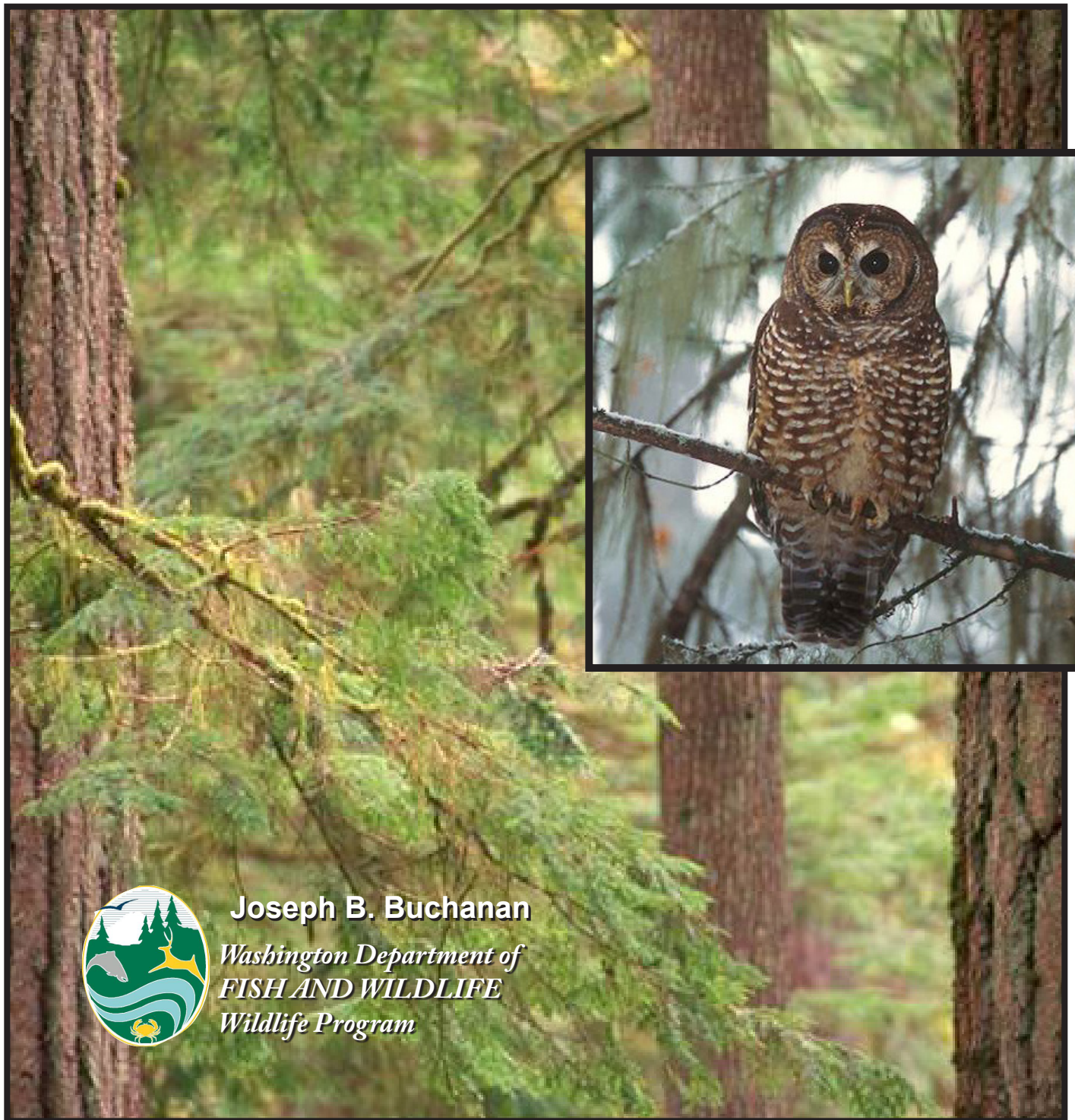


# Periodic Status Review for the Northern Spotted Owl



Joseph B. Buchanan

Washington Department of  
*FISH AND WILDLIFE*  
Wildlife Program

The Washington Department of Fish and Wildlife maintains a list of endangered, threatened, and sensitive species (Washington Administrative Codes 232-12-014 and 232-12-011). In 1990, the Washington Wildlife Commission adopted listing procedures developed by a group of citizens, interest groups, and state and federal agencies (Washington Administrative Code 232-12-297). The procedures include how species listings will be initiated, criteria for listing and delisting, a requirement for public review, the development of recovery or management plans, and the periodic review of listed species.

The Washington Department of Fish and Wildlife is directed to conduct reviews of each endangered, threatened, or sensitive wildlife species at least every five years after the date of its listing by the Washington Fish and Wildlife Commission. The periodic status reviews are designed to include an update of the species status report to determine whether the status of the species warrants its current listing status or deserves reclassification. The agency notifies the general public and specific parties who have expressed their interest to the Department of the periodic status review at least one year prior to the five-year period so that they may submit new scientific data to be included in the review. The agency notifies the public of its recommendation at least 30 days prior to presenting the findings to the Fish and Wildlife Commission. In addition, if the agency determines that new information suggests that the classification of a species should be changed from its present state, the agency prepares documents to determine the environmental consequences of adopting the recommendations pursuant to requirements of the State Environmental Policy Act.

This document is the Draft Periodic Status Review for the Northern Spotted Owl. It contains a review of information pertaining to the status of the Spotted Owl in Washington. It was reviewed by species experts and will be available for a 90-day public comment period. All comments received will be considered during the preparation of the final periodic status review. The Department intends to present the results of this periodic status review to the Fish and Wildlife Commission at an upcoming meeting.

**Submit written comments on this report by e-mail by 7 December 2015 to:**  
T&Epubliccom@dfw.wa.gov

**Or by mail to:**

**Listing and Recovery Section Manager, Wildlife Program  
Washington Department of Fish and Wildlife  
600 Capitol Way North, Olympia, Washington 98501-1091**

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*On the cover: photos of Northern Spotted Owl and habitat by Jared Hobbes*

**DRAFT**

**Periodic Status Review for the Northern Spotted Owl  
(*Strix occidentalis caurina*) in Washington**

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## EXECUTIVE SUMMARY

The Northern Spotted Owl (*Strix occidentalis caurina*) was listed as an Endangered Species in Washington State by the Washington Fish and Wildlife Commission in 1988, and was listed as a Threatened Species under the Endangered Species Act in 1990. This is one of three Spotted Owl subspecies and the only one to occur in the Pacific Northwest. Its distribution is from extreme southwestern British Columbia south through the Cascade Range and coastal mountains to northwestern California. Spotted Owls have very large home ranges (thousands of acres) and use mature and old coniferous forest habitat for nesting, roosting and foraging; loss of this habitat due to timber harvest was the primary reason for its listing. Protections on federal (Northwest Forest Plan) and nonfederal lands (Forest Practices Rules) have reduced the amount of habitat loss, although authorized habitat loss continues under these and other initiatives such as federal habitat conservation plans. The closely related Barred Owl expanded its range across North America and arrived in the Pacific Northwest about 45 years ago. The range of the Barred Owl has continued to expand, and it now is found throughout the range of the Northern Spotted Owl. The Barred Owl has life history traits that enable it to be a more effective competitor of resources than the Spotted Owl, and this competitive advantage has contributed substantially to the continuing population decline of the Spotted Owl in Washington. Population monitoring at three demography study areas in Washington indicate annual rates of change between -4.7 and -7.1%. A variety of management actions are underway to enhance Spotted Owl conservation in Washington and elsewhere within its range. In particular, a landscape-scale experiment to remove Barred Owls from Spotted Owl territories at four study areas will begin in autumn of 2015; one of the study areas is in the eastern Cascade Range in Washington. The decline of Spotted Owls has not subsided in Washington and the population is becoming critically imperiled. The U.S. Fish and Wildlife Service is evaluating whether to change the species' status to Endangered under the Endangered Species Act. We recommend that the status remain as Endangered in Washington State.

## ACKNOWLEDGMENTS

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## INTRODUCTION

The Northern Spotted Owl (*Strix occidentalis caurina*; Fig. 1) is one of three recognized Spotted Owl subspecies (Funk et al. 2008) and is the only one that is found in the Pacific Northwest, ranging from extreme southwestern British Columbia to northern California (Gutiérrez et al. 1995). In Washington, the combined historical and current distribution includes both slopes of the Cascade Range, the Olympic Peninsula, and the Puget lowlands and southwestern Washington (Buchanan 2005). The Spotted Owl was listed as endangered by the State of Washington in 1988, and as federally threatened by the U.S. Fish and Wildlife Service in 1990 (U.S. Fish and Wildlife Service 1990).

## DISTRIBUTION

The distribution of the Spotted Owl includes (or formerly included) conifer forests of western Washington and the eastern slope of the Cascade Range (Buchanan 2005). Nearly all Spotted Owls are found in the Cascade Range and on the Olympic Peninsula (Fig.2). Spotted Owls have been documented from sea level to their upper elevation range which varies from about 3000 feet in the Olympic Mountains to about 5000 feet in parts of the Cascade Range (Buchanan 2005). Within the Cascades, the density of Spotted Owls is generally higher in the south and becomes sparse north of Lake Chelan and the Skagit River. The Spotted Owl is not known to commonly cross large water bodies and for this reason may not have occurred in the San Juan Islands, as there are no records from that area.



Figure 1. Northern Spotted Owl (photo by Jared Hobbs).

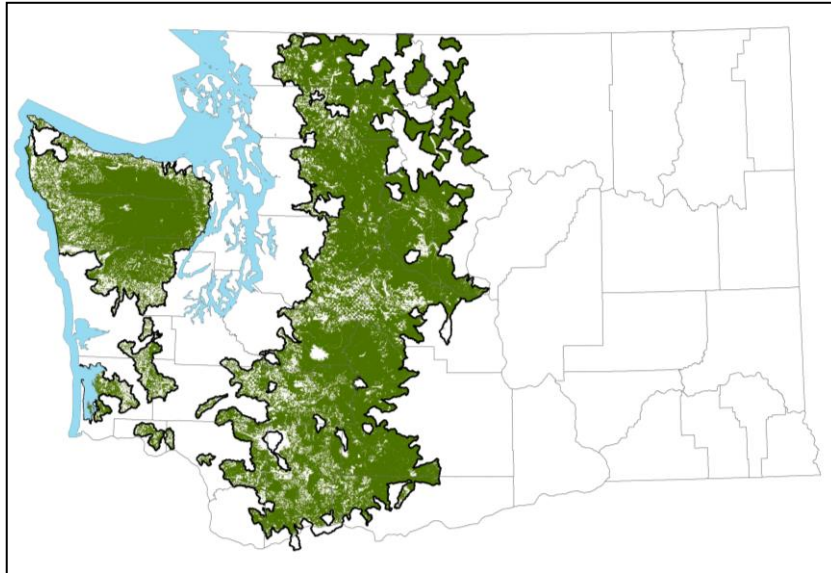


Figure 2. Range of the Spotted Owl in Washington, as depicted by multiple ecological systems (in green. Individual boundaries not shown) in HUC-12 watersheds (black outline) that have supported territorial owls at any point in time since the 1970s. Site location data used to create this map are from the Wildlife and Surveys Data Management database, Washington Department of Fish and Wildlife.

## NATURAL HISTORY

**Habitat requirements.** Spotted Owls are birds of the forest. In western Washington, these owls use mature and old-growth forests that contain large-diameter trees, snags, and downed wood. Other habitat features include a closed canopy and multiple size-classes of trees which results in a complex of canopy layers. In eastern Washington, Spotted Owls use old-growth forests, particularly near the crest of the Cascade Range, but much of the habitat in that region is best characterized as forests that are either comparatively young or mature. Snags and downed wood are less consistently present in the drier east-side forests which also contain dwarf mistletoe, usually the variety associated with Douglas-fir, which creates a dense branching pattern sometimes used as a nest platform by Spotted Owls. Spotted Owls use forests dominated by Douglas-fir, grand fir, western hemlock, and several other coniferous species; western larch, lodgepole pine, ponderosa pine, and hardwoods are typically a minor component of Spotted Owl habitat in Washington (Hanson et al. 1993). Habitat conditions used by Spotted Owls during dispersal are described by Sovern et al. (2015).

**Diet and foraging.** Spotted Owls prey on a variety of species that they capture within the forest environment. Studies of Spotted Owl food habits in Washington indicate that many species are taken, but that certain species are more important in terms of the number or biomass of items consumed. The most important prey of the Spotted Owl in Washington is the northern flying squirrel; other species commonly taken include bushy-tailed woodrat and snowshoe hare (Forsman et al. 2001).

**Home Range and Movements.** Spotted Owls in Washington have home ranges that exceed the size of those from other parts of subspecies distribution (Hamer et al. 2007). Home range estimates for Spotted Owls in Washington were initially reported by Hanson et al. (1993) in a special report written for the

Forest Practices Board to facilitate development of forest practices rules. Those data were subsequently analyzed more comprehensively by the principal investigators and are summarized here. Estimates of home range sizes (100% minimum convex polygon) have been documented from the Olympic Peninsula: mean = 8,916 acres (Forsman et al. 2005) and the eastern Cascade Range: mean = 7,124 acres (Forsman et al. 2015). A 95% adaptive kernel estimated mean for the northwestern Cascade Range was 6,571 acres (Hamer et al. 2007). Home range shape varies from one year to the next, likely as a consequence of changing prey distributions (Carey and Peeler 1995), and this influences the size of two-year home ranges used by pairs of Spotted Owls which are larger than annual home ranges for individual owls or pairs (Forsman et al. 2005). Spotted Owl home ranges include areas used during winter that are never or less frequently used during the breeding season; these include expansion outward from the breeding-season area (“winter expansion”) and seasonal movements to areas at some distance (e.g. up to 6 miles in the northwestern Cascades) from the breeding location (“winter migration”) after which they return to the breeding location the following spring (Hamer et al. 2007).

In comparison to annual movements associated with territories, dispersal movements by Spotted Owls are more extensive. Two types of dispersal have been documented: dispersal of juveniles from the natal site, which is referred to as natal dispersal and, much less frequently, dispersal from a breeding area by adults which is referred to as breeding dispersal. Natal dispersal begins between 25 September and 4 October (95% C.I.) and the mean distance of dispersing juveniles in Oregon and Washington is 8.4 – 9.1 miles for males and 14.2 – 15.2 miles for females; within-sex differences were related to whether owls were banded only or also equipped with transmitters. Mean breeding dispersal distances were 3.8 miles (Forsman et al. 2002).

**Reproduction and Survival.** Ongoing investigations of Spotted Owl demography are summarized and reported in comprehensive published updates approximately every 4-5 years. The most recent analyses have yet to be published, so this review includes information through 2008 that was presented by Forsman et al. (2011) on the three demography study area landscapes in Washington: Cle Elum (central-eastern Cascade Range), Olympic (Olympic National Park and vicinity), and Rainier (central-western Cascade Range). Key findings are that rates of apparent survival have been declining (e.g. <0.80) since 2004 and that fecundity (mean number of female fledglings per female adult per year) has declined at Cle Elum and increased at Rainier. There is little evidence that habitat conditions or the presence of Barred Owl, a species which competitively interacts with Northern Spotted Owls (see below), influenced observed fecundity at any study areas in Washington. On the other hand, the presence of Barred Owls is associated with a negative trend in apparent survival at Rainier and possibly at Olympic. The annual rate of population change indicates a negative trend at all three demography study areas in Washington (see Population and Habitat Status). Through the 1990s, Spotted Owls exhibited a pattern of alternating years of high and low levels of reproduction at many demography study areas; this pattern has persisted at Olympic and Rainier study areas through 2008, but not at the Cle Elum study area (Forsman et al. 2011). Several raptors may prey on Northern Spotted Owls (e.g. Northern Goshawk, Red-tailed Hawk, Barred Owl, Great Horned Owl) (Gutiérrez et al. 1995), although supporting evidence is virtually absent or circumstantial. Additional information on breeding behavior and other components of demography is available (Forsman et al. 1984, Gutiérrez et al. 1995, Gutiérrez et al. 1996, Anthony et al. 2006, Glenn et al. 2011).

## POPULATION AND HABITAT STATUS

**Global.** The Northern Spotted Owl is found in some of the most productive forests in the world. Its range includes an estimated 48.2 million acres of coniferous forest lands in British Columbia,



Washington, Oregon and California (Chutter et al. 2004, Davis et al. in press). As of 2004 (British Columbia) and 2006/2007 (United States), about 30% (14.6 million acres) of this forest was Spotted Owl habitat (Chutter et al. 2004, Davis et al. in press). In the United States, trends of habitat on all land ownerships in Washington, Oregon and California indicate a net loss of -12.9%, or 1.6 million acres between 1993 and 2012 (Davis et al. in press). The estimated amount of Spotted Owl habitat (e.g., 30% of habitat in the species' range) is at the approximate low end of the historical range of variability based on landscape assessments conducted in western Oregon that suggest substantial areas (e.g., between 25-75% of a landscape) of old forest was present prior to European settlement (Wallin et al. 1996, Wimberly et al. 2000, Wimberly 2002).

The Northern Spotted Owl is experiencing a population decline over much of its range. In British Columbia, the population is thought to have declined by 67% between 1992 and 2002 (10.4% per year), and may have declined by over 90% since European settlement (Chutter et al. 2004). Estimates of population change at demography study areas in the United States indicate declines at all 3 study areas in Washington, at 2 of 5 study areas in Oregon, and at 2 of 3 study areas in California (Forsman et al. 2011).

**Washington.** Current information on habitat in Washington is derived from the most recent publication in a series of monitoring reports on implementation of the Northwest Forest Plan which was developed to meet the dual needs of protecting forest habitat for the Northern Spotted Owl with the need for forest products on federal lands. Improvements in methodology were made between the assessment reported in 2011 (Davis et al. 2011) and the most current assessment (Davis et al. in press), and this influenced estimates of habitat. For example, the 2011 estimate of habitat on non-federal lands in 1994/1996 was 1.26 million acres (Davis et al. 2011), whereas the most recent estimate for 1993 was 924,500 acres (Davis et al. in press). Estimated changes in habitat were reported in all parts of the state and the primary losses of habitat were related to timber harvest, wildfire, and insect outbreaks, with timber harvest on non-federal lands comprising the greatest loss of habitat (Table 1). Changes in Spotted Owl habitat under the Washington State Forest Practices Rules (which directs forest practices on nonfederal lands) between 1996 and 2004 were reported by Pierce et al. (2005).

Table 1. Summary of estimated changes in habitat (in acres) on all lands between 1993 and 2012 (data from Davis et al. in press).

Province	1993 habitat estimate	Harvest	Wild-fire	Insect	Other	Total explained loss	Percentage loss from 1993
<b>Federal lands</b>							
Olympic Peninsula	765,800	1,700	1,000	800	2,200	5,770	-0.7
Western Lowlands	12,900	0	0	0	600	600	-4.7
Western Cascades	1,157,700	6,900	2,600	900	3,500	13,900	-1.2
Eastern Cascades	832,700	24,400	52,100	34,000	3,100	113,600	-13.6
<b>Non-federal lands</b>							
Olympic Peninsula	170,400	39,700	0	1,700	0	41,330	-24.3
Western Lowlands	171,600	81,200	0	1,400	0	82,600	-48.1
Western Cascades	234,000	64,500	300	1,100	0	65,900	-28.2
Eastern Cascades	348,500	85,700	6,500	6,500	0	98,700	-28.3
<b>Totals</b>							
Federal lands	2,769,100	33,000	55,700	35,700	9,400	133,800	-4.8
Non-federal lands	924,500	271,100	6,800	10,700	0	288,600	-31.2
All forest areas	3,693,600	304,100	62,500	46,400	9,400	422,400	-11.4

Following European settlement of western Washington, many low elevation forests had already been harvested multiple times when the Spotted Owl was classified as Endangered by the Fish and Wildlife Commission. Only 14 Spotted Owl sites have ever been documented in southwestern Washington. The majority of known sites are in the Cascades and the Olympic Peninsula (Wildlife and Surveys Data Management, Washington Department of Fish and Wildlife). Most of the Spotted Owl sites in Washington are classified as territorial (i.e., site status 1, 2 and 3). As of July 2015, 939 of 1268 known Spotted Owl sites were classified as Status 1 (pair or reproductive), 21 were Status 2 (two birds, pair status unknown), 112 were Status 3 (territorial single), 165 were Status 4 (single, territorial status unknown), and 31 were Status 5 (historical). The latter two categories of sites are not protected under Washington’s Forest Practices Rules. These sites, in total, represent all known sites documented since the 1970’s. Monitoring data and demography analyses (see below) indicate that many of these sites are not currently occupied by Spotted Owls.

The annual rate of population change continues to decline significantly at all three demography study areas in Washington (Table 2), where monitoring has been ongoing for over 25 years. The rate of decline (i.e., the values in the right-hand column in Table 2) is depicted for all three study areas, over a 25-year period, in Figure 3.

Table 2. Summary of the rate of population change from three study areas in Washington (from Forsman et al. 2011). These values represent cumulative rates across the study period for each study area.

Demography Study Areas	Mean fecundity of adult females	Apparent survival of adult females	Apparent survival of adult males	Lambda value	Annual rate of population change
Cle Elum	0.553	0.819	0.819	0.937	-6.3%
Olympic	0.302	0.828	0.852	0.957	-4.3%
Rainier	0.300	0.841	0.844	0.929	-7.1%

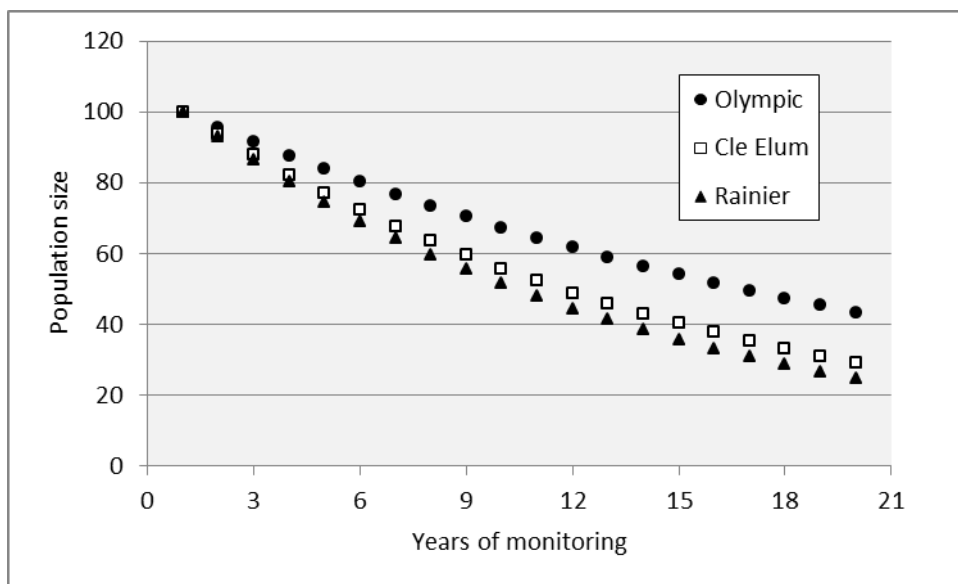


Figure 3. This graph depicts 20-year population declines at three demography study areas in Washington (based on Forsman et al. 2011). These values represent the cumulative rates across the study period for each study area.

## FACTORS AFFECTING CONTINUED EXISTENCE

*Adequacy of Regulatory Mechanisms.* The Northern Spotted Owl was federally listed as threatened in 1990 (U.S. Fish and Wildlife Service 1990). The listing resulted in greater protection of the species' habitat on all lands although it should be noted that harvest of Spotted Owl habitat is allowed under the Northwest Forest Plan, Washington State Forest Practices Rules, and habitat conservation plans. The U.S. Fish and Wildlife Service also designated Critical Habitat which primarily affects management of federal lands and those nonfederal lands for which there exists a federal nexus (e.g. a federal nexus would apply for lands purchased or restored using federal funds) (U.S. Fish and Wildlife Service 2012).

Implementation of the Northwest Forest Plan was meant to provide stable and predictable conservation on federal lands for Spotted Owls and other species associated with late-successional forests (USDA Forest Service and USDI Bureau of Land Management 1994, Noon and Blakesley 2006). Although the Northwest Forest Plan has not been implemented as intended (i.e., much less timber harvest has occurred than was anticipated; Thomas et al. 2006), recent modeling indicates that the lower level of timber harvest on federal lands may benefit Spotted Owl recovery (Dunk et al. 2014).

At the state level, Forest Practices Rules for the Spotted Owl were developed when it was federally listed, and after a legal challenge and a subsequent period of interim rules, new rules developed by stakeholders were adopted by the Forest Practices Board and implemented on 1 July 1996. With the exception of minor revisions, those rules have remained unchanged. An evaluation of the Forest Practices Rules was presented to the Forest Practices Board in 2005 (Buchanan and Swedeen 2005). A significant result of this evaluation was a rule change to implement a process to assess the conservation importance of sites that have been surveyed and found to have no Spotted Owl presence for a period of three consecutive years. These sites were formerly regarded as unoccupied and not included in the category of sites (WAC 222-16-010) subject to forest practices critical habitat rules (WAC 222-16-080). The new process includes several steps, one of which involves convening a three member advisory group to evaluate the importance of the habitat at the specific site that is being considered. If at least one member of the group concluded the habitat had conservation importance any associated proposed harvest would be identified as a Class IV-Special and undergo SEPA review (WAC 222-16-080) which effectively helps maintain protections for sites that may not currently be occupied by Spotted Owls. Following the 2005 evaluation, Forsman et al. (2015) reported that home range composition included 62% selected forest habitat as determined by radio-telemetry (in 1989-1990); this is substantially more than the threshold amount (40% of the area in a 1.8-mile radius circle) which is used under the Forest Practices Rules indicating current rules may be insufficient.

*Fire Risk in Dry Forests.* Large areas of forest in the eastern Cascade Range are now considered to be outside the historical range of variability (Agee 1993, Hessburg and Agee 2003). Specifically, decades of fire suppression, both prior to and subsequent to listing of the Spotted Owl, have altered the tree species composition, structure and spatial distribution of closed-canopy forests (Hessburg and Agee 2003), and this has continued to intensify and expand the scope of this risk. Some areas that were formerly open dry forest have been invaded by higher densities of trees, often by shade tolerant species. As a consequence, fires in such forests may remove substantial areas of closed-canopy forest and result in landscape conditions that will not be suitable for Spotted Owl use for many decades. Fire suppression has created Spotted Owl habitat, but has also created forest conditions, some of which are not sustainable, such that large fires and impacts of insects and disease may degrade or destroy portions of these forests. The U.S. Fish and Wildlife Service acknowledged the need to address this risk by proactively managing dry forest landscapes (U.S. Fish and Wildlife Service 2011, Henson et al. 2013). There is ongoing debate about the fire ecology of dry forests and the risk of habitat loss due to canopy-replacement fire in the eastern

Cascade Range of the Pacific Northwest (Hanson et al. 2009, Spies et al. 2009, DellaSala et al. 2013, Franklin and Johnson 2013).

**Competition with Barred Owls.** The Barred Owl has expanded its range across the North American continent in the last century and now is found throughout the range of the Northern Spotted Owl in British Columbia, Washington, Oregon and California (U.S. Fish and Wildlife Service 2011). The Barred Owl is closely related to the Spotted Owl, and has a competitive advantage over the Spotted Owl in that it is a habitat and prey generalist (e.g. it can use a broader range of habitat and food types), uses a smaller home range, produces more offspring and has far greater dispersal capability (U.S. Fish and Wildlife Service 2011). Closely-related species generally do not occupy the same habitats and when they do, competition would be expected (Gutiérrez et al. 2007). Barred Owls have become very common in Washington, including in areas that have not recently been occupied by Spotted Owls.

Numerous studies have investigated aspects of the relationship of Spotted Owls and Barred Owls. These investigations have reported habitat relationships (Hamer et al. 2007, Singleton et al. 2010) as well as negative effects of Barred Owls on Spotted Owls relative to pair (or local) extinction rates, colonization rates, or survival (Anthony et al. 2003, Kelly et al. 2003, Olson et al. 2005, Dugger et al. 2011, Kroll et al. 2010, Sovern et al. 2014) and hybridization (Kelly and Forsman 2004). Other aspects of competitive interactions that favor Barred Owls over Spotted Owls (Van Lanen et al. 2011, Wiens et al. 2014, Yackulic et al. 2014), including documentation of greater effects of Barred Owls on Spotted Owls as a consequence of factors such as the amount or type of habitat or the level of forest fragmentation (Dugger et al. 2011, Yackulic et al. 2012, Sovern et al. 2014) have also been documented. Barred Owl competition is potentially the greatest direct factor driving the current and continued population decline of the Northern Spotted Owl and may limit the positive effects of other conservation actions in the near-term.

**Climate Change.** Models of climate change indicate changes in precipitation levels and temperature throughout the Pacific Northwest. Although the models vary in their specific predictions, all of them indicate that substantial changes will occur. As a consequence, it appears likely that such changes will alter conditions in the forest environment. Changes that appear likely include increased temperature, changes in precipitation, less snowpack and increased frequency and intensity of wildfire, and insect and disease outbreaks (Latta et al. 2010, Littell et al. 2010, Chmura et al. 2011). These factors and their resulting consequences have the potential to alter forest conditions in areas used by Spotted Owls. For example, in areas where Douglas-firs are water limited (as in the eastern Cascade Range), further reduction of precipitation may impact the growth and development of this species which is the primary conifer associated with Spotted Owl habitat in much of the Cascade Range. In addition, extensive areas of forest severely damaged by wildfires or insect outbreaks would reduce the area of habitat available for Spotted Owls. Numerous researchers and managers propose using an adaptive management approach to address forest management in the face of uncertainty associated with climate change effects (Spies et al. 2010, Chmura et al. 2011, Halofsky et al. 2011), and some propose retaining a diverse range of abiotic conditions to maximize the likelihood that appropriate environmental conditions persist to facilitate adaptation of vegetation and wildlife populations (Lawler et al. 2015).

**Other factors.** Environmental contaminants, hybridization (with Barred Owls), genetic variation, disease, predation, and demographic isolation have been identified as potential threats to Spotted Owls, but none are currently known to impact the population (e.g. Gutiérrez et al. 1995, Kelly and Forsman 2004, Ishak et al. 2008, Funk et al. 2010). The importance of any of these factors could change through time, particularly if the Spotted Owl population continues to decline, because small populations become

disproportionately susceptible to factors that may have little if any effect on larger populations (Courchamp et al. 1999).

## MANAGEMENT ACTIVITIES

Several key management activities are ongoing within the range of the Northern Spotted Owl. These are briefly described below.

***Proposal to Designate as Endangered Status under the Endangered Species Act.*** The U.S. Fish and Wildlife Service recently indicated it will assess whether the Endangered Species Act status of the Northern Spotted Owl should be changed from threatened to endangered (U.S. Fish and Wildlife Service 2015). That review will also serve as the five-year review for the Northern Spotted Owl.

***Demography Monitoring.*** Demographic monitoring is ongoing at three study areas in Washington. These areas have been active for at least 20 years (Olympic, started in 1987; Cle Elum, started in 1989; Rainier, started in 1992). A fourth demography study area, the Wenatchee National Forest and vicinity, was active between 1990 and 2003. These ongoing long-term studies provide important information for monitoring trends in demographic vital rates of Northern Spotted Owls. This information is used to assess, adapt, and direct conservation actions to benefit Northern Spotted Owls. Several comprehensive assessments of Spotted Owl demography have come from this work (e.g. Forsman et al. 1996, Franklin et al. 1999, Anthony et al. 2006, Forsman et al. 2011).

***Barred Owl Removal Experiment.*** Landscape-level experiments to assess the effects of competitive interactions between Barred Owls and Spotted Owls are scheduled to begin in autumn 2015. One of the study areas for the removal experiment is the Cle Elum demography study area in the eastern Cascade Range of Washington. It is anticipated that four years of data will be collected prior to a formal analysis, although it is likely that preliminary data analyses may be informative (U.S. Fish and Wildlife Service 2013). The revised federal recovery plan outlined the need to implement a Barred Owl removal experiment (U.S. Fish and Wildlife Service 2011). An assessment of various potential methods to manage the competitive interaction between the two owl species concluded that the most effective approach would be to use removal methods (Buchanan et al. 2007). The framework for such an effort was subsequently developed and proposed by Johnson et al. (2008), and aspects of a proposed removal experiment, including its practicality, have been assessed (Diller et al. 2013, U.S. Fish and Wildlife Service 2013), largely based on an initial effort conducted in northern California (Diller et al. 2013).

***Dry Forest Management.*** Despite disagreement about the need for, and principles of, dry forest management (Hanson et al. 2009, Spies et al. 2009, DellaSala et al. 2013, Franklin and Johnson 2013), implementation of the concept was endorsed by the U.S. Fish and Wildlife Service as a key component of Spotted Owl conservation efforts in forests of the eastern Cascade Range (Henson et al. 2013). Convening a dry forest working group and assessing Spotted Owl responses to fires were identified as necessary actions in the revised recovery plan (U.S. Fish and Wildlife Service 2011). Conceptual and practical aspects of dry forest management have been presented (e.g. Franklin et al. 2008, Hessburg et al. 2015), and have been placed in the context of Spotted Owl conservation (e.g. Irwin et al. 2004, Kennedy and Wimberly 2009, Gaines et al. 2010, U.S. Fish and Wildlife Service 2011).

***Incentives Program.*** The Forest Practices Board convened a Northern Spotted Owl Implementation Team to develop ideas to inform implementation of strategies where incentives for landowners could facilitate voluntary measures to protect Spotted Owl habitat. The discussions by this group were fruitful

and the group's work was recognized by the U.S. Fish and Wildlife Service, resulting in a Recovery Action that recommends development of voluntary actions to incentivize conservation (U.S. Fish and Wildlife Service 2008, 2011). A technical team was convened to use modeling to prioritize landscapes where voluntary conservation measures would be most beneficial for Spotted Owls, and the group's preliminary report has been released (Dunk et al. 2014).

***Captive Breeding in British Columbia.*** When the population of Spotted Owls in British Columbia had declined to less than 20 individuals practical options to restore the population were identified and evaluated by the Spotted Owl Population Enhancement Team. The option that was adopted involved capturing many of the remaining Spotted Owls to establish a captive-bred population whose offspring could subsequently be released to the wild after a period of Barred Owl removal activity (Fenger et al. 2007). The initiative was adopted because the few remaining known owls were largely isolated across the landscape, most of them were not paired, and many were known to be at or near the suspected age of reproductive senescence. This ongoing captive breeding initiative currently includes cooperating facilities in British Columbia, Washington and Oregon. Methods of husbandry are still being refined to enhance captive breeding success. Given the amount and distribution of habitat in British Columbia (Sutherland et al. 2007) it may be possible to restore a population of several hundred Spotted Owls in the province (Chutter et al. 2004). The presence and connectivity of Spotted Owl populations on both sides of the international border should allow for more stability in that part of the owl's range.

## CONCLUSION AND RECOMMENDATION

When the Northern Spotted Owl was federally listed in 1990, the primary factor contributing to its status under the Endangered Species Act was the loss of forest habitat. Implementation of the Northwest Forest Plan which guides management of federal forests, and Forest Practices Rules which regulate timber harvest on nonfederal lands, reduced the rate of habitat loss. Habitat loss continues, however, and coupled with a population of Barred Owls that may still be increasing, indicates that the status of the Spotted Owl in Washington has become critically imperiled. Without management that effectively addresses competitive interactions with Barred Owls it is likely the Spotted Owl could become functionally extirpated in Washington in the near-term future. Since its listing in Washington, the endangered status of the Spotted Owl has changed only in that the probability of extirpation has increased. As such, we recommend that the current listing as endangered be retained.

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# WASHINGTON STATE STATUS REPORTS, PERIODIC STATUS REVIEWS, RECOVERY PLANS, AND CONSERVATION PLANS

## **Status Reports**

2015 Tufted Puffin  
2007 Bald Eagle  
2005 Mazama Pocket Gopher,  
Streaked Horned Lark, and  
Taylor's Checkerspot  
2005 Aleutian Canada Goose  
2004 Killer Whale  
2002 Peregrine Falcon  
2000 Common Loon  
1999 Northern Leopard Frog  
1999 Olympic Mudminnow  
1999 Mardon Skipper  
1999 Lynx Update  
1998 Fisher  
1998 Margined Sculpin  
1998 Pygmy Whitefish  
1998 Sharp-tailed Grouse  
1998 Sage-grouse  
1997 Aleutian Canada Goose  
1997 Gray Whale  
1997 Olive Ridley Sea Turtle  
1997 Oregon Spotted Frog  
1993 Larch Mountain Salamander  
1993 Lynx  
1993 Marbled Murrelet  
1993 Oregon Silverspot Butterfly  
1993 Pygmy Rabbit  
1993 Steller Sea Lion  
1993 Western Gray Squirrel

1993 Western Pond Turtle

## **Periodic Status Reviews**

2015 Steller Sea Lion

## **Recovery Plans**

2012 Columbian Sharp-tailed Grouse  
2011 Gray Wolf  
2011 Pygmy Rabbit: Addendum  
2007 Western Gray Squirrel  
2006 Fisher  
2004 Sea Otter  
2004 Greater Sage-Grouse  
2003 Pygmy Rabbit: Addendum  
2002 Sandhill Crane  
2001 Pygmy Rabbit: Addendum  
2001 Lynx  
1999 Western Pond Turtle  
1996 Ferruginous Hawk  
1995 Pygmy Rabbit  
1995 Upland Sandpiper  
1995 Snowy Plover

## **Conservation Plans**

2013 Bats

Status reports and plans are available on the WDFW website at:  
<http://wdfw.wa.gov/publications/search.php>

