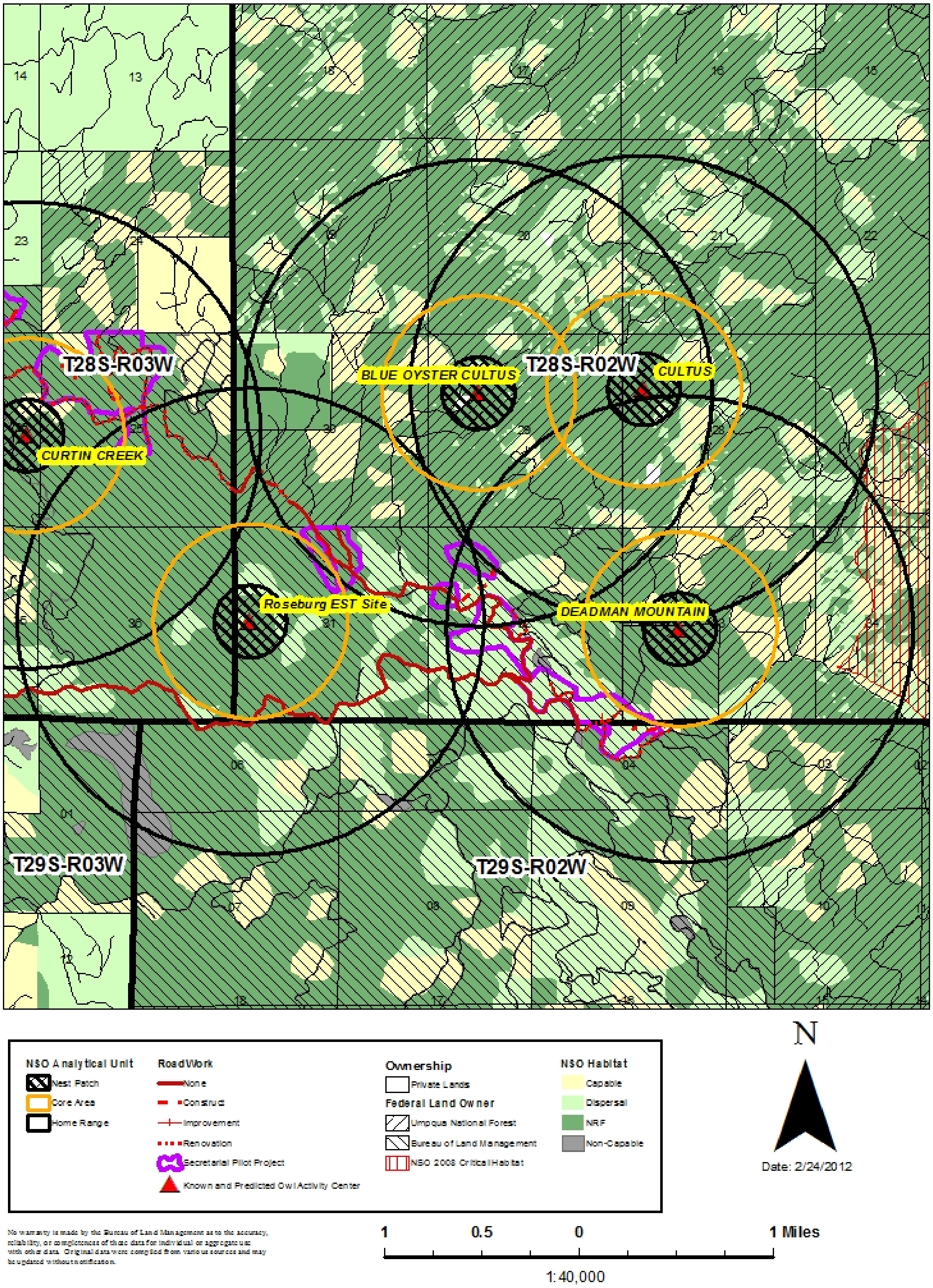
T28S-R03W
T28S-R02W
T29S-R03W
T29S-R02W
BLUE OYSTER CULTUS
CULTUS
CURTIN CREEK
Roseburg EST Site
DEADMAN MOUNTAIN
NSO Analytical Unit
Nest Patch
Core Area
Home Range
Road Work
None
Construct
Improvement
Renovation
Secretarial Pilot Project
Known and Predicted Owl Activity Center
Ownership
Private Lands
Federal Land Owner
Umpqua National Forest
Bureau of Land Management
NSO 2008 Critical Habitat
NSO Habitat
Capable
Dispersal
NRF
Non-Capable
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Date: 2/24/2012
No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of these data for individual or aggregate use with other data. Original data were compiled from various sources and may be updated without notification.
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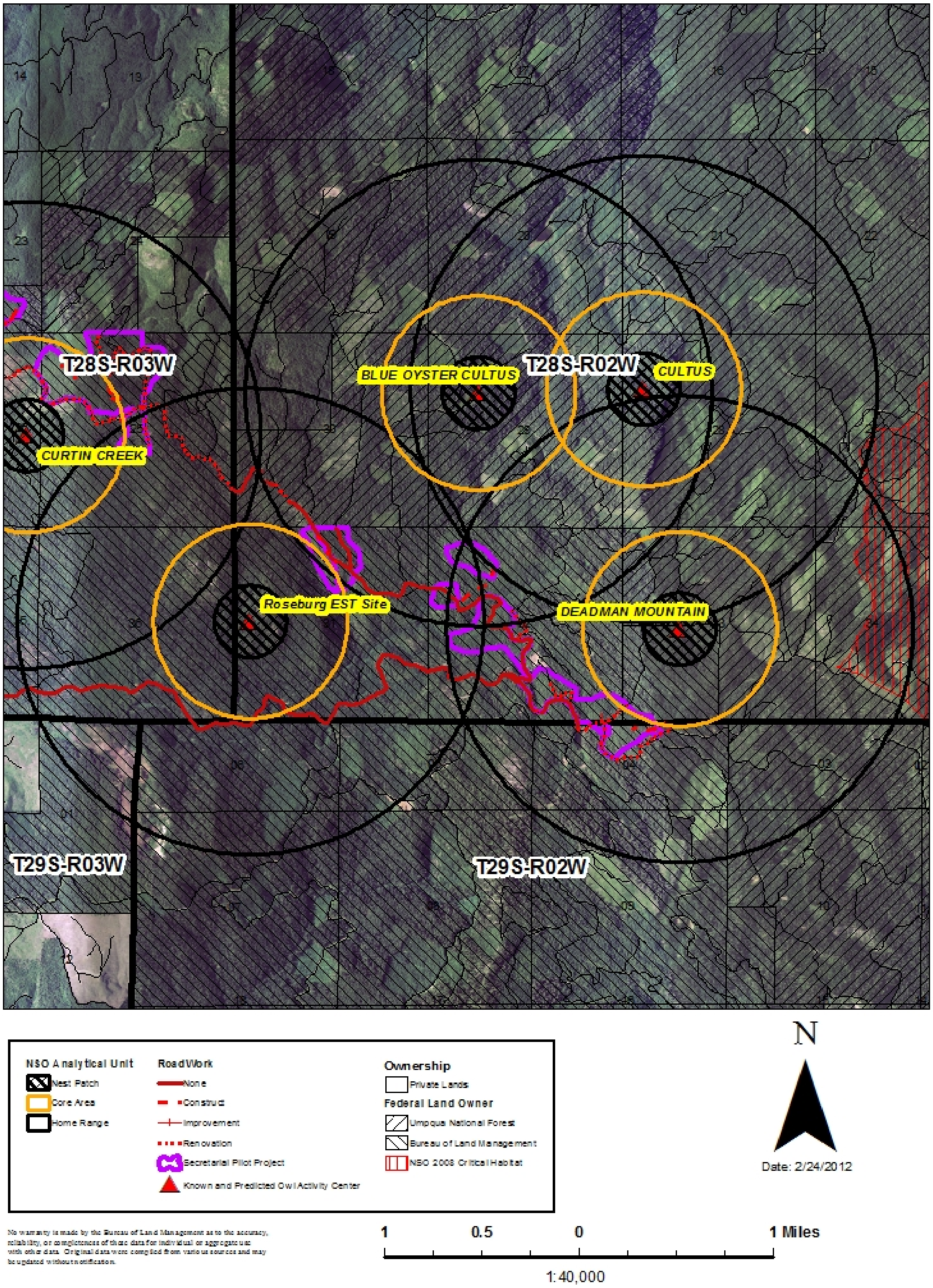

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APPENDIX 3. Structural Stage Classification
(As adapted from Appendix B, of the Western Oregon Plan Revision (BLM 2008))

Conifer forests within the planning area are classified in this analysis by a four-stage structural classification:

- Stand Establishment
- Young
- Mature
- Structurally Complex

These four structural classes are further sub-divided by additional structural divisions and by tree species composition groupings.

Vegetation Series (by plant series)

The vegetation series are groupings that have been made for this analysis based on plant series and do not exactly correspond to mapped plant series or plant association groupings. The data on plant series was modeled at a very fine scale and has been coarsened in scale for this analysis. Adjustments have been made to the geographic boundaries of these vegetation series grouping to provide explicit boundaries without interspersion.

Western Hemlock and Tanoak: Western Hemlock, Sitka Spruce, Pacific Silver Fir, Tanoak

Douglas-fir: Douglas-fir, Grand Fir, White Fir, Shasta Red Fir, Mountain Hemlock, Ponderosa Pine

Non-forest: Jeffrey Pine, Oregon White Oak, Juniper, Sagebrush, Grassland, Water

Classification

Each class appended with Vegetation Series:

- Western Hemlock and Tanoak
- Douglas-fir

1) Stand Establishment

<200 years old in current Forest Operations Inventory Average tree height <50 feet

1a.) Without Structural Legacies

<6 trees per acre ≥20 inches diameter breast height

1b.) With Structural Legacies

≥6 trees per acre ≥20 inches diameter breast height

The Stand Establishment stage extends from stand initiation until stands have reached canopy closure and density-dependent tree mortality begins. Average tree height reflects the influence of site productivity on tree growth. At an average tree height of 50 feet, stands have passed the point at which they are typically pre-commercial thinned. The minimum density of structural legacies is set at 6 trees per acre.

2) Young

<200 years old in current Forest Operations Inventory Average tree height ≥50 feet

Western Hemlock and Tanoak

<24 trees per acre ≥20 inches diameter breast height

Douglas-fir

<12 trees per acre ≥20 inches diameter breast height

2a.) Young High Density

relative density (Curtis RD) ≥ 25

2a1.) Without Structural Legacies

Descended from Stand Establishment without Structural Legacies

2a2.) With Structural Legacies

Descended from Stand Establishment with Structural Legacies

2b.) Young Low Density

relative density (Curtis RD) < 25

2b1.) Without Structural Legacies

Descended from Stand Establishment without Structural Legacies

2b2.) With Structural Legacies

Descended from Stand Establishment with Structural Legacies

The Young stage is characterized by the predominance of density-dependent tree mortality, and, in high density stands, a small range of tree diameters. Young stands have not yet acquired the density of large diameter trees that characterize Mature stands. Young Low Density stands are those with a tree density sufficiently low to largely eliminate the influence of density-dependent tree mortality.

3) Mature

<200 years old in current Forest Operations Inventory

Western Hemlock and Tanoak

≥24 trees per acre ≥20 inches diameter breast height

Douglas-fir

≥12 trees per acre ≥20 inches diameter breast height

3a.) Single Canopy

Western Hemlock and Tanoak

Coefficient of Variation of tree diameters > 10 inches diameter breast height (CVgt[10]) < 0.35

Douglas-fir

CVgt(10) < 0.34

3b.) Multiple Canopy

Western Hemlock and Tanoak

CVgt(10) ≥ 0.35

<4.7 trees per acre ≥40 inches diameter breast height

Douglas-fir

CVgt(10) ≥ 0.34

<2.1 trees per acre ≥40 inches diameter breast height

The Mature stage generally begins as tree growth rates stop increasing (after culmination of mean annual increment), as tree mortality shifts from density-dependent mortality to density- independent mortality. The threshold values for the Mature stage are derived from Poage (*unpublished*), which comprises BLM timber cruise data for timber sales in the late 1980s and early 1990s. This data presents a precise and accurate sample of the population of trees in timber sale areas. Because timber harvest during that period was predominately in Mature and Structurally Complex forest, this data set, described in Poage (2000), provides a characterization of Mature and Structurally Complex forest on BLM-administered lands.

The thresholds presented here for Mature forest are intended to establish a threshold that represents the structural conditions of most Mature forests, but not necessarily absolute minimum conditions found in all Mature forests. Therefore, the density of large trees (greater than 20 inches in diameter) was derived from the 66th percentile of sample values from the Poage dataset, separating the data for the Western Hemlock and Tanoak, and Douglas-fir vegetation series.

The threshold for canopy layering was derived from the coefficient of variation in tree diameters, inferring that variation in tree diameters is reflected by variation in tree heights. The threshold here was derived by the mean coefficient of variation of tree heights minus one standard deviation from the Poage dataset.
This analysis initially examined other measures of canopy layering, included a Canopy Height Diversity index (Spies and Cohen 1992), a Diameter Diversity Index (McComb et al. 2002), and a canopy classification technique in Baker and Wilson (2000).

The Canopy Height Diversity index uses data on tree heights directly, but classified most existing stands over 200 years old in this analysis as “single canopy,” and therefore would be too restrictive.

The Diameter Diversity Index infers canopy height diversity from weighted values of tree diameters. The weighting values produce results that may be more effective at classifying existing stands than evaluating modeled stands. The Diameter Diversity Index results do not appear to accurately reflect future changes in canopy layering resulting from thinning or partial disturbance and would classify relatively young, even-aged stands as “multiple canopy.”
The technique in Baker and Wilson (2000) uses tree height and canopy measurements, but would classify almost all stands in this analysis as “multiple canopy.”

Coefficient of variation in tree diameters provides greater discrimination among the stands in this analysis than the other measures and appears to be sensitive to future changes in stand conditions. Coefficient of variation in tree diameters could provide misleading results in strongly bi-modal stands (i.e., very large trees and very small trees), which would be a concern if this analysis were attempting to provide continuous values of canopy layering. But this analysis is only attempting to classify stands as either single canopy layered or multiple canopies.

4) Structurally Complex

4a.) Existing Old Forest

≥ 200-years old in current Forest Operations Inventory

4a1.) Existing Very Old Forest

≥ 400-years old in current Forest Operations Inventory

4b.) Developed Structurally Complex

< 200-years old in current Forest Operations

Western Hemlock and Tanoak

CVgt(10) ≥0.35

≥ 24 trees per acre ≥20 inches diameter breast height

≥ 4.7 trees per acre ≥40 inches diameter breast height

Douglas-fir

CVgt(10) ≥0.34

≥ 12 trees per acre ≥20 inches diameter breast height

≥ 2.1 trees per acre ≥40 inches diameter breast height

This analysis assumes that stands identified as 200 years old or older in the current stand inventory are Structurally Complex forest. In addition, stands that are not 200 years old or older but meet threshold values for Developed Structurally Complex described above are identified as Structurally Complex forest. Threshold values for Developed Structurally Complex include density of very large trees (greater than 40 inches in diameter) derived from the 66th percentile of sample values from the Poage dataset, separating data for the Western Hemlock and Tanoak and Douglas-fir vegetation series.

Structurally Complex stands approximate “old-growth” stands described in many analyses (see, e.g., District RMP/EISs), “Medium/large Conifer Multi-story” stands described in the FEMAT Report, and “Large, Multi-storied Older Forest” stands described in the LSOG Monitoring Report. In this analysis, “late-successional forest” encompasses both Mature and Structurally Complex stands, similar to how the Northwest Forest Plan FSEIS used “late-successional forest” to encompass mature and old-growth forests. The LSOG Monitoring Report (pp. 9-10) summarized the difficulties in describing and classifying older forest conditions.

Western Hemlock and Tanoak

CVgt(10) ≥0.35
≥ 24 trees per acre ≥20 inches diameter breast height
≥ 4.7 trees per acre ≥40 inches diameter breast height

Douglas-fir

CVgt(10) ≥0.34
≥ 12 trees per acre ≥20 inches diameter breast height
≥ 2.1 trees per acre ≥40 inches diameter breast height

This analysis assumes that stands identified as 200 years old or older in the current stand inventory are Structurally Complex forest. In addition, stands that are not 200 years old or older but meet threshold values for Developed Structurally Complex described above are identified as Structurally Complex forest. Threshold values for Developed Structurally Complex include density of very large trees (greater than 40 inches in diameter) derived from the 66th percentile of sample values from the Poage dataset, separating data for the Western Hemlock and Tanoak and Douglas-fir vegetation series.

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