# Proposed Barred Owl Management Strategy

U.S. Fish and Wildlife Service

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# Contents

# 1. Purpose and Use of the Barred Owl Management Strategy

The 2011 Northern Spotted Owl Recovery Plan (Recovery Plan) identified barred owls as one of the two primary threats to the survival and recovery of northern spotted owls, habitat loss being the other (USFWS 2011, pp. II-4, III-62). The Recovery Plan included barred owl specific Recovery Actions, including Recovery Action 30: Manage to reduce the negative effects of barred owls on spotted owls so that Recovery Criterion 1 can be met. This included implementing the results of research to adaptively manage the effects of barred owls to meet Recovery Criterion 1. Recovery Criterion 1 focuses on stable spotted owl population trends: "The overall population trend of spotted owls throughout the range is stable or increasing over 10 years, as measured by a statistically reliable monitoring effort." The U.S. Fish and Wildlife Service (Service) chose to begin implementation of Recovery Action 30 through the development of this Barred Owl Management Strategy (Strategy). This does not limit others from implementing Recovery Action 30 thorough other efforts.

California spotted owls were proposed for listing in February 2023. Barred owls are still relatively low in numbers in the Sierra Nevada, though they have been detected as far south as the Sequoia National Forest. A self-sustaining barred owl population was established in the northern Sierra Nevada, but was effectively removed under a scientific take permit. While barred owls have not yet reached levels where they are having population-level impacts on California spotted owls, the potential for expansion of the barred owl range and populations into the subspecies range remains very high. In the proposed listing, the Service considered the barred owl to represent a significant threat to the persistence of California spotted owls (88 FR 11600 at 11619).

The Strategy is focused on addressing the threat to northern and California spotted owl survival and recovery from invasive barred owl competition by providing a comprehensive management approach for reducing barred owl impacts.

The Strategy is specific to barred owl management. The Strategy does not address spotted owl habitat or other spotted owl conservation issues, including those addressed under other conservation efforts, management planning, or legal requirements. The Strategy is not a replacement for, and would not result in any change in, northern spotted owl designated critical habitat, nor does it have any effect on Federal agency consultations regarding the northern spotted owl although, as discussed further below, it could be utilized by Federal agencies in various ways under ESA section 7. While the Strategy is the Service's effort at implementing Recovery Action 30, it does not serve as a replacement for, or result in changes in, the Northern Spotted Owl Recovery Plan.

The Strategy can be applied to barred owl management in forested areas across all types of land ownerships, but is not a replacement for, and would not result in any change in, management as included in current land use plans or agreements, and does not make any changes to existing plans or agreements. The actions described were designed to be implemented in concert with existing land management requirements.

In terms of the role of the Strategy in relation to section 7 of the ESA, the Service intends the Strategy and associated Migratory Bird Treaty Act (MBTA) permit to be a voluntary tool in efforts to reduce the impact of the barred owl for the conservation of the northern spotted owl. The Service encourages Federal agencies to implement the Strategy as part of their ESA section 7(a)(1) conservation planning as the Service believes this is the most effective and comprehensive way to utilize the Strategy for the benefit to the northern spotted owl and other listed species impacted by the invasive barred owl. This does not preclude Federal agencies from choosing to implement the Strategy as part of proposed actions considered in consultation with the Service under section 7(a)(2), nor does it preclude the Service from recommending implementation of the Strategy in a particular area as a non-binding conservation recommendation where warranted.

The Strategy is the Service's recommended approach to implementation of Recovery Action 30 and the management of barred owls for the conservation of spotted owls, but it is not the only possible approach. This Strategy does not prevent other entities from choosing to develop their own barred owl management programs and applying for their own required permits. The Strategy also does not limit ongoing or future barred owl research.

# 2. Spotted Owl

## 2.1 Biology

Spotted owls are a medium-sized forest owl native to western North America. Of the three identified subspecies, two are the subject of this action, the northern spotted owl *(Strix occidentalis caurina)* and the California spotted owl *(Strix occidentalis occidentalis)* (Map 1). Northern spotted owls were historically found in the western forests of southwest British Columbia through Washington and Oregon to northwestern California. The California spotted owl is found in the Sierra Nevada Mountains, the mountains of central coastal California, and the peninsular and transverse ranges of southern California. There is a distinct geographic separation between the Sierra Nevada and Coastal-Southern California populations (Verner et al. 1992, p. 4).


Map 1. Range of northern and California spotted owls.

Both subspecies select structurally diverse forests with larger trees and moderate to dense canopy closure for nesting, with more variable habitat acceptable for foraging. Their primary prey include flying squirrels (*Glaucomys* spp.), woodrats (*Neotoma* spp.), lagomorphs (*Lepus americanus*, *Sylvilagus bachmani*), and red tree voles (*Arborimus longicaudus*).

## 2.2 Management Status

The U.S. Fish and Wildlife Service (Service) listed the northern spotted owl as a threatened species under the ESA on June 26, 1990 (55 FR 26114). The primary reason for listing the northern spotted owl was the widespread loss of their habitat across the range and the inadequacy of existing regulatory mechanisms to conserve the subspecies. On December 15, 2020, we published a 12-month finding (85 FR 81144), in which we announced that reclassification of the northern spotted owl from a threatened species to an endangered species is warranted but precluded by higher-priority actions. On June 27, 2023, we affirmed that reclassification of the northern spotted owl to endangered is warranted but precluded; proposed rules to reclassify threatened species to endangered are a lower priority than listing currently unprotected species (i.e., candidate species), since species like the northern spotted owl currently listed as threatened are already afforded the protection of the ESA and implementing regulations. (88 FR 41560 at 41578). The primary stressors affecting the northern spotted owl's current biological status include lag effects of past habitat loss, continued timber harvest, wildfire, and incursion of the nonnative northern barred owl (*Strix varia varia*), which is currently the stressor with the largest negative impact on northern spotted owls (88 FR 41560 at 41578). Critical habitat for the northern spotted owl was last revised on November 10, 2021 (86 FR 62606). The northern spotted owl is listed as Endangered by the State of Washington and Threatened by the States of Oregon and California.

The Service proposed the California spotted owl for listing on February 23, 2023 (88 FR 11600). The Sierra Nevada Distinct Population Segment (DPS) of the California spotted owl is proposed for listing as threatened due to the impact of high-severity fire, tree mortality, drought, and barred owls. The Coastal-Southern California DPS is proposed for listing as endangered due to continuing population declines, fragmented habitat, risk of high-severity fire, tree mortality, and drought. The subspecies is listed as a species of special concern by the State of California.

## 2.3 Past and Ongoing Spotted Owl Management

Northern spotted owls have been the focus of management direction and efforts since long before their listing, starting with the Oregon Spotted Owl Management Plan in 1977. This expanded into a two-State regional effort with Washington in 1978 (Thomas et al. 1990, pp. 17-18, 51-58). Region 5 of the U.S. Forest Service (Forest Service) developed regional guidelines for management of northern spotted owls in California (USFS 1988, entire). Management continued to evolve, culminating with the Northwest Forest Plan for Federal lands in 1994 (USDA and USDI 1994, entire). The Northwest Forest Plan was designed, in part, to arrest the downward trends in northern spotted owl populations by providing for late successional and old growth forest over the long term, through the maintenance and restoration of habitat conditions necessary to support viable populations on Federally-administered lands throughout the range of the subspecies. This remains the management approach for Forest Service and Bureau of Land

Management (BLM) lands in California within the northern spotted owl range. BLM lands in Oregon are managed under Southwestern Oregon, and Northwestern and Coastal Oregon Resource Management Plans (RMP) (BLM 2016a, entire; BLM 2016b, entire), which have similar land allocations as the Northwest Forest Plan.

All of these plans focus on management of northern spotted owl habitat. These plans significantly reduced the rate of loss of forest habitat to timber harvest on Federal lands. Initially, the Northwest Forest Plan appeared to be resulting in improvements in spotted owl population dynamics. The 5-year demography analyses appeared to show a slow improvement in the rate of spotted owl population decline until around 2008, after which the rate of decline again accelerated (Anthony et al. 2006, pp. 22-29; Dugger et al. 2016, pp. 70-73; Forsman et al. 1996, entire; Forsman et al. 2011, pp. 54-57, 65-67; Franklin et al. 1999, pp. 44-45; Franklin et al. 2021, entire). This decline corresponds with the continued invasion and population expansion of barred owls. Habitat protection and management remains an important component of the conservation and recovery of the northern spotted owl. Conservation of spotted owls under land management plans on National Forests and BLM Districts provides highly valuable contributions to the habitat component of the recovery of spotted owls. Only the 2016 BLM Southwestern Oregon, and Northwestern and Coastal Oregon RMPs include provisions for barred owl management.

State lands are managed under a variety of plans. In Washington, the Department of Natural Resources completed the State Trust Lands Habitat Conservation Plan (HCP) in 1997 (amended in 2019). This ecosystem-based forest management plan addresses forest management and other activities on the State trust lands it manages for revenue for the respective Trusts while developing and protecting habitat for spotted owls. In Oregon, the Oregon Department of Forestry (ODF) lands are managed under the 2010 Northwest Oregon Forest Management Plan. Currently, ODF is preparing the Western Oregon State Forests HCP and a companion Forest Management Plan is in development and will replace the 2010 Northwest Oregon Forest Management Plan. The proposed HCP includes designated conservation areas intended to protect and enhance spotted owl habitat. The Oregon Department of State Lands is developing an HCP for the Elliott State Research Forest in Coos and Douglas Counties. The proposed HCP includes management activities for the conservation of rare species and their habitat on the forest. In California, the Management Plan for the Jackson State Demonstration Forest, managed by the California Department of Forestry and Fire Protection, includes protection of spotted owl sites. None of the existing plans provide specific barred owl management provisions, though some of the proposed HCPs include potential barred owl management.

Each State has regulations for the harvest of timber on private lands. They include varying levels of protection for active, and sometimes historical, spotted owl sites. Within each State, there are HCPs developed with private and non-Federal landowners which cover actions related to northern spotted owls. Each one is specific to the conditions and capabilities of the permittee. Most include some level of forest management that support one or more aspects of spotted owl biology. Only two, the Green Diamond Resources Company and Sierra Pacific Industries HCPs include barred owl removal research as a component of the plans.

The primary reason for listing the northern spotted owl was the widespread loss of their habitat across the range and the inadequacy of existing regulatory mechanisms to conserve the spotted owl. This led to the focus on habitat management for northern spotted owls. With the exception of the Green Diamond Resources Company and Sierra Pacific Industries HCPs, spotted owl management to date has been focused on habitat management.

California spotted owls are managed under a variety of Federal land use plans. The Forest Service has been a part of ongoing conservation efforts for California spotted owls, including the 2004 Sierra Nevada Forest Plan Amendment (USFS 2004, entire), the 2005 Southern California National Forest Land Management Plans (USFS 2005, entire), the 2016 Lake Tahoe Basin Management Unit Land and Resource Management Plan (USFS 2016, entire), the 2019 Inyo National Forest Plan (USFS 2019, entire), the 2023 Sierra National Forest Land Management Plan (USFS 2023a, entire), and the 2023 Sequoia National Forest Land Management Plan (USFS 2023b, entire). The main goals of these conservation efforts across all National Forests are the protection and management of California spotted owl activity centers and territories (also called home range core areas), increasing the frequency of large trees on the landscape, and increasing structural habitat diversity. California BLM lands within the range of the California spotted owl are managed under a variety of RMPs. The Redding Resource Management Plan (BLM 1993, entire) and South Coast Resource Management Plan (BLM 1994, entire) do not mention California spotted owls specifically, but the general provisions are to minimize the decline and promote the enhancement of Special Status Species, including the California spotted owl, which is a BLM sensitive species. The Eagle Lake and Sierra RMPs were completed in 2008. All contain direction to manage habitat to maintain or increase forest characteristics for California spotted owls, as does the Bakersfield RMP for the Kaweah Area of Critical Environmental Concern. The Sierra Pacific Industries HCP includes lands within the California spotted owl range and the commitment to address barred owls through the implementation of several barred owl studies that include removal of barred owls.

# 3. Barred Owl

## 3.1 Biology

Barred owls are a medium sized forest owl native to eastern North America which were historically found east of the Great Plains and south of the 49th parallel (Livezey 2009a, p. 53), with a subspecies in central Mexico. They began to expand their range around 1900, concurrent with European settlement and facilitated by the subsequent human-caused changes to the Great Plains and northern boreal forest. Barred owls arrived in the spotted owl range in the Pacific Northwest in the early 1970s, establishing populations in northern Washington in the early 1980s. They continue to spread southward in the Cascades and coastal mountains, building dense populations behind the invasion front (Map 2) (See Section 3.3 and Appendix 1 for more details).

In the West, barred owls prefer the same older, structurally diverse forest type selected by spotted owls, though barred owls will utilize a wider range of forested habitat types than spotted owls. This includes wooded urban areas and large tracts of second-growth forests.

Barred owls are generalist predators, eating a wide variety of prey items. Barred owls consume the same nocturnal arboreal rodents that are the focus of the spotted owls' diet, and in large quantities given their dense populations (Baumbusch 2023, entire; Kryshak et al. 2022, entire; Woods et al. 2020, entire). However, they also consume numerous other species, including other mammals, amphibians, insects, crayfish, and mollusks. Because of their adaptability to a wide variety of forested habitats and ability to eat a wide variety of prey, barred owls can develop dense populations.

## 3.2 Management Status

The barred owl is protected under the Migratory Bird Treaty Act (MBTA; 16 U.S.C. 793 et seq.), which prohibits take (as defined at 50 CFR 10.12) of protected migratory bird species unless authorized by the Service in accordance with the MBTA and implementing regulations. Implementation of the Strategy would require a permit or other authorization under the MBTA. Barred owls are not listed or special status species in Oregon and California. In Washington, barred owls are classified as protected wildlife under WAC 220-200-100.

## 3.3 The Western Invasion of Barred Owls

Barred owl populations began to expand westward in the early 1900s (Livezey 2009a, p. 50). Barred and spotted owl are both forest owls, whose ranges were separated by the relatively treeless Great Plains and harsh conditions in the northern boreal forest in Canada, both likely formidable barriers to expansion (Livezey 2009b, entire). While the mechanism and route that facilitated westward expansion are not well documented, theories point to potential changes in the conditions on the Great Plains and northern boreal forest as probable explanations.

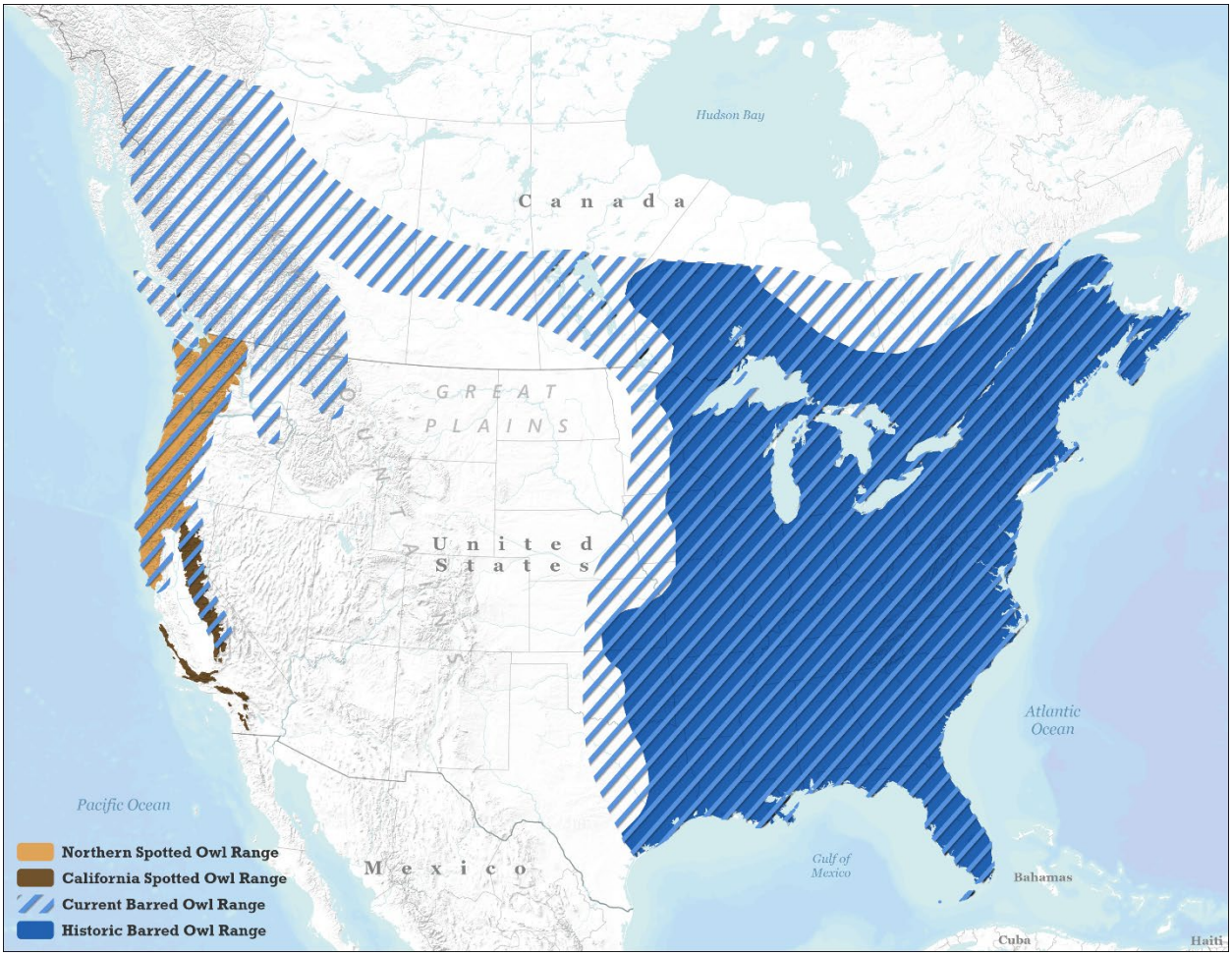
Livezey (2009b, entire), using strength of evidence analysis, concluded that the historical lack of trees in the Great Plains acted as a barrier to the range expansion and that increases in forest caused by the anthropogenic impact of European settlement enabled the westward extension of the barred owl range. These include anthropogenic impacts such as fire exclusion and suppression, bison and beaver extirpation, deer and elk overhunting, establishment of riparian forests, and extensive planting of trees and shelterbelts in the northern Great Plains and southern edges of northern boreal forests, all of which may have contributed to tree and forest expansion. In addition, northern boreal forests experienced a continued increase in temperatures as $CO_2$ levels in the atmosphere rose, with short but pronounced warming periods in the early to mid-1900s (Campbell et al. 1993, entire; Gullett and Skinner 1992, entire; Schindler et al. 1998, entire). (For more detail, see Appendix 1).

## 3.4 Current Range of the Barred Owl in the West

The first record of barred owls within the range of the spotted owl was in 1959 in British Columbia, Canada. Barred owls established populations, subsequently spreading south (Grant 1966, p. 39). Barred owls were first located in western Washington within the range of the spotted owl in 1972 and the first breeding record was 1974 (Smith et al. 1997, p. 230). The first record in Oregon was from 1974 and California in 1976 (Livezey 2009a, p. 40).

Barred owls are now found throughout the range of the northern spotted owl and have invaded the range of the California spotted owl as far south as the Sequoia National Forest in the southern Sierra Nevada (Map 2). Barred owls have not been documented in the Coastal-Southern California population of California spotted owls yet but have been found south of the northern spotted owl range along the central coast.

Barred owl populations expand behind the invasion front and generally occur in dense populations where they have been in place for the longest period and habitat is readily available. This includes Washington and northern Oregon, with the densest documented populations occurring in the Oregon Coast Ranges. Barred owl densities are generally lower in the southern provinces and very few individuals are found in the far southern portion of the northern spotted owl range, Marin and Sonoma Counties, California.




**Map 2.** Historic and current range of barred owls and overlap with northern and California spotted owl range.

Barred owls established a population in the northern Sierra Nevada by 2017, from which 65 barred and hybrid owls were removed during an experiment between 2018 and 2020. Removal of detected barred owls continues as part of ongoing research in the Sierra Nevada at a rate of 10 to

15 barred owls per year (2020 to 2022). At the current time, most barred owl detections appear to be dispersers that are detected one time and then are not located on subsequent follow-up surveys.

# 4. Spotted Owl Population Condition

Northern spotted owl populations have been tracked on eight Federal and three non-Federal demography study areas for over 25 years. The most recent demography analysis (Franklin et al. 2021, entire) used data from 1993 through 2018. Spotted owl populations on all study areas were declining, at rates of between 2 and 9 percent annually. The highest annual rates of decline were in the Olympic and Cle Elum study areas in Washington with over 8 percent annual decline and the Oregon Coast Ranges study area in Oregon with over 7 percent annual decline. The lowest rates of decline were in the Hoopa and Northwest California Study areas. (Franklin et al. 2021, pp. 11-12; Franklin pers. comm. 2023).

Another way to describe the cumulative effect of population declines is to analyze the realized population change. As noted in Franklin et al. (2021, p. 12) this provides a depiction of the cumulative consequences of the annual estimates of population change, expressed relative to an initial population in 1995. The Washington study areas declined by 75 to over 80 percent over the period 1995 to 2017. In Oregon, all study areas declined by more than 60 percent, and some more than 75 percent. California study areas declined the least, but the Northwest California area declined by 50 percent, and the Green Diamond area by greater than 60 percent. Because the Hoopa study area results were truncated in 2012, the documented decline is limited to the period between 1995 and 2012, when the population declined about 30 percent. For perspective, only three study areas had more than 35 percent of their 1995 population level remaining by 2017 (Franklin et al. 2021, p. 13) and populations have continued to decline.

California spotted owl populations have been tracked on three National Forest and one National Park Service demography study areas for over 30 years in the Sierra Nevada, California. Additionally, a single demographic study of California spotted owls was conducted on the San Bernardino National Forest from 1987 to 1998, with opportunistic occupancy surveys conducted in subsequent years across multiple mountain ranges of southern California. Spotted owl populations on all National Forest study areas were declining, at annual rates of 3.3 percent on the Lassen National Forest, 1.5 percent on the Sierra National Forest, 3.1 percent on the Eldorado National Forest, and at a rate 8 percent for southern California (Keane et al. 2023; Peery et al. 2021, p. 15; LaHaye et al. 2004, pp. 2, 16). The Sequoia-Kings Canyon National Park study area had an increase of 1.9 percent from 1990 to 2012 (Keane et al. 2023). This latter study was unfunded from 2014 to 2016, surveys were reinitiated in 2017 with greater focus on occupancy surveys and additional time required to estimate a demographic trend.

Estimates of realized population change provide an additional approach to assess the cumulative effect of population declines by estimating the change in population size relative to the initial population at the start of the studies (Franklin et al. 2021, p. 12). The Lassen, Eldorado and Sierra National Forest study areas declined by 41 to 45 percent over the study periods. The Sequoia-Kings Canyon National Park study area increased by 36 percent.

Population change can also be assessed by monitoring change in site or territory occupancy, that is, what proportion of territories or owl sites within a study area are occupied by owls over time. Territory occupancy on the Eldorado National Forest declined by 60 percent between 1990 and 2020 (Peery et al. 2021, p. 16). Territory occupancy declined by 52 percent across multiple mountain ranges in southern California (Tempel et al. 2022, p. 18). Linking density estimates from the long-term demography study areas to occupancy estimates from bioregional-scale passive acoustic monitoring, Kelly et al. (2023, entire) estimated that the Sierra Nevada spotted owl occupancy was between 30 to 42 percent and population size was between 2,218 and 2,328 owls.

# 5. Barred Owl Impact on Spotted Owl Populations

Our understanding of the impact of barred owls on our native spotted owls has evolved over time. In 1990, at the time of listing, the Service stated that the long-term impact of barred owls on the northern spotted owl was unknown but of considerable concern (55 FR 26114 at 26191). By 2004, the Service had identified competition from the invasive barred owl as a primary threat to northern spotted owl populations (USFWS 2004, p. 43).

The Recovery Plan (USFWS 2011, entire) identified past habitat loss, current habitat loss, and competition from the recently arrived barred owl as the most pressing threats to the northern spotted owl (USFWS 2011, p. I-6.), identifying 10 recovery actions specific to barred owls. In the proposed listing of the California spotted owl, the Service similarly concluded ". . . barred owls are a significant threat to the persistence of California spotted owls, and we expect the magnitude of the threat to increase into the foreseeable future, particularly if management efforts are not continued" (88 FR 11600 at 11619).

Franklin et al. (2021, p. 13) noted, "Since the last meta-analysis (Dugger et al., 2016), we found that [northern spotted owl] populations continued to experience dramatic declines on study areas distributed across the species' geographic range. Evidence that the presence of [barred owls] was a primary causative factor for those declines is stronger, and [barred owl] presence was found to negatively affect every demographic trait we estimated for [northern spotted owl]."

The mechanism for the negative impact of barred owls on spotted owls is a combination of interference competition, where barred owls exclude spotted owls from breeding territories, and exploitation competition for habitat and food (Gutiérrez et al. 2007, p. 189; Hamer et al. 2007, p. 763; Wiens et al. 2014, p. 38). Franklin et al. (2021, p. 15) noted "Our study provides range-wide evidence that the negative consequences of interspecific competition with [barred owl] have increasingly overwhelmed dwindling populations of [northern spotted owl] since the last meta-analysis reported by Dugger et al. (2016)."

In recent years, barred owls have penetrated into the range of the California spotted owl in the Sierra Nevada Mountains, although their population remains low and scattered in most of the California spotted owl range at this time. A rapidly expanding population of barred owls was established in the northern Sierra Nevada by 2018 (Wood et al. 2020, p. 5). The bulk of those barred owls, and associated spotted x barred owl hybrids, were removed during a research study between 2018 and 2020 (Hofstadter et al. 2022, p. 5). While barred owls have not impacted

California spotted owls to any significant degree to date, the potential for invasion is increasing as barred owl populations to the north expand. Barred owls are considered a significant threat to the persistence of California spotted owls, and we expect the magnitude of the threat to increase into the foreseeable future (88 FR 11600 at 11619).

# 6. Barred Owls as an Invasive Species in the West

We evaluated the status of barred owls under Executive Order 13751 (*Safeguarding the Nation From the Impacts of Invasive Species*) to determine if barred owls met the definition of an invasive species in the ranges of the northern and California spotted owl. A full description of this analysis is contained in Appendix 1.

We concluded that the barred owl in western North America meets the definition of an invasive species as defined in E.O. 13751 for the following reasons. The barred owl is a non-native species, not historically present in the range of the northern and California spotted owls. Barred owls were introduced unintentionally through dissemination across the previous barrier to movement of this forest owl created by the generally treeless conditions of the Great Plains and harsh conditions of the northern boreal forest in Canada. This movement was made possible by human-caused changes to the Great Plains and northern boreal forest. Barred owls are causing significant environmental harm to northern spotted owls, a subspecies listed as threatened under the ESA, and are likely to cause significant harm to California spotted owls as barred owl populations continue to expand. They are also likely harming other species through predation or competition and are considered a risk to create a trophic cascade in some forest systems. In other words, the addition of barred owls to a new ecosystem has the potential to alter the food web in ways that could cause local extirpations of competitors or prey, and even affect fundamental ecosystem processes like the transfer of nutrients between fungi, plants, and animals (Holm et al. 2016, pp. 6-7).

# 7. Past and Ongoing Research Addressing Barred Owl Effects on Spotted Owls and Barred Owl Removal

Research on the potential effect of the non-native barred owl on native spotted owls, including removal experiments, has been ongoing since 1986. Hamer et al. (2007, entire) conducted some of the first studies looking at barred and spotted owls in areas of overlap in the northern Cascade Range of Washington from 1986 to 1989. This was the first study to document the exclusion of spotted owl from territories by barred owls. Kelly et al. (2003, entire) compiled historical data on barred and spotted owls in Oregon and examined data from demography study areas in Oregon and Washington through 1999. They documented that spotted owl site occupancy declined in the presence of barred owls. Olson et al. (2005, entire) also concluded that the increasing presence of barred owls on spotted owl sites would likely lead to further declines in spotted owl site occupancy. Wiens et al. (2014, entire) conducted similar work from 2007 to 2009 in the Oregon Coast Ranges. Their study found a negative effect of barred owls on movements, resource selection, and reproduction of spotted owls and a strong potential for both exploitation and interference competition between spotted owls and recently established barred owls. Several

additional studies corroborated these conclusions, including but not limited to Gutiérrez et al. (2007, entire), Dugger et al. (2011, entire), and Yackulic et al. (2014, entire).

The spotted owl demographic meta-analyses have been conducted every five years since 1992. In the fourth analysis, Anthony et al. (2006, p. 32) found a weak negative effect of barred owls on spotted owl survival on a few of the study areas. Forsman et al. (2011, p. 70) found evidence of negative relationship between demographic rates of spotted owls and the presence of barred owls, on more of the study areas and stronger than reported by Anthony et al. (2006, p. 32). Five years later, Dugger et al. (2016, pp. 98-99) identified barred owls as a primary influence negatively affecting life history traits, territory occupancy rates, and, ultimately, rates of population change in northern spotted owls. In the most recent demography analysis, Franklin et al. (2021, p. 13) noted that northern spotted owls continued to experience dramatic declines on all study areas. The evidence that barred owl presence is a primary causative factor in the declines was stronger than in past analyses and barred owl presence was found to negatively affect every demographic trait.

Several studies have investigated the effect of removing barred owl on spotted owls, starting with work by Lowell Diller on Green Diamond Resource Company lands in 2009 (Diller et al. 2016, entire). The ongoing demography study area was divided into treatment and control areas, and barred owls were removed from the treatment area through 2013. Following the initiation of barred owl removal, the rate of population change of northern spotted owls significantly increased in the treated areas with the mean rate greater than 1.0, suggesting a stable or increasing population, but declined steeply on the control area (Diller et al. 2016, p. 702). Seven northern spotted owl sites, occupied by barred owls prior to removal, were reoccupied by spotted owls within the year. Spotted owl survival rates recovered to rates similar to the early study period (circa 2009) on the treatment area, while they continued to decline on the control area.

In 2013, the Service initiated the Barred Owl Removal Experiment to implement Recovery Action 29 in the Recovery Plan – "Design and implement large-scale control experiments to assess the effects of barred owl removal on spotted owl site occupancy, reproduction, and survival" (USFWS 2011, p. III-65). Removal of barred owls began on the Hoopa Reservation in California in 2013. Study areas were added in Cle Elum (Washington) and the Oregon Coast Ranges (Oregon) in 2015, and Union/Myrtle (Klamath) (Oregon) in 2016. The removal of barred owls had a strong, positive effect on the survival of northern spotted owls and a positive, but weaker, effect on recruitment of spotted owls. The weaker effect of removals on recruitment was likely the result of limited availability of new recruits due to years of depressed reproduction in spotted owls. After removals, the estimated annual rate of spotted owl population change stabilized in areas with removals (0.2 percent decline per year), but continued to decline sharply in areas without removals (12.1 percent decline per year) (Wiens et al. 2021, pp. 1, 5).

Barred owls and barred x spotted owl hybrids established a rapidly growing population in the northern Sierra Nevada in the range of the California spotted owl by 2017 (Wood et al. 2020, p. 4). Barred owls were lethally removed starting in 2018. Sixty-five barred and hybrid owls were removed from this population (Hofstadter et al. 2022, entire). As a result, occupancy rates of spotted owl territories by barred owls decreased from 0.19 to 0.03. Fifteen of the 27 former spotted owl territories from which barred owls or hybrids were removed were reoccupied by

spotted owls within one year. Recolonization of sites by barred owls was very low the year following removals.

There are several ongoing barred owl removal experiments in California, including additional research on the Green Diamond Resource Company lands (initiated 2020, anticipated duration five to ten years) and continued removal on the Hoopa Reservation. Sierra Pacific Industries initiated experimental removal on their lands in the northern and California spotted owl ranges in 2014 to provide additional scientific information to researchers studying genetics of the barred owl invasion (Sierra Pacific Industries 2020, p. 37).

# 8. Barred Owl Management Strategy

## 8.1 Background

In initiating the Strategy development, Service managers provided the following policy guidance:

1. The Strategy should be a Service decision and document. We would convene an intergovernmental interagency Core Team (Team) to develop the Strategy to ensure coordination and to develop a Strategy that met the needs of potential implementers to the maximum extent practicable. The Service would conduct NEPA compliance on the Strategy and would issue an MBTA permit for implementation if the Strategy met the general permit issuance criteria and requirements for issuance.

2. The Strategy should cover the ranges of both the northern and California spotted owls. Barred owls represent a threat to both subspecies and developing a coordinated strategy was important to addressing this threat.

3. The Strategy should be developed at a landscape level, considering all lands, Federal and non-federal. We would address conservation needs and management options across the landscape. The Strategy would not create any specific requirements for proactive actions, or limitations on non-federal lands other than those associated with any needed permitting for willing landowners and land managers. The Strategy would be focused on recommendations.

4. With the extensive range and different ownerships, elements of the Strategy would likely need to vary in space and time. Specific management options could vary by geographic area, as needed and appropriate. In addition, the Strategy could include temporal elements allowing the spread of application or implementation over an extended time frame.

Using this guidance, the Team developed goals for the development of the Strategy. The focus of this Strategy is to develop a framework within which effective management of the invasive barred owl can be efficiently implemented to reduce threats from barred owls to the northern and California spotted owl and contribute to their survival and recovery into the future. This included:

1. maintaining or enhancing spotted owl populations and distribution across their ranges sufficient to promote for conservation/recovery of each subspecies;

2. reducing the rate of loss of occupied spotted owl range resulting from barred owl competition; and

3. providing spotted owl habitat that is free of, or with reduced competition from, invasive barred owls.

The management direction and goals were incorporated into the following purpose and need statement for the Strategy:

> The purpose of this action is to reduce barred owl populations to improve the survival and recovery of northern spotted owls and to prevent declines in California spotted owls from barred owl competition. Relative to northern spotted owls, the purpose is to reduce barred owl populations within selected treatment areas in the short term and increase northern spotted owl populations in those treatment areas. Relative to the California spotted owl, the purpose is to limit the invasion of barred owls into the range of the subspecies and provide for a rapid response to reduce barred owl populations that may become established.
>
> The need for this action is that barred owls compete with northern and California spotted owls. Competition from the invasive barred owl is a primary cause of the rapid and ongoing decline of northern spotted owl populations. Due to the rapidity of the decline, it is critical that we manage invasive barred owl populations to reduce their negative effect before northern spotted owls are extirpated from large portions of their native range. As stated in the recent northern spotted owl demographic meta-analysis: "[N]orthern spotted owl populations potentially face extirpation if the negative effects of barred owls are not ameliorated while maintaining northern spotted owl habitat across their range" (Franklin et al. 2021, p. 2). The Recovery Plan also emphasizes the need for action in Recovery Action 30: "Manage to reduce the negative effects of barred owls on northern spotted owls so that Recovery Criterion 1 can be met." Recovery Criterion 1 is to provide for a stable or increasing population trend of northern spotted owls throughout the range over 10 years (USFWS 2011, p. II-1). Therefore, the management strategy needs to allow for rapid implementation and result in swift reduction in barred owl numbers.
>
> California spotted owls face a similar risk from barred owl competition as barred owl populations continue to expand southward. While California spotted owls have not yet experienced substantial declines as a result of barred owl competition, the southward invasion of the barred owl has reached their range, and we anticipate that additional impacts to California spotted owl populations would be inevitable without barred owl management. Invasive species are very difficult to remove once established. Therefore, the management strategy needs to focus on limiting the invasion of barred owls into the California spotted owl range. If barred owl populations do become established, the management strategy needs to provide for early intervention to prevent adverse effects of barred owls on California spotted owl populations.

## 8.2 General Elements and Considerations

As described in Section 1.0, the Strategy only addresses barred owl threats and management. It does not change underlying land management or result in changes to section 7 consultation requirements under the ESA. It does not modify northern spotted owl critical habitat, the Recovery Plan, or any land designations. It is complementary to, and does not replace, the management of spotted owl habitat.

As described in the guidance from managers above, the Strategy is a set of recommendations for the management of barred owls. The Strategy provides a management framework for entities (Federal, State, or Tribal government agencies, or private entities) that choose to implement this barred owl management. Nothing in the Strategy requires any entity to implement barred owl management; rather, it outlines management approaches, geographic areas, and other components to guide management actions by interested and willing landowners or land managers.

The Strategy does not create any specific requirements for proactive actions, nor does it place any additional limitations on Federal or non-Federal lands. However, any actions that are conducted under this Strategy and associated MBTA permit must fit within the description of the Strategy and follow the protocol for barred owl removal and required monitoring. Management of barred owls described in the Strategy can only be conducted on lands of willing landowners or land managers. Presence of an area within the mapped or described area does not convey any additional rights to the implementing entities.

Because barred owls are a protected species under the MBTA, implementation of actions described in the Strategy would require an MBTA permit from the Service's Migratory Bird Program. The Service will apply for a Special Purpose MBTA permit for the implementation of actions under the Strategy. If issued, the Service may designate other qualifying entities, governmental or non-governmental to implement actions consistent with the Service's permit. Entities may also choose to apply for an MBTA Special Purpose permit of their own using the Strategy.

## 8.3 Barred Owl Population Management

Removal methods: Under the Strategy, management of barred owl populations would be accomplished by lethally removing barred owls, thereby reducing barred owl populations. Management may include removal of spotted x barred owl hybrids, though the removal protocol for hybrids is more restrictive to reduce risk of accidentally injuring or killing a spotted owl. Hybrids represent the same impact to spotted owls as genetically pure barred owls, displacing them from their territories.

Removal methods are designed to:

- Minimize the number of barred owls in the management area. While we do not anticipate removal of all barred owls from within a management area, we do anticipate reducing and maintaining barred owl populations at levels lower than would occur without management, and that these lower levels will allow for increased spotted owl survival and recruitment.
- Be as humane and quick as possible within the confines of the method.
- Pose little to no risk of injury to nontarget species, including the spotted owl.

We considered potential approaches to reducing barred owl populations or their effect on spotted owls. Only those that result in the removal of barred owls from the landscape meet the purpose and need for the Strategy (Section 8.1). Lethal removal of barred owls from identified management areas is the only population reduction method that is proven to work in reducing barred owl populations, thereby improving spotted owl population response (Diller et al. 2016, entire; Wiens et al. 2020, entire; Hofstadter et al. 2022, entire). Therefore, barred owl management under the Strategy is focused on lethal removal of barred owls.

Lethal removal is accomplished by attracting the barred owls with recorded calls and shooting birds that respond and approach closely. All removals will be conducted by removal specialists that meet the training and experience requirements described in the removal protocol (Appendix 2). The protocol is based on the experience gathered from several previous barred owl removal studies and is designed to ensure a quick, humane kill; minimize the potential for non-fatal injury to barred owls; and vastly reduce the potential for non-target species injury or death. In areas where firearm use is inadvisable or prohibited, the protocol includes an option to capture and euthanize barred owls. Basic documentation and information will be required for all removals to ensure application of the protocol and to provide information for future modifications to this protocol.

All actions taken under the auspices of the Strategy must conform to all elements of the protocol in Appendix 2 and any additional conditions of the issued MBTA permit. Entities implementing barred owl removal under this Strategy will be required to meet the requirements of training for removal specialists described in Appendix 2, abide by the protocol for removal, and provide all required reports.

We will continue to review new information and we will consider modifying the protocol as needed to ensure removal is as humane as possible.

Duration of Barred Owl Management Actions: Barred owl management is most effective when continued for an extended time period. Based on removal experiments, continued removal over several years resulted in a continuing decline in barred owl density over that time and allowed spotted owls to respond to the newly available habitat.

Where barred owl populations are well established, a single year of removal is less likely to lead to improvements in spotted owl populations. Therefore, we recommend, but do not require, that anyone implementing barred owl removal do so with the intent to continue the effort for at least five years. We are not requiring a specific commitment, knowing the potential for changes in

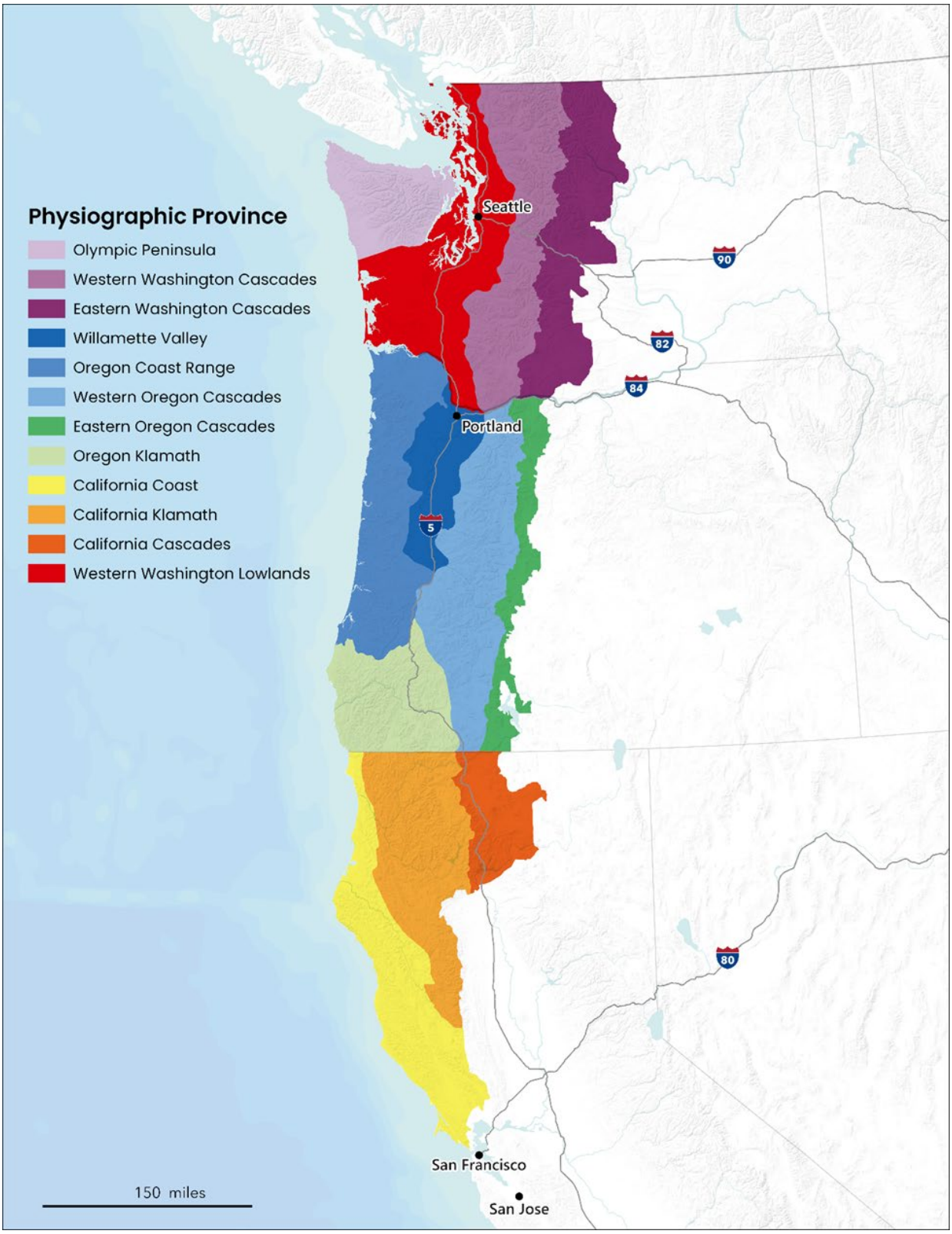
funding and personnel, but the intent to try to continue funding and removal actions is important. In cases where the management area is affected by catastrophic events, such as wildfire, or other factors make continuation of a specific area unrealistic, the area may be reconfigured, or the effort moved to a location unaffected by the event.

In areas at the leading edge of the invasion of barred owls, where few territorial barred owls exist on the landscape, a single year of removal, or removal conducted only when and where barred owls are located, could have significant value in slowing the invasion. In this case, we recommend continued monitoring and additional removal if barred owls recolonize that area. Even a multiple year effort may not involve removal every year, but only when barred owls reoccupy the area. We include monitoring for barred owl recolonization as a component of the management action.

## 8.4 Northern Spotted Owl Range

The purpose of the Strategy in the northern spotted owl range is to stop or slow spotted owl population declines from barred owls within selected treatment areas in the short term and increase spotted owl populations in the intermediate term. Competition from the invasive barred owl is a primary cause of the recent rapid and ongoing decline of northern spotted owl populations. Due to the rapidity of the decline, it is critical that we manage barred owl populations to reduce their negative effect on spotted owls before northern spotted owls are extirpated from large portions of their native range. The Recovery Plan emphasizes the need for action in Recovery Action 30: “Manage to reduce the negative effects of barred owls on northern spotted owls so that Recovery Criterion 1 can be met.” Recovery Criterion 1 is to provide for a stable or increasing population trend of spotted owls throughout the range over 10 years (USFWS 2011, p. II-1). Therefore, the management strategy needs to allow for rapid implementation and result in swift reduction in barred owl competition.

In the range of the northern spotted owl, the Strategy is organized by physiographic province, in keeping with the Recovery Plan (Map 3). Recovery Criterion 2 specifically addresses population distribution in terms of viable spotted owl subpopulations within each province, which the Recovery Plan defines as recovery units. In addition, we included consideration of population connectivity between provinces where habitat exists to support such connection.




**Map 3.** Physiographic provinces in the northern spotted owl range.

Northern spotted owl populations, as demonstrated by the most recent demography meta-analysis results, are declining at between two and nine percent annually, with greater declines generally in the north where barred owls have been established for a longer time period (Franklin et al. 2021, pp. 11-13). Rates of population decline are lower on the California study areas, though still significant. The presence of barred owls was identified as a primary causative factor for the declines and negatively affected every demographic trait estimated for the northern spotted owl in the recent demography meta-analysis (Franklin et al. 2021, p. 13). In a two-species occupancy model, barred owl occupancy was a dominant negative effect on colonization of territories by spotted owls. However, other factors, such as habitat components and climate, were also important in the dynamics of territory occupancy, reinforcing the importance of maintaining spotted owl habitat on the landscape (Franklin et al. 2021, p. 18; Dugger et al., 2011, pp. 2464, 2467). Maintenance of a landscape with adequate amounts and distribution of habitat also provides areas available for re-colonization by northern spotted owls should management actions allow for reduction of barred owl populations and facilitates connectivity for northern spotted owls dispersing among occupied areas (Sovern et al. 2014, p. 5).

Barred owls are now found throughout the range of the northern spotted owl. Barred owl populations have grown within their invaded range and generally occur in dense populations where they have been in place for the longest period, including Washington and northern Oregon. The densest documented populations occur in the Oregon Coast Ranges, with generally lower densities in the southern provinces and very few barred owls in the far southern portion of the northern spotted owl range, Marin and Sonoma Counties, California.

## 8.4.1 Common Elements Across All Provinces

The Strategy includes three approaches to barred owl management, applied across the range at varying scales – 1) spotted owl site management, 2) General Management Areas (GMAs) with associated Focal Management Areas (FMAs), and 3) Special Designated Areas. The details of management under these approaches may vary by province, depending on the condition of spotted owls, barred owls, and habitat within the province (as described in Section 10 and Appendix 4.1 through 4.11). The following provides the general background on these three management approaches.

### 8.4.1.1 Prioritization

All actions described in the Strategy are prioritized within each province to provide focus and recommendations to implementing entities. The priorities are primarily for the benefit of entities that are planning to fund or carry out barred owl management under the Strategy, or allow for implementation of the Strategy on lands they administer, and are selecting among multiple options within a given province. All provinces, except for the Willamette Valley Province, are important for northern spotted owl recovery, since Recovery Criterion 2 requires adequate population distribution, with viable subpopulations in each province (aside from the Willamette Valley, USFWS 2011, p. II-1). If a funding or implementing organization is selecting from multiple options across provinces, we would encourage selecting high priority actions within each province.

The priorities are non-binding and any action described by the Strategy may be implemented at any time. That is, we do not need to implement all Priority A items before starting on Priority B items. In some cases, a landowner that wants to participate in barred owl management may only have Priority D or E options on their lands. This allows them to implement such management even though the options available to them are not the highest priority. Within the northern spotted owl range, the Strategy uses a five-level prioritization system (A to E), applied at the province level. The Strategy includes Priority A, B, C, and D actions in each province, and Priority E actions in some provinces. See Appendix 3 for more details.

> **Priority A** defines actions that should, and can, be implemented immediately to prevent extinction or extirpation of spotted owls in the province or targeted areas in the province, particularly in areas with very low spotted owl populations. Additionally, in areas where spotted owl populations are not critically low, this defines actions needed to secure key areas with remaining populations as anchors to the eventual expansion of managed areas and healthy populations.
>
> **Priority B** defines actions that should be implemented as soon as possible to slow spotted owl population declines.
>
> **Priority C** defines actions that should be implemented in the near future to establish areas for spotted owl populations to stabilize and increase to sustainable levels.
>
> **Priority D** defines action that, if implemented, would further assist in stabilizing or increasing spotted owl populations.
>
> **Priority E** defines actions that, if implemented, would provide additional support to spotted owl populations.

These priorities apply to management at the scale of both individual spotted owl sites, and block management or other management within mapped management areas. When referring to site management, the priorities apply regardless of whether the site is located within or outside a mapped management area. When applied to mapped management areas, the given priorities are based on the information available to us as of the writing of the Strategy, and new information may become available over time that would support a different prioritization for a given mapped management area. Therefore, we encourage future implementers who use the priorities in decision making to consider the rationale for the prioritization of a given management area (see Appendix 4), as well as the full definitions of the priorities (see Appendix 3), to determine whether a change in priority for a mapped management area may be warranted based on new information.

Additionally, we encourage implementers to carefully consider the risks and benefits associated with spreading management among multiple mapped management areas within a province (some of which may be lower priority), which would be beneficial for redundancy, versus implementing management over a larger portion of a single, high priority mapped management area, which may allow for more efficient barred owl removal and exclusion and higher spotted

owl population connectivity. These factors may sometimes justify the selection of lower-priority options even when higher-priority options are available.

#### 8.4.1.2 Spotted Owl Site Management

Removal of barred owls within and around spotted owl sites is a component of management in all provinces, including the Western Washington Lowlands Physiographic Province. Spotted owl site management can be applied anywhere within the province, within or outside of GMAs and Special Designated Areas. Spotted owl site management is prioritized based on information regarding the condition of the site (Table 1). Prioritization of spotted owl site management varies between provinces based on the size and condition of the remaining spotted owl populations. Currently occupied sites (in other words, sites with spotted owls detected within the last year) are assigned Priority A in every province.

**Table 1.** Site condition definitions used in site management prioritization.

| Site condition | Definition |
|---|---|
| Currently active site | Survey results detected pair or single occupancy, or other spotted owl detections, within the last year |
| Recently active site | Survey results detected pair or single occupancy, or other spotted owl detections, within the last five years |
| Historical site, last active 5-10 years ago | Previously occupied pair or single site with last detection between 5 and 10 years ago, and no surveys or negative surveys since then |
| Historical site, last active >10 years ago | Previously occupied pair or single site with last detection more than 10 years ago, and no surveys or negative surveys since then |
| Potential site | No known history of spotted owl occupancy (no surveys, negative surveys, or incidental detections more than 5 years old), but habitat amount and configuration appear adequate to support a territorial spotted owl pair |

Removing barred owls within and around occupied spotted owl sites is intended to help retain the existing population, increase the potential for recruitment of young, and provide a source of young for recolonization of larger blocks where barred owl management occurs. Removing barred owls from within and around occupied spotted owl sites is intended to improve survival of, and potentially allow for reproduction by, the remaining spotted owls while larger block management efforts are developed and implemented.

Managed spotted owl sites within or near GMAs may provide a source of young for colonization of FMAs as barred owl populations are reduced in those areas. They may enhance connectivity between FMAs within and between GMAs, particularly between smaller FMAs. These spotted owl sites may be the nucleus of spotted owl populations in future management blocks, especially where spotted owl site management is applied to clusters of neighboring sites. As barred owl populations are reduced in FMAs, this may provide the starting point for the growth and stabilization of spotted owl populations.

Removing barred owls from currently unoccupied spotted owl sites is intended to provide support for recolonization and population growth. If habitat has not changed substantially, previous use by spotted owls demonstrates the ability of these areas to support spotted owls.

Managed spotted owl sites between GMAs may serve to increase connectivity between GMAs, increasing spotted owl population connectivity within and among the provinces. In some other sites outside of block management areas, it may not make sense to continue site management in the long run. However, site management in the short term may enable these sites to provide a source of spotted owl individuals for augmentation of block management areas in the future should such management action be necessary. This could include captive breeding, captive rearing, and direct translocation, if decisions are made in the future to pursue such actions.

Due to the smaller size of these management areas, spotted owl site management provides a wider range of options for landowner contribution to barred owl management, particularly for smaller landowners. The smaller size also makes site management suitable for areas where there are not large amounts of spotted owl habitat due to terrain, or extensive loss of habitat from wildfires, harvest, or other disturbances. Their smaller size also requires less logistical support and may allow for management to be initiated more quickly in these areas.

The specific values considered in developing the recommendations for spotted owl site management in each province are described in Appendices 4-1 to 4-10.

*Spotted Owl Site Management Recommendations:*

Spotted owl site management involves the lethal removal of barred owls within an area equivalent to that of a circle with a radius usually between 1.5 and 2 home range radii, including a spotted owl home range and nearby areas likely to harbor barred owls. In areas where spotted owl sites are isolated, and particularly for sites in Priority A condition, we recommend a larger management area, up to 3 home range radii. The home range radii, which were established based on the area used by radio-tagged spotted owls over a calendar year and vary by province, are commonly used in ESA Section 7 consultation. The values in Table 2 describe the area represented by circles of 1.5, 2, and 3 home range radii in each province. This acreage can be distributed in a circle around the activity center, or implementers can use local knowledge, topography, and habitat condition to design a non-circular area of the appropriate size that provides the best conditions for barred owl management. Throughout the Strategy we use the following home range radii. While this generally applies to all provinces in the northern spotted owl range, conditions in some areas may warrant variations on this approach (See Appendix 4.1 to 4.11).

When designing a non-circular area for site management, considerations include the configuration of spotted owl habitat, the distribution of barred owls, and the history of spotted owl use of the landscape, if known. Site management effectiveness may be increased if the site management areas include areas near the spotted owl site with concentrations of barred owls that, if not removed, will continue to send dispersers into the spotted owl territory. In cases where spotted owls have been pushed into more marginal habitat conditions, management of

both the current, marginal habitat area and nearby higher-quality spotted owl sites could allow spotted owls to access better habitat conditions.

Some spotted owl sites will overlap with GMAs or Special Designated Areas, and in areas with larger remaining spotted owl populations, buffered sites will overlap significantly with one another. Applying site management to clusters of two or more sites in close proximity is likely to provide more efficient management conditions and increased benefits for spotted owls present in those sites.

**Table 2.** Standardized home range radii (HRR) for spotted owl sites in the range of the northern spotted owl for barred owl management.

| Physiographic Province | HRR in Miles | 1.5 HRR in miles | Area within 1.5 HRR in Acres | 2.0 HRR in Miles | Area within 2.0 HRR in Acres | 3.0 HRR in miles | Area within 3.0 HRR in Acres |
|---|---|---|---|---|---|---|---|
| Olympic Peninsula[1] | 1.8 | 2.7 | 14,657 | 3.6 | 26,058 | 5.4 | 58,630 |
| Western Washington Lowlands[1] | 1.8 | 2.7 | 14,657 | 3.6 | 26,058 | 5.4 | 58,630 |
| Western Washington Cascades | 1.8 | 2.7 | 14,657 | 3.6 | 26,058 | 5.4 | 58,630 |
| Eastern Washington Cascades | 1.8 | 2.7 | 14,657 | 3.6 | 26,058 | 5.4 | 58,630 |
| Oregon Coast Ranges | 1.5 | 2.3 | 10,179 | 3.0 | 18,096 | 4.5 | 40,715 |
| Western Oregon Cascades | 1.2 | 1.8 | 6,514 | 2.4 | 11,581 | 3.6 | 26,058 |
| Eastern Oregon Cascades | 1.2 | 1.8 | 6,514 | 2.4 | 11,581 | 3.6 | 26,058 |
| Oregon Klamath | 1.3 | 2.0 | 7,645 | 2.6 | 13,592 | 3.9 | 30,582 |
| California Klamath | 1.3 | 2.0 | 7,645 | 2.6 | 13,592 | 3.9 | 30,582 |
| California Cascades | 1.3 | 2.0 | 7,645 | 2.6 | 13,592 | 3.9 | 30,582 |
| California Coast – Mixed Conifer Zone | 1.3 | 2.0 | 7,645 | 2.6 | 13,592 | 3.9 | 30,582 |
| California Coast – Redwood Zone | 0.7 | 1.1 | 2,217 | 1.4 | 3,941 | 2.1 | 8,867 |

[1]In consultation the home range radius used for the Olympic Peninsula and Western Washington Lowlands is 2.7 miles, based on west side radiotelemetry. This is also used in the Washington Forest Practices rules. For the purpose of barred owl management, this resulted in an extremely large area. Washington-based biologists participating in Strategy development decided that 1.8 miles was adequate for barred owl management in this situation. This does not change other uses of the 2.7-mile radius.

### 8.4.1.3 General Management Areas

General Management Areas are the primary focus of management in most provinces. These are large, mapped areas within the boundaries of which barred owl management may occur. The interagency, intergovernmental Team developed and mapped these GMAs at the physiographic province scale, in keeping with the Recovery Plan's focus on maintaining viable spotted owl subpopulations within each province (USFWS 2011, p. II-1). We included small, forested areas along the edges of the Willamette Valley Physiographic Province with the adjacent forested provinces (Oregon Coast Ranges or Western Oregon Cascades Physiographic Provinces). In some cases, GMAs also include small areas of neighboring provinces for logistical reasons.

We generally designed GMAs to include enough area to potentially support 200 to 300 spotted owl sites, though they may be smaller or larger due to topographic or habitat conditions. These sizes are based on home range sizes used by radio-tagged spotted owls over a calendar year and assuming a 25 percent overlap between neighboring spotted owl sites, also based on this same data. The sizes vary by province (Table 3).

**Table 3.** General size of an area in acres capable of containing 200 and 300 spotted owl pairs.

| Physiographic Provinces | 200 Pair Size Area in Acres | 300 Pair Size Area in Acres |
|---|---|---|
| Olympic Peninsula, Western Washington Cascades, Eastern Washington Cascades | 1,140,021 | 1,710,031 |
| Oregon Coast Ranges | 791,681 | 1,187,522 |
| Western Oregon Cascades, Eastern Oregon Cascades | 506,676 | 760,014 |
| Oregon Klamath, California Klamath, California Cascades, California Coast (Mixed conifer areas) | 594,641 | 891,961 |
| California Coast (Redwood areas) | 172,411 | 258,616 |

These large areas allow for the creation of multiple smaller focal management areas (FMAs) within each GMA (see below). Multiple smaller management areas within such a landscape provide some redundancy to protect against loss to catastrophic events, such as large, high-severity wildfires. The GMAs represent the boundaries within which these smaller, focal barred owl management areas would be created at the time of implementation.

We did not include Tribal lands within GMAs unless requested to do so by the Tribe. The Hoopa Valley and Yurok Tribes requested inclusion of their lands in northern California and the Yakama Nation requested inclusion of a portion of their lands in the Eastern Washington Cascades within GMAs, thereby allowing greater flexibility for barred owl management on these areas under the Strategy.

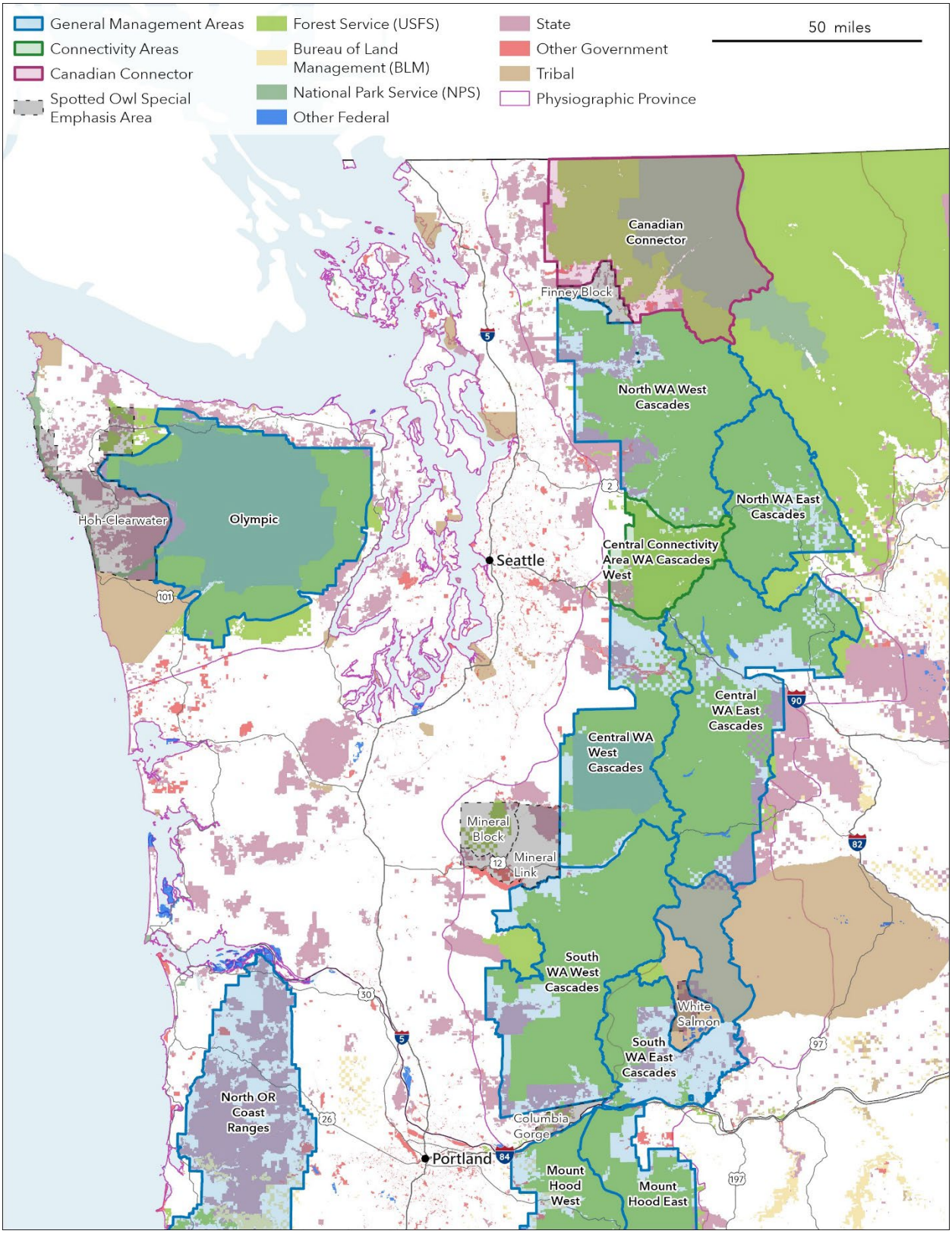
Where possible around the edges of the GMAs, we did not include towns and other human-populated areas. However, some such populated areas do lie within the boundaries. These areas would generally not be part of any barred owl management area, and no firearm-based removal activity would occur within one-quarter mile of any occupied dwellings, established open campgrounds, and other locations with regular human use (Appendix 2). Again, barred owls will only be removed from the lands of willing landowners or land managers.

Considerations used in mapping the proposed GMAs included, but were not limited to, known locations and densities of spotted owl sites, spotted owl habitat density and diversity, estimated barred owl density, locations of previous and ongoing research and monitoring efforts, connectivity across province boundaries, potential risk of catastrophic losses to wildfire and other stochastic events, potential or current isolation of spotted owl populations, and the presence of potential barriers to barred owl invasion. We used landscape-scale GIS layers including, but not limited to, ownership, management status, spotted owl habitat, forest lands, fire risk maps, and spotted owl site history. In this context, forest lands include any lands with the capability to grow forests or which were historically forested, including recently harvested or burned

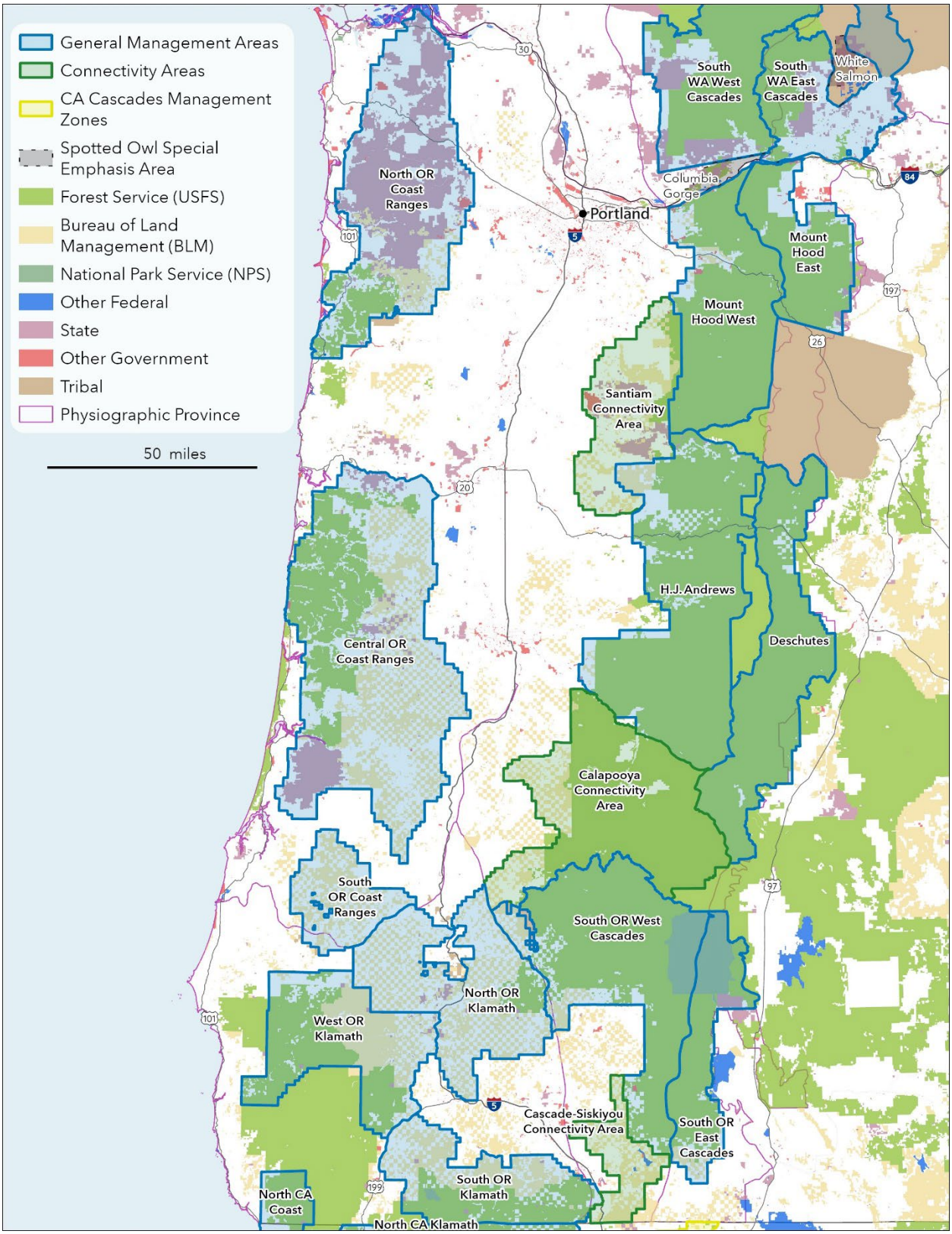
landscapes, and all ages of forest. We use forest lands to provide reasonable representation of potential barred owl habitat. Spotted owl habitat maps focus on forested areas with features suitable for spotted owl nesting and roosting, and in some areas we also referred to more marginal mapped habitat that may in some cases be used for nesting and roosting, or in other cases for foraging. We also referred to models evaluating the potential for a given landscape to support nesting pairs. The results of this mapping are shown on Maps 4 to 6. The details on the considerations for mapping of each GMA are found in Appendix 4.1 to 4.10.

The entire area within any GMA would generally not be under barred owl management at any one time. Within each province, we encourage, but do not require, implementers to consider limiting barred owl management within a single GMA to 50 percent and provide redundancy against catastrophic loss by implementing management in other GMAs within the province.

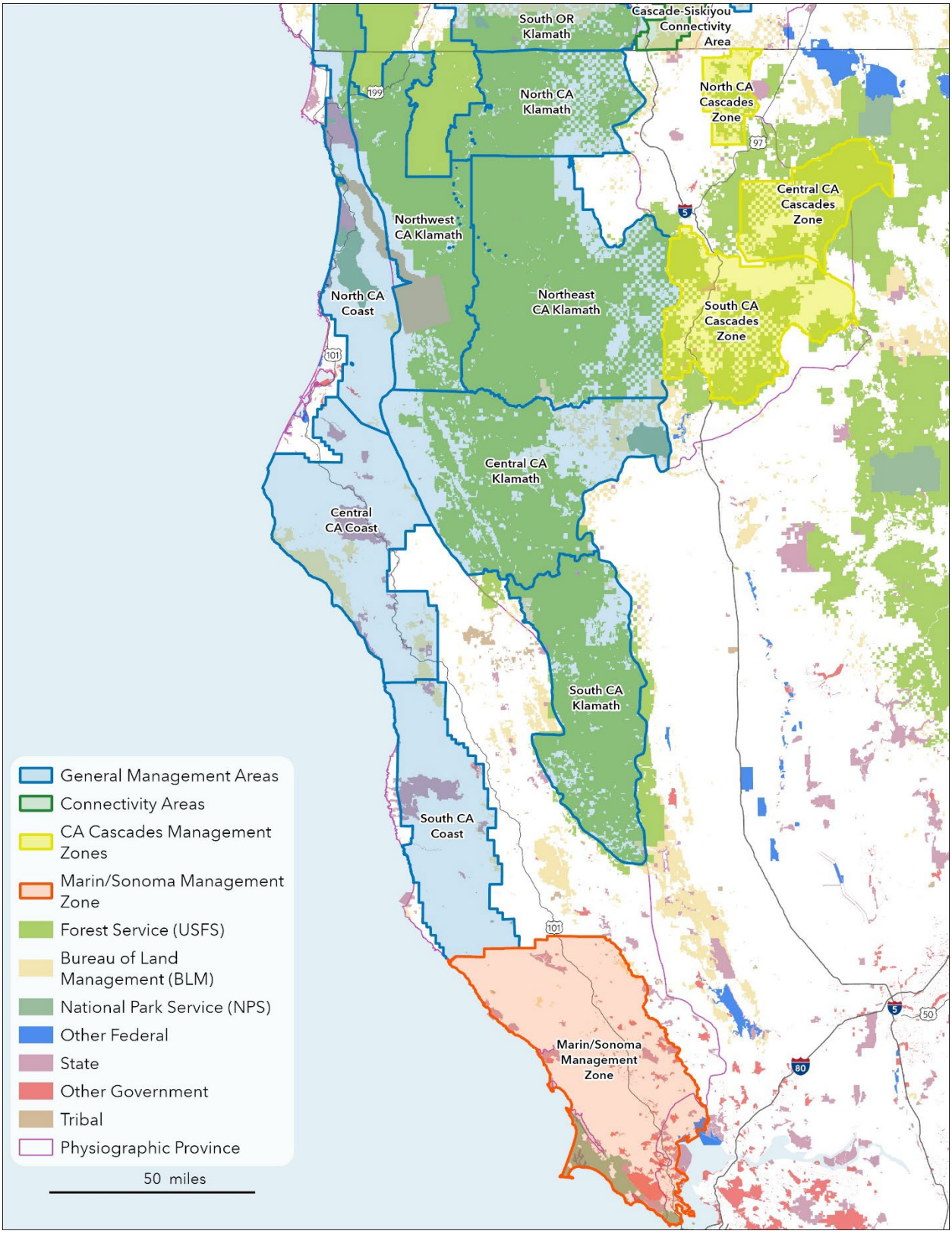
To encourage distribution across the range of the northern spotted owl, in keeping with the Recovery Plan Criterion 2's focus on developing viable spotted owl subpopulations within each province, we have set a maximum of 50 percent of the combined GMA area within a province for barred owl management at any one time. This can be distributed between the GMAs based on the interest of landowners and land managers. This maximum applies only to management within FMAs. Spotted owl site management outside of GMAs, or within a GMA but outside of FMAs, does not count towards the 50 percent maximum. We express acreage in this document in terms of the percentage of forest lands, which represent a reasonable representation of potential barred owl habitat. Table 4 provides the maximum acres of forest potentially under FMA management applying the above management limits, by province. Note, the location of management areas may move within the GMA over time particularly if a portion of a GMA is lost to fire or other catastrophic events.




**Map 4.** General management areas and special designated areas in the northern spotted owl range in Washington.




**Map 5.** General management areas and special designated areas in the northern spotted owl range in Oregon.




**Map 6.** General management areas and special designated areas in the northern spotted owl range in northern California.

**Table 4.** Maximum forest acres under FMA management within GMAs at any one time by physiographic province.

| Physiographic Province | Maximum Forest Acres Under Management |
|---|---|
| Olympic Peninsula | 603,076 |
| Western Washington Cascades | 1,495,410 |
| Eastern Washington Cascades | 1,126,160 |
| Oregon Coast Ranges | 1,568,510 |
| Western Oregon Cascades | 1,534,729 |
| Eastern Oregon Cascades | 719,406 |
| Oregon Klamath | 965,905 |
| California Coast | 1,148,702 |
| California Klamath | 2,555,649 |
| California Cascades | 603,076 |
| TOTAL | 11,717,544 |

*Focal Management Areas*

GMAs represent the outer boundaries of areas within which smaller Focal Management Areas would be established during implementation of the Strategy. These would be selected by the implementing agency or entity, or a group of agencies or entities, based on general direction and prioritization provided in Appendix 4.1 to 4.10. Implementers may also incorporate their own logistical and biological priorities into their decisions on Focal Management Area placement. This provides the implementing entities with the opportunity to set the Focal Management Area boundaries, where active removals would occur, based on the latest local knowledge, interests, and agency management goals. Focal Management Areas could occur anywhere within the GMA boundaries. Where appropriate, Focal Management Areas may also cross GMA boundaries to overlap two adjacent GMAs, for example, to promote connectivity between provinces, or improve efficiency of implementation.

In most GMAs, we recommend FMAs be of a size that could support 50 spotted owl pairs if fully occupied (Table 5). Blocks of this size are manageable logistically, reduce the rate of barred owl reinvasion into removal areas, and are likely to be more effective for promoting sustainable populations of spotted owls, compared with smaller blocks. We recommend considering the spatial arrangement of FMAs within or among GMAs, and when possible place FMAs within 12 to 15 miles of one another, within landscapes that support spotted owl dispersal, to increase the likelihood of demographic connection between spotted owl populations that develop within the FMAs. Managed sites or clusters of sites, and any other barred owl management (e.g., within Connectivity Areas or Management Zones, or experimental barred owl removal conducted outside of this Strategy) can also help to facilitate connectivity between FMAs.

Habitat and topographic conditions may limit the size of FMAs in some GMAs. In this case, smaller FMAs may be developed, though we recommend that these be as large as possible, with a focus on areas capable of supporting a cluster of spotted owl sites, rather than single sites, and

that they be placed in closer proximity to allow for population interaction. The appropriate size is described for each GMA and province in Appendix 4.1 to 4.11.

**Table 5.** General size of an area capable of containing 50 spotted owl pairs if fully occupied.

| Physiographic Provinces | 50 Pair Size Area in Acres |
|---|---|
| Olympic Peninsula, Western Washington Cascades, Eastern Washington Cascades | 285,005 |
| Oregon Coast Ranges | 197,920 |
| Western Oregon Cascades, Eastern Oregon Cascades | 126,669 |
| Oregon Klamath, California Klamath, California Cascades, California Coast (Mixed conifer areas) | 148,660 |
| California Coast (Redwood areas) | 43,103 |

The boundaries of FMAs may change over time. For example, if a substantial portion of an FMA is lost to wildfire, changing the boundaries or moving the management effort to another area would be appropriate. Changes in land management plans, results of monitoring, and other factors may lead to a modification of boundaries of or movement of an FMA to another location. If management succeeds in greatly reducing the density of barred owls, implementers may consider expanding the management area to include surrounding areas. In all cases, the total area under FMA management within a province at any one time (not including areas managed under site management guidelines) would be limited to the area in Table 4.

#### 8.4.1.4 Special Designated Areas

Five additional types of special designated areas are mapped to meet various needs, depending on conditions within the province (Table 6). Management direction varies by designation and priority within the province. The described activity is in addition to, and not a replacement for, spotted owl site management described above. The following is a general description of these area types.

**Table 6.** Maximum forest area within each province to be managed at any one time within Special Designated Areas other than Management Zones

| Physiographic Province | Designation Type | % of Area Under Management | Maximum Forest Acres Under Management |
|---|---|---|---|
| Olympic Peninsula | SOSEA Special Designated Area | 10 | 35,941 |
| Western Washington Cascades | Connectivity Area | 25 | 66,439 |
| | Canadian Connector | 25 | 186,296 |
| | SOSEA Special Designated Area | 10 | 35,134 |
| Eastern Washington Cascades | SOSEA Special Designated Area | 10 | 4,491 |
| Western Oregon Cascades | Connectivity Area | 25 | 422,554 |
| CA Coast | Marin/Sonoma Management Zone | 100 | 587,434 |
| CA Cascades | Management Zones | 100 | 1,976,883 |
| TOTAL | | | 3,315,172 |

*Connectivity Areas.* These areas are mapped in Washington and Oregon. They generally lie between larger GMAs and are intended to provide for generational steppingstone connectivity and movement between GMAs once spotted owl populations stabilize in the GMAs. We define generational connectivity to mean that a series of managed areas, each capable of supporting one or preferably a cluster of spotted owl pair sites, is arranged in close enough proximity to one another to allow for dispersal between sites, thereby supporting demographic connections between larger managed blocks, such as FMAs. While these are generally assigned Priority D and will meet their full value as spotted owl populations develop in the neighboring GMAs, management to maintain existing spotted owl sites within these areas is generally assigned Priority A and will provide a base for expanding management in the future. Therefore, we anticipate barred owl management may occur on up to 25 percent of the forest lands in the connectivity areas in each province where they occur (Maps 3 and 4). More specific direction on management is found in Appendix 4.3 and 4.6.

*Canadian Connector.* The Government of British Columbia, Canada, is engaged in a barred owl management and spotted owl reintroduction effort. If those efforts are successful, management in this block on the U.S. side of the border with Canada could be valuable to that effort. While we do not know what that would entail at this time, we anticipate some barred owl management activity in this area may be of conservation value in the future. Barred owl management could occur on up to 25 percent of the forest lands in this designation at any one time (see Map 3 and Appendix 4.3).

*Spotted Owl Special Emphasis Areas.* The State of Washington identified key landscapes, referred to as Spotted Owl Special Emphasis Areas (SOSEAs), where spotted owl conservation in the form of demographic and/or dispersal support was important on non-federal lands. Where these areas lie within GMAs, Connectivity Areas, or the Canadian Connector, barred owl management as described for those designations would apply. However, barred owl management on portions of the SOSEAs that lie outside of these areas could provide support to spotted owl populations in the provinces. Portions of SOSEAs that are not within another designation are

SOSEA Special Designated Areas. While these are generally of lower priority, barred owl management may occur on 10 percent of forest lands within the SOSEA Special Designated Areas (Map 4 and Appendix 4.1, 4.3, and 4.4).

*Marin/Sonoma Management Zone.* Conditions in Marin and Sonoma Counties are substantially different than in the rest of the northern spotted owl range. Barred owls are present in small numbers and have not yet established significant populations. The remaining spotted owl habitat is found in blocks of limited size managed by a variety of agencies and landowners. Management focus in this area is on preventing barred owls from becoming established and displacing the remaining spotted owls. Therefore, barred owls may be removed from the land of willing landowners and land managers anywhere within these counties (see Map 5 and Appendix 4.9).

*California Cascades Management Zones:* The California Cascades Province, though it is within the northern spotted owl range, is one of the primary pathways for barred owl invasion of the California spotted owl range. Therefore, location and removal of all barred owls within this province is priority A or B for California spotted owls, depending on the exact location (see Section 11.1 below). If this approach is successful, no additional management will be needed in the province. However, in case this approach cannot be implemented fully, management within three mapped Management Zones would help to prioritize barred owl removals to best support northern spotted owl populations. Barred owl management could occur throughout each Management Zone. If barred owls establish populations within this province large enough that the early detection and rapid response paradigm is no longer appropriate, these Management Zones could be managed using an approach similar to GMA management used in other areas where spotted owl habitat is relatively sparse (see Map 5 and Appendix 4.11).

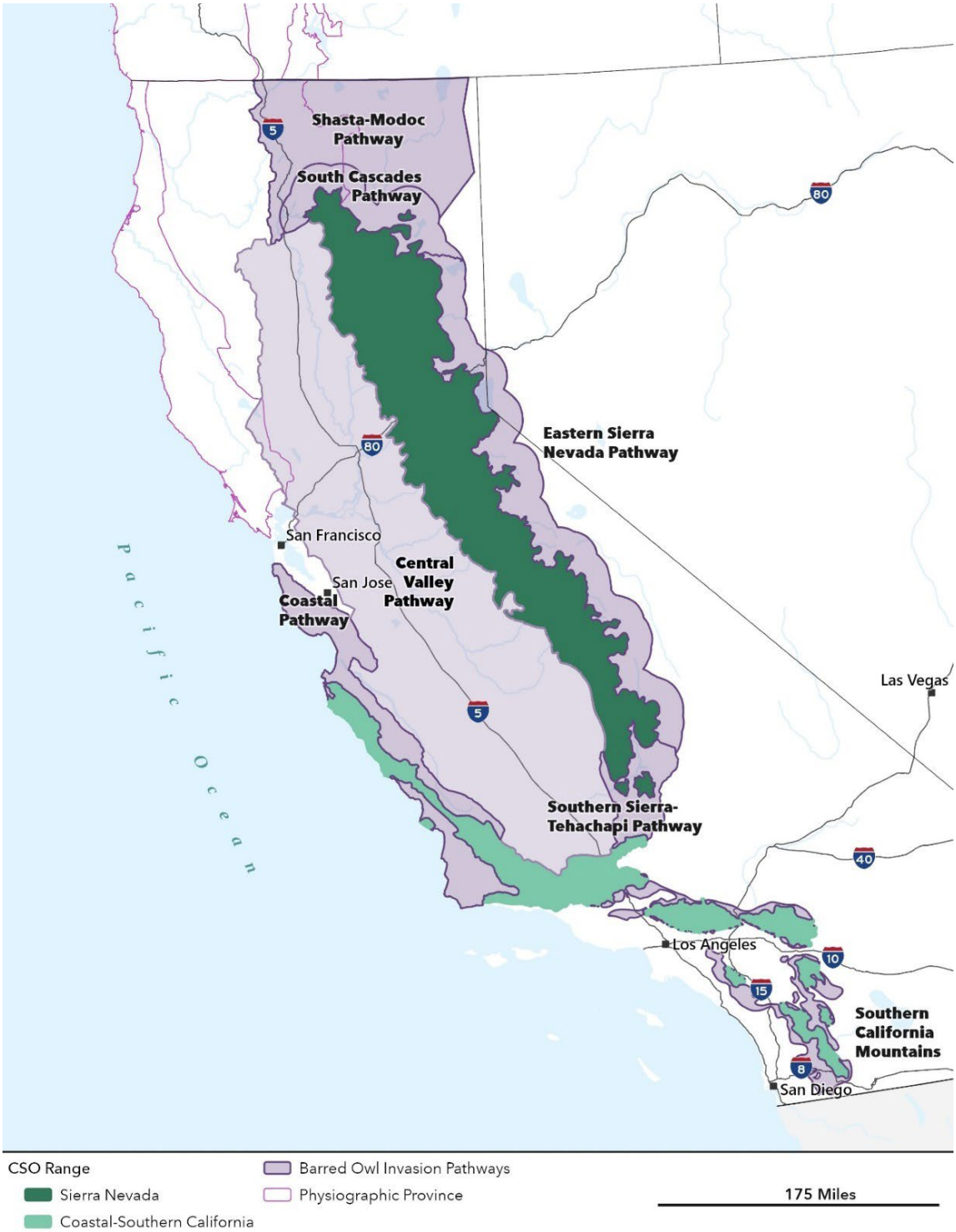
## 8.5 California Spotted Owl Range

The purpose of the Strategy in the California spotted owl range is to limit the invasion of barred owls into the range of the subspecies and respond quickly to reduce barred owl populations that may become established. While California spotted owls have not yet experienced substantial declines as a result of barred owl competition, the southward invasion of the barred owl has reached their range, and future impacts to California spotted owl populations are expected to be inevitable without barred owl management. Therefore, the Strategy focuses on limiting the invasion of barred owls into the California spotted owl range. If barred owl populations do become established, the Strategy allows for early intervention to prevent adverse effects of barred owls on California spotted owl populations.

In the range of the California spotted owl, we developed the Strategy based on the two populations proposed for listing under the ESA - the Sierra Nevada and the Coastal-Southern California populations (88 FR 11600). In addition, the Strategy addresses the potential invasion pathways for barred owls into the Sierra Nevada or Coastal-Southern California populations (see Map 7).

In recent years, barred owls have penetrated the range of the California spotted owl in the Sierra Nevada Mountains, although their population remains low and scattered in most of the California spotted owl range at this time. A rapidly expanding population of barred owls was established in

the northern Sierra Nevada by 2018 (Wood et al. 2020, p. 5). The bulk of those barred owls, and associated spotted x barred owl hybrids were removed during a research study between 2018 and 2020 (Hofstadter et al. 2022, p. 5).




Map 7. Management Strategy in the California spotted owl range, including Sierra Nevada and Coastal-Southern California segments and primary invasion pathways.

While barred owls have not substantially impacted California spotted owl populations in the Sierra Nevada to date, the establishment of a rapidly growing population in the northern Sierra Nevada, and the history of the invasion and impacts on northern spotted owls following such expansion, supports the assumption that, unless the barred owl populations can be managed, barred owls will continue to invade southward until the barred owls threaten the California spotted owl. As barred owls continue moving south into the California spotted owl's range, the northern portion of the Sierra Nevada population will likely experience the earliest impact and a greater magnitude of this threat (88 FR 11600 at 11623).

Barred owls have not reached the Coastal-Southern California population yet, so competition with barred owls is not yet considered a current threat within this population. (88 FR 11600 at 11625). However, as barred owls continue to move south, it is likely they will reach this population in the absence of barred owl management.

Given the continued threat of barred owl invasion, the Strategy focuses not only on the California spotted owl range, but also the potential invasion pathways into their range. For the Sierra Nevada population, the most likely invasion pathway into the province is through the Shasta-Trinity and Modoc National Forests and surrounding forested areas in the California Cascades province, immediately to the north of area occupied by the Sierra Nevada population. Given their ability to use a wide variety of forest conditions, barred owls could also potentially move through the riparian forests of the Central Valley of California.

Barred owls may be able to colonize the Coastal-Southern California spotted owl's range because of the barred owl's ability to use a variety of forest conditions. There are two potential invasion pathways. One is in the forests between the Coastal-Southern California and the Sierra Nevada populations, should barred owls become established in the Sierra Nevada. The other is along the central coast between the southern tip of the northern spotted owl range and the northern tip of the Coastal-Southern California spotted owl population. Detections of barred owls in coastal forests in the Santa Cruz Mountains in San Mateo County, California, an area without known occurrences of the California spotted owl, suggests a pathway towards connectivity to the Coastal portion of the California spotted owl's range (88 FR 11600 at 11618).

## 8.5.1 Common Elements Across All Populations and Areas

There are two primary elements in the Strategy for the California spotted owl range: (1) survey, inventory, and monitoring for invading barred owls and (2) removal of all barred owls that are located. The application of these varies by population based on the current barred owl presence and general habitat conditions.

#### 8.5.1.1 Prioritization

All actions described in the Strategy are prioritized within each area to provide focus and recommendations to implementing entities. The priorities are non-binding and any action described by the Strategy would be allowed at any time. That is, we do not need to implement all Priority A items before starting on Priority B items. In some cases, a landowner that wants to

participate in barred owl management may only have Priority C option on their lands. This allows them to implement such management even though it is not the highest priority. Within the California spotted owl range, the Strategy uses a 3-level prioritization system (A to C), applied at the population level. See Appendix 3 for more details.

**Priority A:** Actions that should be implemented as soon as possible to prevent barred owls from establishing populations where they are not yet established, particularly in areas where the risk of population establishment is high.

**Priority B:** Actions that should be implemented in the near future to prevent barred owl populations from expanding and establishing populations where they do not currently exist.

**Priority C:** Actions that may be implemented over time and would help to prevent barred owl populations from expanding and establishing populations.

# 9. Potential Impact of the Strategy on Barred Owl Populations

Barred owls currently occur in dense populations in most of the range of the northern spotted owls. Based on data from the densities identified in the Barred Owl Removal Experiment on the areas where barred owls were not removed, the number of territorial barred owls present range from approximately one to three barred owls per 1,000 acres of forest land. This study ended in 2020, and these estimates do not account for the likely increase in barred owls in the southern study areas since that time. The northern study areas may be at carrying capacity and therefore barred owl densities may be stable on these areas. Barred owls are also found in many areas not generally classified as forest, such as suburban parks and neighborhoods, and in the young forests of the Western Washington Lowlands Province. Based on the densities described above, and the acreage of forest land within the range of the northern spotted owl covered by the Strategy, we estimate that there are over 100,000 barred owls currently in the area potentially affected by the Strategy.

Under the Strategy, barred owl management in the northern spotted owl range is limited to 50 percent of total area within the mapped GMAs within each province, between 10 and 25 percent of special designated areas (aside from Management Zones), and additional management within and around spotted owl sites. Not all lands are included in mapped management areas, though spotted owl site management (management of barred owls around spotted owl sites) may occur anywhere in the province. Areas with high density spotted owl habitat were generally included in mapped management areas, leaving the areas outside with lower habitat density. Therefore, we anticipate that spotted owl site management outside of mapped management areas would impact less than 50 percent of the area. Including activities both inside and outside of management areas, we do not expect that more than 50 percent of any one province, with the exception of the California Cascades Province, would likely be subject to active barred owl management at any one time, and in most provinces the percentage would be substantially less. Barred owl management may occur in the entire California Cascades Province, as a potential invasion pathway for the California spotted owl range.

In the California spotted owl range and associated potential invasion pathways, territorial barred owl populations are currently low. The intent of the Strategy is to prevent the establishment of non-native barred owls in the range of the California spotted owl.

Impacts of the Strategy on barred owl populations vary by scale. In the northern spotted owl range, on areas of active barred owl management (spotted owl site or block management area scale), barred owl populations will be reduced. Based on past removal experiments, even in these areas barred owl populations will persist, though at lower levels. In areas outside of active management, barred owl populations will persist and will likely increase, at least in the southern portions of the northern spotted owl range where barred owls have not yet reached carrying capacity. Measurable impacts to barred owl populations may occur at the province scale if management is implemented at the maximum level allowed, though this is unlikely in the early years of implementation. In the California spotted owl range and potential invasion pathways, if we succeed in removing territorial barred owls as they settle, there will be very limited impact on barred owls as populations would not be able to develop. None of the barred owl management activity in this Strategy will affect the native populations of barred owls in eastern North America.

# 10. Summary of the Strategy in the Northern Spotted Owl Range

The following provides an overview of the Strategy components within the northern spotted owl range, first rangewide, and then by physiographic province. These components include 1) spotted owl site management priorities, 2) GMA priorities, and 3) Special Designated Area priorities. For each province, we summarize the focus of barred owl management and highlight any unique considerations for barred owl management in the province. Additional details, including more detailed management recommendations and elements for prioritization of FMA management within GMAs, or other management within special designated areas, may be found in Appendix 4.1 to 4.11.

Site management is a component of the Strategy in every province. Site management around currently occupied sites (sites with spotted owl occupancy or presence detected within the last year) are assigned Priority A in every province. Priority B site management targets sites where spotted owls are likely to be present, or may be present, and is assigned differently in different provinces depending on the status of spotted owl surveys, spotted owl populations, and barred owl populations in each province. Priority C and D site management targets sites that have supported spotted owl occupancy in the past, or may support occupancy in the future, but where spotted owls are less likely to be present now. Table 7 summarizes the prioritization of site management by site condition (see Table 1) in every province.

**Table 7.** Site management prioritization by site condition and province. Priority levels range from the higher, designated by A, to the lower, designated by E.

| Site condition | Olympic Peninsula | Western Washington Lowlands | Western Washington Cascades | Eastern Washington Cascades | Oregon Coast Ranges | Western Oregon Cascades | Eastern Oregon Cascades | Oregon Klamath | California Coast | California Klamath | California Cascades |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Currently active site | A | A | A | A | A | A | A | A | A | A | A |
| Recently active site | A | A | A | A | A | A or B | A | B | B | B | B |
| Historical site, active 5-10 years ago | B | D | B | B | C | C | C | C | C | C | C |
| Historical site, active >10 years ago | C | D | C | C | C | D | C | D | D | D | D |
| Potential site | D | D | D | D | D | D | D | D | D | D | D |

General management areas are mapped in every province except for the Western Washington Lowlands and California Cascades. Each of the remaining provinces has three mapped GMAs, except for the Olympic Peninsula, which has one, and the California Klamath, which has five. Although the management recommendations vary slightly by GMA, all include management of FMAs in large block areas, up to 50 spotted owl pair sites per FMA where possible, and smaller FMAs still encompassing multiple pair areas, where 50 pair areas are not possible. Table 8 lists every GMA by province, along with the prioritization and area of forest lands included in the GMA.

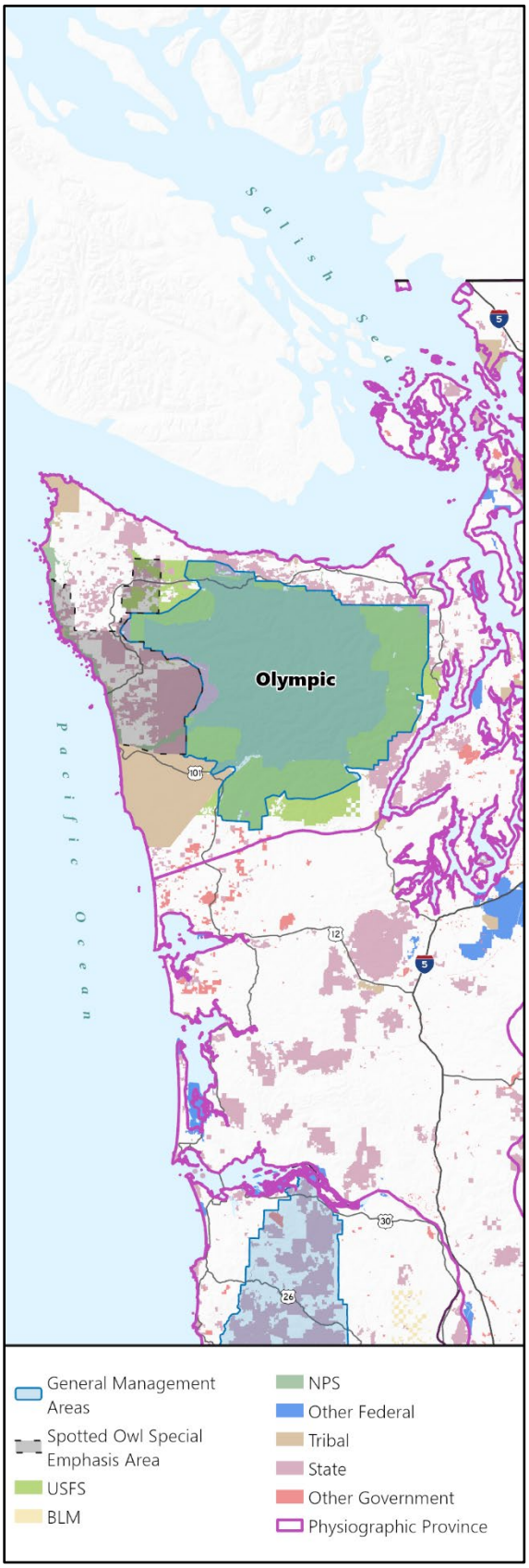
Special designated areas vary by province. Connectivity Areas are mapped in the Western Washington Cascades and Western Oregon Cascades. The Canadian Connector is also mapped in the Western Washington Cascades, and management recommendations for this special designated area largely resemble those for Connectivity Areas. Each Washington province includes SOSEA Special Designated Areas, which include only the portion of each SOSEA that does not fall within another mapped management area. The Marin/Sonoma Management Zone in the California Coast Province and the California Cascades Management Zones have similar management recommendations emphasizing an early detection and rapid response approach that would be inappropriate for other portions of the northern spotted owl range, and additional recommendations for use if this approach cannot be fully implemented and large barred owl populations become established. Table 9 lists each special designated area, along with its prioritization and the area of forested lands included in the special designated area.

**Table 8.** List of GMAs by province, priority, and acreage of forest lands. Priority levels range from the higher, designated by A, to the lower, designated by E.

| Physiographic Province | GMA Name | Priority | Total Forest Area (acres) |
|---|---|---|---|
| Olympic Peninsula | Olympic | A | 1,196,916 |
| Western Washington Cascades | Central WA West Cascades | A | 654,932 |
| | South WA West Cascades | B | 1,101,666 |
| | North WA West Cascades | C | 903,600 |
| Eastern Washington Cascades | Central WA East Cascades | A | 1,094,518 |
| | North WA East Cascades | B | 452,374 |
| | South WA East Cascades | B | 620,797 |
| Oregon Coast Ranges | Central OR Coast Ranges | A | 1,724,822 |
| | North OR Coast Ranges | B | 1,113,268 |
| | South OR Coast Ranges | C | 298,932 |
| Western Oregon Cascades | H.J. Andrews | A | 1,273,146 |
| | South OR West Cascades | B | 1,019,074 |
| | Mount Hood West | C | 464,686 |
| Eastern Oregon Cascades | South OR East Cascades | A | 316,392 |
| | Deschutes | A | 683,834 |
| | Mount Hood East | C | 401,858 |
| Oregon Klamath | North OR Klamath | A | 755,556 |
| | West OR Klamath | B | 660,034 |
| | South OR Klamath | B | 516,220 |
| California Coast | North CA Coast | A | 646,150 |
| | Central CA Coast | B | 813,174 |
| | South CA Coast | B | 972,840 |
| California Klamath | Northwest CA Klamath | A | 797,188 |
| | North CA Klamath | B | 608,764 |
| | Central CA Klamath | B | 1,232,536 |
| | Northeast CA Klamath | C | 1,500,432 |
| | South CA Klamath | C | 866,632 |

**Table 9.** Special designated areas by province, priority, and acreage of forest lands. Priority levels range from the higher, designated by A, to the lower, designated by E.

| Physiographic Province | Special Designated Area Name | Priority | Total Forest Area (acres) |
|---|---|---|---|
| Olympic Peninsula | Olympic Hoh-Clearwater SOSEA | E | 359,408 |
| Western Washington Cascades | Canadian Connector | D | 745,180 |
| | Central Connectivity Area WA Cascades West | D | 269,240 |
| | Finney Block SOSEA | E | 58,504 |
| | Mineral Block SOSEA | E | 105,056 |
| | Mineral Link SOSEA | E | 155,876 |
| | Columbia Gorge SOSEA | E | 31,772 |
| Eastern Washington Cascades | White Salmon SOSEA | E | 34,090 |
| Western Oregon Cascades | Santiam Connectivity Area | D | 507,260 |
| | Calapooya Connectivity Area | D | 986,012 |
| | Cascade-Siskiyou Connectivity Area | D | 196,944 |
| California Coast | Marin/Sonoma Management Zone | A | 587,434 |
| California Cascades | South California Cascades Management Zone | A | 732,339 |
| | Central California Cascades Management Zone | C | 409,840 |
| | North California Cascades Management Zone | C | 139,642 |

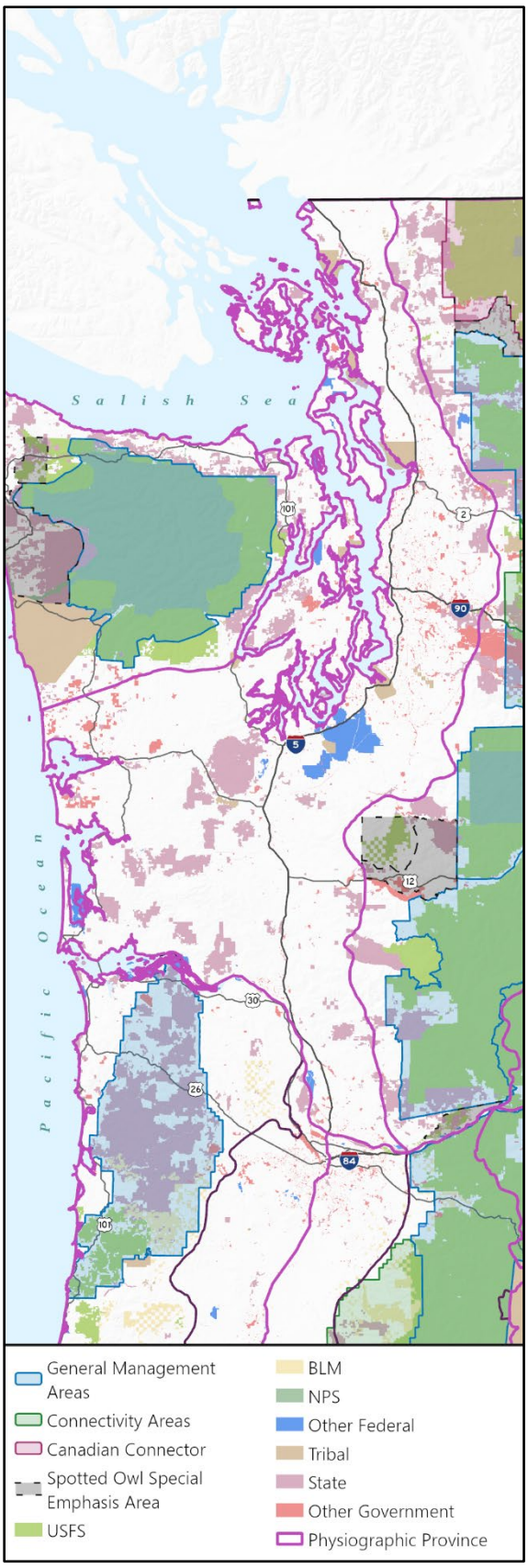



## 10.1 Olympic Peninsula Province

Spotted owl populations in the mountainous Olympic Peninsula Province are small and isolated from spotted owl populations in other provinces. The remaining spotted owls in this province are generally located in marginal habitat at high elevations, where barred owl densities tend to be lower. The landscape of the Olympic Peninsula is primarily managed by Olympic National Park and Olympic National Forest, with substantial State, Tribal, and private lands in the western portion of the province. The Strategy in this province includes site management, one GMA, and one SOSEA Special Designated Area.

Site management in this province is primarily intended to protect the limited number of remaining spotted owls, in order to prevent extirpation in this province. Because many areas have not been surveyed consistently in recent years, we recommend that historical sites, particularly those active regularly over the past 10 years, be surveyed for activity. More detailed background and site management recommendations are listed in Appendix 4.1.B.1.

The Olympic General Management Area, a Priority A GMA, includes most concentrations of high-quality nesting and roosting habitat in the province, and all recent known spotted owl detections in the province. The Olympic Demography Study Area, which largely overlaps the GMA, provides long-term data and ongoing monitoring information, which are expected to support rapid implementation of effective barred owl management and increase the efficiency of effectiveness monitoring. Accessibility may be a challenge in parts of this GMA, especially since current known spotted owl sites are generally located at higher elevations farther from roads. Unvegetated ridgelines in this GMA may provide natural barriers, which may allow for barred owl removal to progress from the upper end of a drainage toward lower elevations, with an eventual focus on excluding barred owls from entering the drainage rather than needing to conduct removals



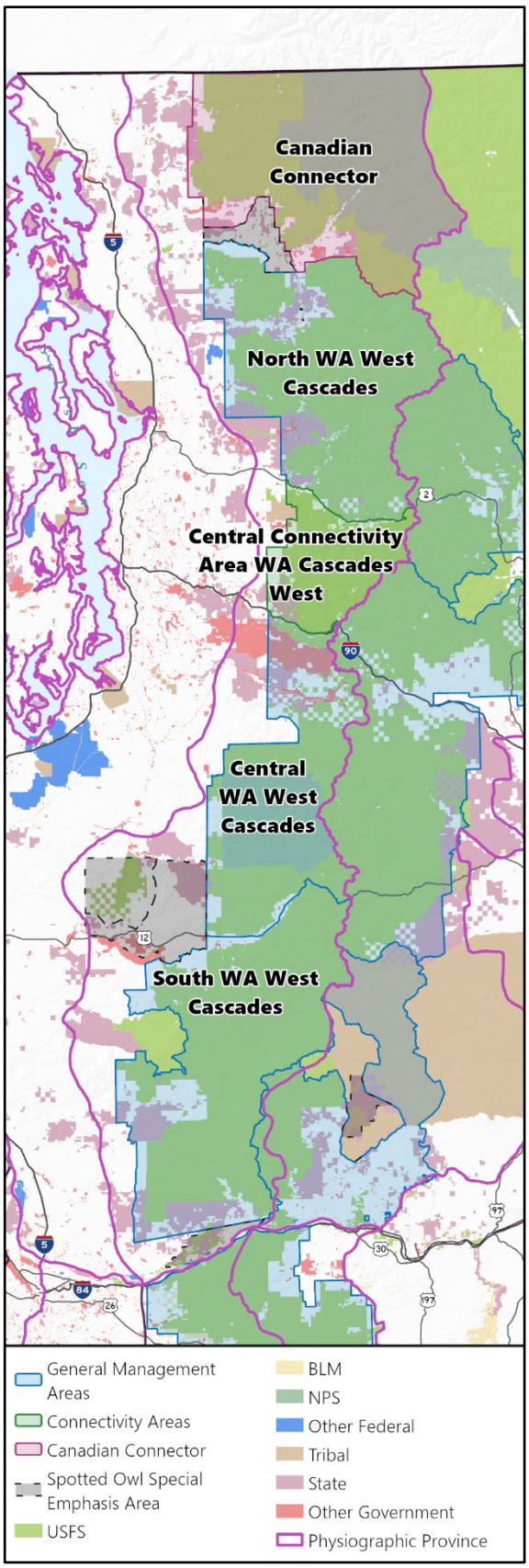

throughout a whole watershed every year. More detailed management recommendations for the GMA are listed in Appendix 4.1.B.2.a.

The Hoh-Clearwater SOSEA Special Designated Area is assigned Priority E, and includes those parts of the Hoh-Clearwater SOSEA that are outside of the Olympic GMA. It includes a large part of the Olympic Experimental State Forest and much of the coastal strip of Olympic National Park. Management within the SOSEA Special Designated Area may include site management or other approaches to barred owl removal that would best support spotted owl populations in the province. More detailed management recommendations for the SOSEA Special Designated Area are listed in Appendix 4.1.B.2.b.

## 10.2 Western Washington Lowlands Province

The landscape of the Western Washington Lowlands Province consists largely of developed areas, agriculture, and industrial timberlands, with the small amount of remaining spotted owl habitat widely scattered. We do not expect that functional spotted owl populations are present in this province, but individual spotted owls may be present here, especially in parts of the province that contain some remaining spotted owl habitat. The Strategy in this province includes only site management.

Site management in this province is primarily intended to protect spotted owls where and when they are present. This will help to preserve options for these individual spotted owls to contribute to the conservation of the subspecies. For example, if future decisions are made to pursue population augmentation through translocation or captive breeding, spotted owls that have dispersed into this province may be part of the source population for these augmentation actions, and barred owl management could be conducted to protect these individuals until they can be moved. More detailed background and site management recommendations are listed in Appendix 4.2.B.




## 10.3. Western Washington Cascades Province

Spotted owl populations in the Western Washington Cascades Province appear to be critically small. We know of only two spotted owl sites that remain occupied, both by single individuals. Survey effort has been low in this province, and we expect that some other spotted owls remain, but their distribution is unknown. The northern portion of this province is extremely rugged, with spotted owl habitat confined to valley bottoms, while the southern portion of the province is topographically gentler, with larger, more continuous blocks of spotted owl habitat. The Mount Baker-Snoqualmie and Gifford Pinchot National Forests, along with Mount Rainier National Park, manage the bulk of the landscape of this province, but State and private lands are also important in portions of the province. The Strategy in this province includes site management, three GMAs, the Canadian Connector, a Connectivity Area, and four SOSEA Special Designated Areas.

Site management in this province is primarily intended to protect the limited number of remaining spotted owls, in order to prevent extirpation in this province. Because many areas have not been surveyed consistently in recent years, we recommend that historical sites, particularly those active within the past 10 years, be surveyed for activity. More detailed background and site management recommendations are listed in Appendix 4.3.B.

The Central Washington West Cascades General Management Area, a Priority A GMA, includes the remaining known current spotted owl sites in the province. Spotted owl habitat here is well-connected with spotted owl habitat and other management areas to the south, east, and north. The Rainier Demography Study Area, which largely overlaps the GMA, provides long-term data and ongoing monitoring information, which are expected to support rapid implementation of effective barred owl management and increase the efficiency of effectiveness monitoring.

Unvegetated ridgelines in this GMA may provide natural barriers, which may allow for barred owl removal to progress from the upper end of a drainage toward lower elevations, with an eventual focus on excluding barred owls from entering the drainage rather than needing to conduct removals throughout a whole watershed every year.

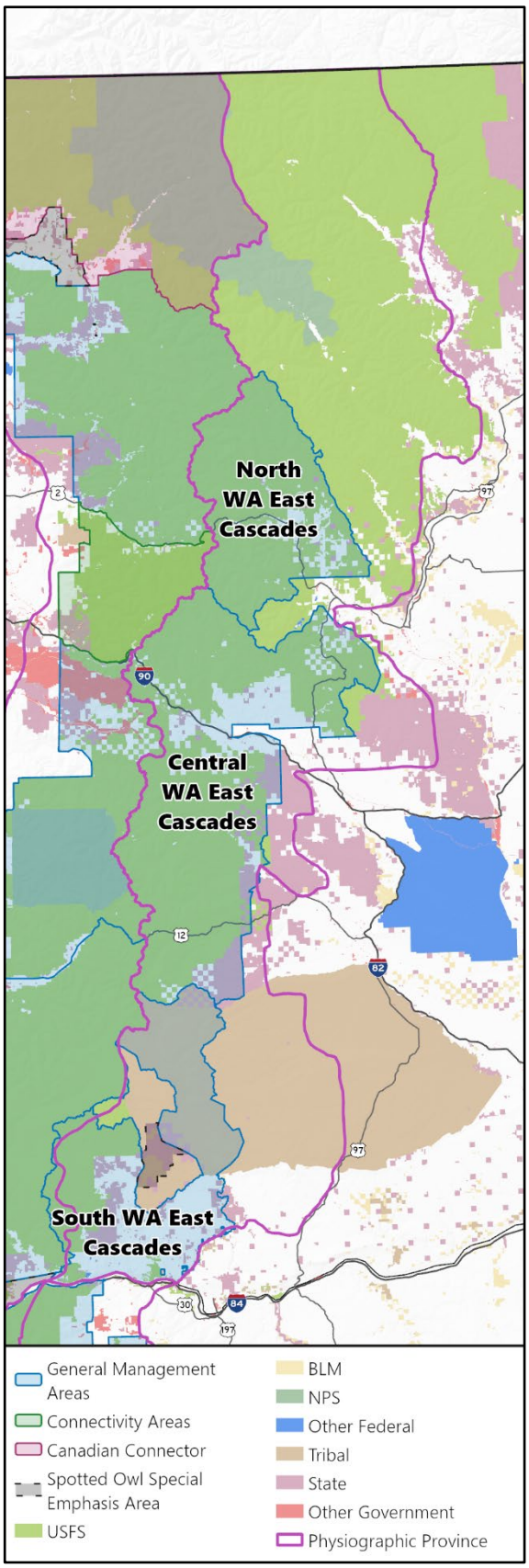
The South Washington West Cascades General Management Area, a Priority B GMA, includes large areas of well-connected habitat. Spotted owl habitat here is well-connected with spotted owl habitat and other management areas to the north and east. Because survey effort here has been low in recent years, and current spotted owl presence and distribution are unknown, it will be important to conduct additional surveys here to inform the location of FMAs so that they can effectively support spotted owl individuals and populations.

The North Washington West Cascades General Management Area, a Priority C GMA, includes large areas of fjord-like habitat. Spotted owl habitat here is connected with spotted owl habitat and other management areas to the north, east, and south. Because survey effort here has been low in recent years, and current spotted owl presence and distribution are unknown, it will be important to conduct additional surveys here to inform the location of FMAs so that they can effectively support spotted owl individuals and populations. Unvegetated ridgelines in this GMA may provide natural barriers, which may allow for barred owl removal to progress from the upper end of a drainage toward lower elevations, with an eventual focus on excluding barred owls from entering the drainage rather than needing to conduct removals throughout a whole watershed every year.

The Canadian Connector, a priority D special designated area, is located in the northern portion of the province along the Canadian border. Its primary purpose is to support Canadian spotted owl reintroduction efforts. Additionally, management recommendations similar to those for Connectivity Areas would be appropriate here. Unvegetated ridgelines in the Canadian Connector may provide natural barriers, which may allow for barred owl removal to progress from the upper end of a drainage toward lower elevations, with an eventual focus on excluding barred owls from entering the drainage rather than needing to conduct removals throughout a whole watershed every year.

The Central Connectivity Area Washington Cascades West, a priority D special designated area, is located between the North and Central Washington West Cascades GMAs. Management recommendations here are intended to promote demographic connections between the four neighboring GMAs including two in the Western Washington Cascades and two in the Eastern Washington Cascades. Unvegetated ridgelines in this Connectivity Area may provide natural barriers, which may allow for barred owl removal to progress from the upper end of a drainage toward lower elevations, with an eventual focus on excluding barred owls from entering the drainage rather than needing to conduct removals throughout a whole watershed every year.

The Finney Block SOSEA Special Designated Area includes those parts of the Finney Block SOSEA that are outside of the North Washington West Cascades GMA and Canadian Connector. The Mineral Link SOSEA Special Designated Area includes those parts of the Mineral Link SOSEA that are outside of the Central and South Washington West Cascades GMAs. The Columbia Gorge SOSEA Special Designated Area includes those parts of the Columbia Gorge SOSEA that are outside of the South Washington West Cascades GMA. The Mineral Block




SOSEA Special Designated Area includes the entire Mineral Block SOSEA. All are assigned Priority E. Management within the SOSEA Special Designated Areas may include site management or other approaches to barred owl removal that would best support spotted owl populations in the province.

More detailed management recommendations are listed for each GMA in Appendix 4.3.B.2.a, and for the special designated areas in Appendix 4.3.B.2.b.

## 10.4. Eastern Washington Cascades Province

Spotted owl populations in the Eastern Washington Cascades Province are critically small. Spotted owl habitat in the north has historically been naturally fragmented by steep topography, but has also suffered disproportionate habitat loss to wildfire and other forest disturbances. Habitat losses have also occurred in the remainder of the province. The Okanogan-Wenatchee and Gifford Pinchot National Forests, along with the Yakama Nation, manage the bulk of the landscape of this province, but State and private lands are also important in portions of the province. The Strategy in this province includes site management, three GMAs, and a SOSEA Special Designated Area.

Site management in this province is primarily intended to protect the limited number of remaining spotted owls, in order to prevent extirpation in this province. Because some areas have not been surveyed consistently in recent years, we recommend that historical sites, particularly those that have regularly been active within the past 10 years, be surveyed for activity. Where spotted owls remain present in the northern portion of the province, where there are no mapped management areas, long-term site management of clusters of sites would be appropriate. More detailed background and site management recommendations are listed in Appendix 4.4.B.

The Central Washington East Cascades General Management Area, a Priority A GMA, includes the largest number of remaining known current spotted owl sites, including pair sites, in the province. Spotted owl habitat here is connected with spotted owl habitat and other management areas to the south, west, and north. The Cle Elum Demography Study Area, which largely overlaps the GMA, provides long-term data and ongoing monitoring information, which are expected to support rapid implementation of effective barred owl management and increase the efficiency of effectiveness monitoring. Experimental barred owl removal was previously conducted in a portion of this study area and provided benefits to the spotted owl population in the removal areas.

The North Washington West Cascades General Management Area, a Priority B GMA, includes current spotted owl sites and concentrations of habitat. Spotted owl habitat here is connected with spotted owl habitat and other management areas to the west and south. Unvegetated ridgelines in this GMA may provide natural barriers, which may allow for barred owl removal to progress from the upper end of a drainage toward lower elevations, with an eventual focus on excluding barred owls from entering the drainage rather than needing to conduct removals throughout a whole watershed every year.

The South Washington East Cascades General Management Area, a Priority B GMA, includes current spotted owl sites, including pair sites on the Yakama Nation Reservation, and concentrations of habitat. Spotted owl habitat here is connected with spotted owl habitat and other management areas to the north and west. Although it is not clear to what extent spotted owls may disperse across the Columbia River, this area provides the best opportunity for such dispersal. Because survey effort has been low in recent years in parts of this area, it will be important to conduct additional surveys here to inform the location of FMAs so that they can effectively support spotted owl individuals and populations.

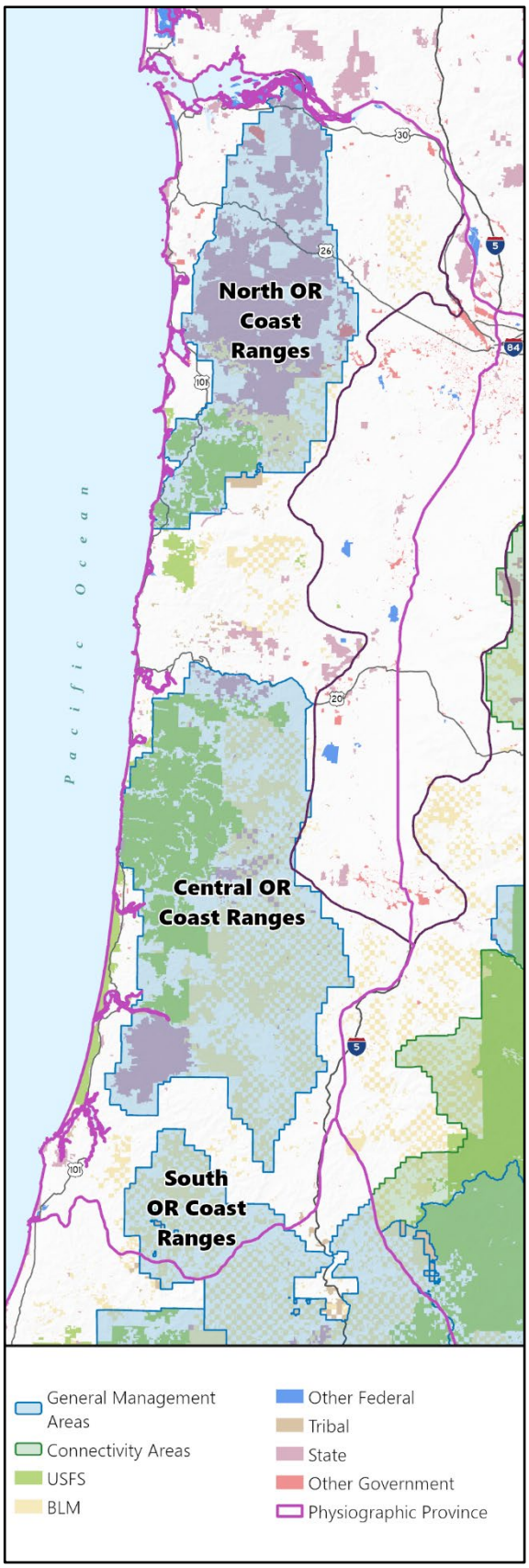
The White Salmon SOSEA Special Designated Area includes those parts of the White Salmon SOSEA that are outside of the South Washington East Cascades GMA. It is assigned Priority E. Management within the SOSEA Special Designated Area may include site management or other approaches to barred owl removal that would best support spotted owl populations in the province.

More detailed management recommendations are listed for each GMA in Appendix 4.4.B.2.a, and for the SOSEA special designated area in Appendix 4.4.B.2.b.

## 10.5 Oregon Coast Ranges Province

Spotted owl populations in the Oregon Coast Ranges Province are declining rapidly and are highly stressed by large, dense barred owl populations. Extensive spotted owl habitat losses to fire and harvest began nearly 200 years ago, but spotted owl habitat is beginning to recover in portions of the province. Private lands are extensive in this province, but most spotted owl habitat is found on the Siuslaw National Forest, BLM lands, and State lands including the Clatsop and Tillamook State Forests and Elliott State Research Forest. The Strategy in this province includes site management and three GMAs.

Site management in this province is primarily intended to protect the limited number of remaining spotted owls, in order to prevent extirpation in this province. Many portions of the province are well-surveyed, but in those areas where recent surveys are lacking, we recommend




that historical sites, particularly those that have been active within the past 10 years, be surveyed for activity. More detailed background and site management recommendations are listed in Appendix 4.5.B.

The Central Oregon Coast Ranges General Management Area, a Priority A GMA, includes the largest concentration of high-quality spotted owl habitat in the province. The Coast Ranges Demography Study Area and the Tyee Demography Study Area, which both largely overlap the GMA, provide long-term data and ongoing monitoring information, which are expected to support rapid implementation of effective barred owl management and increase the efficiency of effectiveness monitoring. Experimental barred owl removal was previously conducted in a portion of the Coast Ranges study area and provided benefits to the spotted owl population in the removal areas. This GMA also includes the Elliott State Research Forest, where an HCP in development proposes to use barred owl management to as a conservation measure.

The North Oregon Coast Ranges General Management Area, a Priority B GMA, encompasses a well-surveyed and accessible landscape where spotted owls persist in spite of high barred owl pressure and currently marginal habitat conditions, though some habitat here is recovering and increasing in value over time. This GMA includes large areas of State lands, where an HCP in development could use barred owl management and habitat development to offset unavoidable adverse effects of forest management to spotted owls.

The South Oregon Coast Ranges General Management Area, a Priority C GMA, consists of a largely checkerboard landscape where habitat is heavily concentrated on BLM lands. Spotted owl habitat here is well-connected with spotted owl habitat and other management areas to the south, in the Oregon Klamath Province. This area currently provides the best connectivity between the Oregon Coast Ranges and the rest of the northern spotted owl range.

More detailed management recommendations are listed for each GMA in Appendix 4.5.B.2.a.

## 10.6 Western Oregon Cascades Province

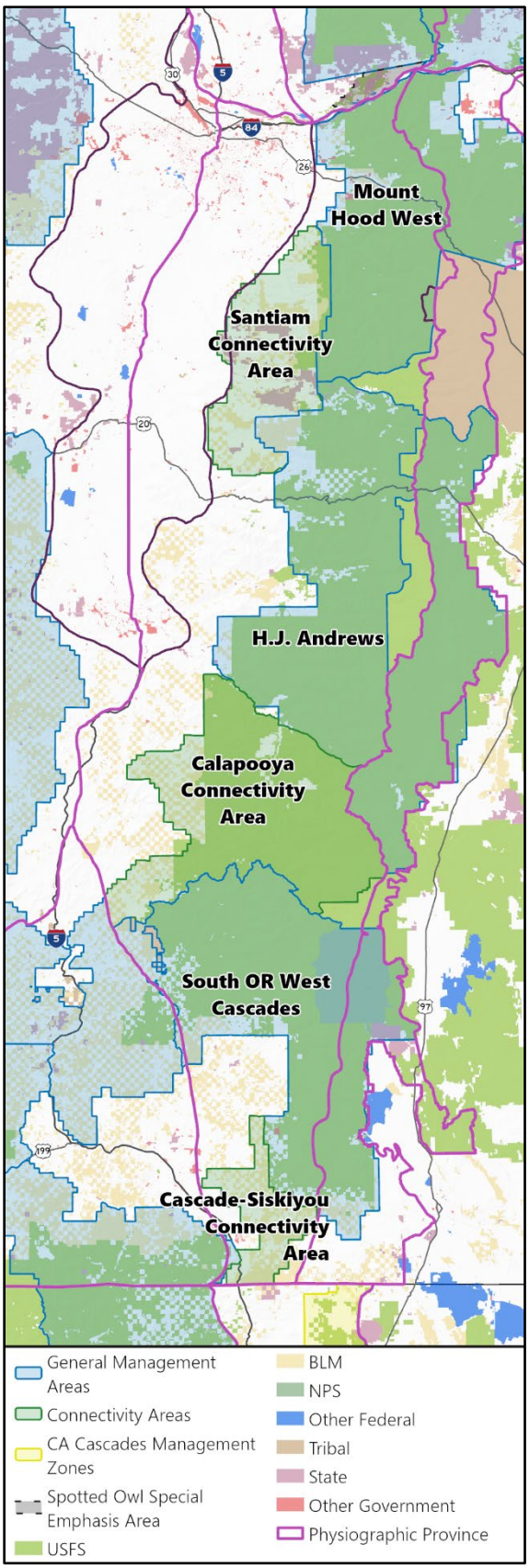
Spotted owl populations in the Western Oregon Cascades Province appear to follow a gradient, with unknown, likely very small, populations in the north and better surveyed, more robust, though still declining, populations in the south. The central portion of the province contains dense concentrations of spotted owl habitat, and population decline in the central area has until recently appeared to be more in line with the more robust southern populations, but the most recent data may indicate a sharp decline there. The Mount Hood, Willamette, Umpqua, and Rogue River-Siskiyou National Forests manage most of the mid- and upper elevations of this landscape of this province, with BLM lands and private lands more common at lower elevations. The Strategy in this province includes site management, three GMAs, and three Connectivity Areas.

Site management in this province is intended to slow population declines, preventing extirpation particularly in then northern portion of the province, and to secure key areas for the future development of block management. Because many areas have not been surveyed consistently in recent years, especially in the northern portion of the province, we recommend that historical sites be surveyed for activity, with emphasis on those with known spotted owl activity within the last ten years. More detailed background and site management recommendations are listed in Appendix 4.6.B.

The H.J. Andrews General Management Area, a Priority A GMA, includes dense concentrations of habitat in the central portion of the province. Spotted owl habitat here is well-connected with spotted owl habitat and other management areas to the south. There is some connectivity to spotted owl habitat and other management areas to the north and east, but this connectivity is disrupted by recently burned areas and high elevations. The H.J. Andrews Study Area, which is mostly included within the GMA, provides long-term data and ongoing monitoring information, which are expected to support rapid implementation of effective barred owl management and increase the efficiency of effectiveness monitoring. Data from the study area indicate the possibility of a recent acceleration of population declines here, but this area also appears to have great potential for recovery if barred owl populations can be controlled.

The South Oregon West Cascades General Management Area, a Priority B GMA, includes large areas of well-connected habitat. It includes the western portion of Crater Lake National Park in addition to Forest Service, BLM, and private lands. It provides for connectivity between the Oregon Klamath and Eastern Oregon Cascades Provinces, as well as north-south connectivity within the Western Oregon Cascades Province. The South Cascades Demography Study Area, which overlaps the GMA, provides long-term data and ongoing monitoring information, which are expected to support rapid implementation of effective barred owl management and increase the efficiency of effectiveness monitoring.

The Mount Hood West General Management Area, a Priority C GMA, includes large areas of well-connected habitat. Spotted owl habitat here is connected with spotted owl habitat and other management areas to the east. There is some connectivity to spotted owl habitat and other management areas to the west and south, but this connectivity is disrupted by recently burned areas. Because survey effort here has been low in recent years, and current spotted owl presence



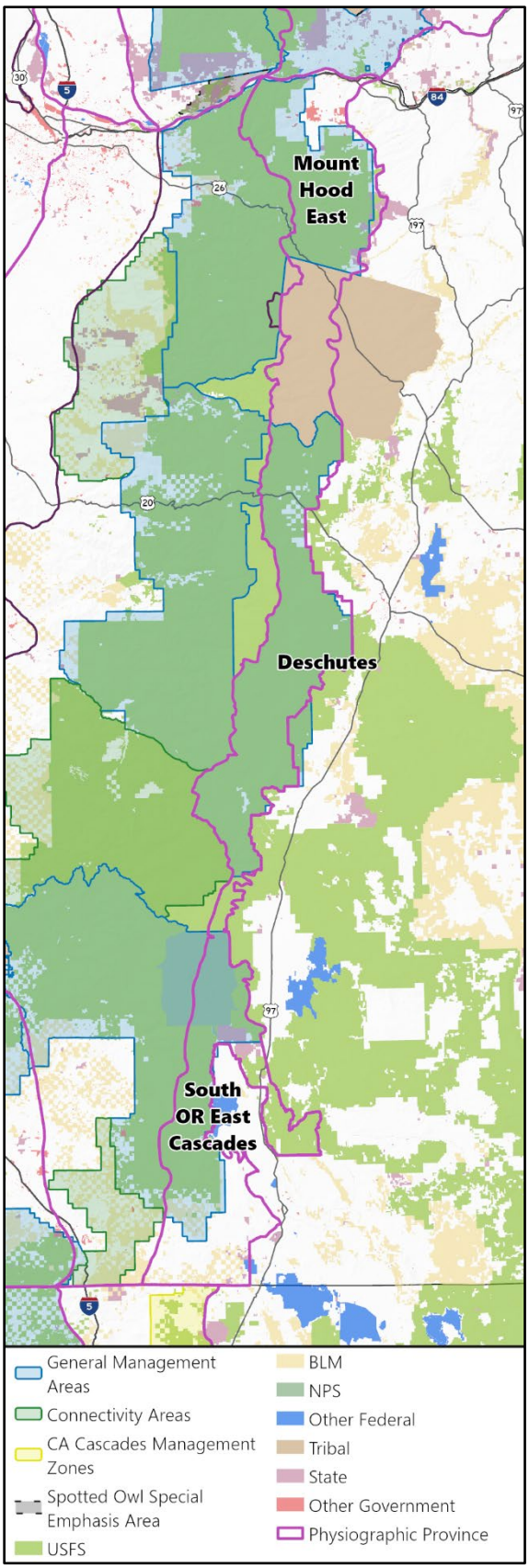

and distribution are unknown, it will be important to conduct additional surveys here to inform the location of FMAs so that they can effectively support spotted owl individuals and populations.

The Santiam Connectivity Area, a priority D Connectivity Area, is located along the western boundaries of the Mount Hood West and H.J. Andrews GMAs. This connectivity area is intended to provide a low-elevation pathway to connect spotted owl populations that may develop in the northern and central portions of the range, since connectivity at middle and high elevations was disrupted by large, severe recent fires. It includes the Santiam State Forest, where an HCP in development could use barred owl management and habitat development to offset unavoidable adverse effects of forest management to spotted owls.

The Calapooya Connectivity Area, a priority D Connectivity Area, is situated between the H.J. Andrews, Deschutes, South Oregon West Cascades, and North Oregon Klamath GMAs. This connectivity area is intended to facilitate demographic connections among spotted owl populations that may develop in the surrounding GMAs.

The Cascade-Siskiyou Connectivity Area, a priority D Connectivity Area, includes the spotted owl habitat between the South Oregon West Cascades and South Oregon Klamath GMAs. It is also located near, but not directly adjacent to, the South Oregon East Cascades and North California Klamath GMA, as well as spotted owl habitat within the California Cascades Province. This connectivity area is intended to provide demographic connections among spotted owl populations that may develop in all of these nearby areas.

More detailed management recommendations are listed for each GMA in Appendix 4.6.B.2.a, and for the Connectivity Areas in Appendix 4.6.B.2.b.




## 10.7 Eastern Oregon Cascades Province

Spotted owl populations in the Eastern Oregon Cascades Province are small and have been affected, especially in the central portion of the province, by recent habitat loss due to fires and other habitat disturbances. The landscape here is managed primarily by the Mount Hood, Deschutes, and Fremont-Winema National Forests. The Warm Springs Reservation, Crater Lake National Park, BLM, and private lands are also important in portions of the province. The Strategy in this province includes site management and three GMAs.

Site management in this province is primarily intended to protect the limited number of remaining spotted owls, in order to prevent extirpation in this province. Because many portions of the province lack recent surveys, we recommend that historical sites, particularly those that have been active within the past 10 years, be surveyed for activity. On the Ya Whee Plateau, where there are no mapped management areas, long-term site management of clusters of sites would be appropriate. More detailed background and site management recommendations are listed in Appendix 4.7.B.

The Deschutes General Management Area, a Priority A GMA, appears to include the largest number of remaining spotted owls in the province. A relatively high recent survey effort here, as compared with other areas outside of study areas, could support immediate implementation of barred owl management where it would be most effective in protecting many of the remaining spotted owls in the province. There are areas of habitat connectivity to management areas in the Western Oregon Cascades Province. Habitat is highly fragmented here, so we expect FMA development in this GMA to focus on creating well-connected small blocks or clusters of sites, rather than large block management areas.

The South Oregon East Cascades General Management Area, a Priority A GMA, includes

concentrations of high-quality nesting and roosting habitat and known recent spotted owl presence. It includes the eastern portion of Crater Lake National Park and a portion of Sun Pass State Forest, in addition to Forest Service, BLM, and private lands. It provides for good connectivity to the Western Oregon Cascades Province, and from there, to the rest of the subspecies range. The South Cascades Demography Study Area, which overlaps the GMA, provides long-term data and ongoing monitoring information, which are expected to support rapid implementation of effective barred owl management and increase the efficiency of effectiveness monitoring.

The Mount Hood East General Management Area, a Priority C GMA, includes a single known current spotted owl site, in spite of apparently good habitat conditions. It includes the largest concentrations of habitat in the province, and spotted owl habitat here is well-connected with spotted owl habitat and other management areas to the west, in the Western Oregon Cascades Province. Although it is not clear to what extent spotted owls may disperse across the Columbia River, this area provides the best opportunity for such dispersal. Because recent survey effort here has been low in recent years, and only one current spotted owl site is known in this GMA, it will be important to conduct additional surveys here to inform the location of FMAs so that they can effectively support spotted owl individuals and populations. Although FMA management will be important here in the long term, site management at current and recent spotted owl sites may be sufficient in the short term.

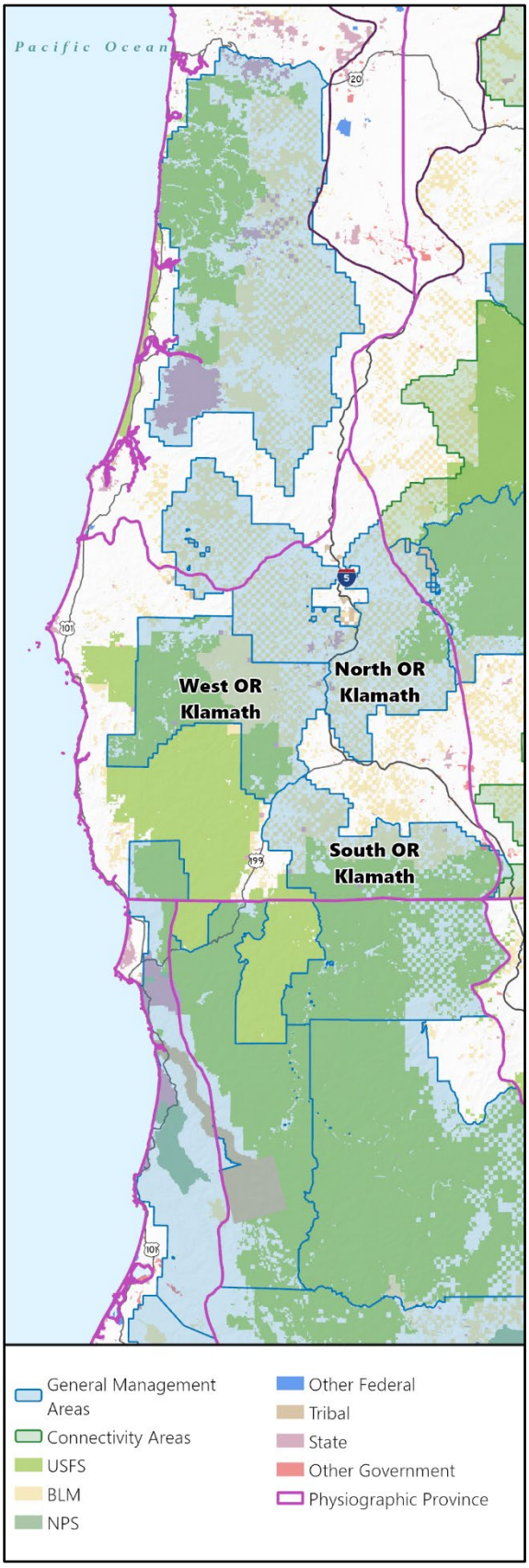
More detailed management recommendations are listed for each GMA in Appendix 4.7.B.2.a.

## 10.8 Oregon Klamath Province

Spotted owl populations in the Oregon Klamath Province are relatively robust, though still declining. Much of the landscape in the north and east of this province consists of BLM checkerboard with private lands. In the west and south, the landscape includes more continuous blocks of the Rogue River-Siskiyou National Forest, along with small areas of other National Forests, and BLM lands. The Strategy in this province includes site management and three GMAs.

Site management in this province is primarily intended to maintain the current spotted owl population to maximize the potential for recruitment and population expansion. In areas of the province that have not been surveyed consistently in recent years, we recommend that historical sites, particularly those that have been active within the past 10 years, be surveyed for activity. More detailed background and site management recommendations are listed in Appendix 4.8.B.

The North Oregon Klamath General Management Area, a Priority A GMA, includes large concentrations of habitat within a checkerboard landscape. The Klamath Demography Study Area, which is largely included within the GMA, provides long-term data and ongoing monitoring information, which are expected to support rapid implementation of effective barred owl management and increase the efficiency of effectiveness monitoring. Experimental barred owl removal was previously conducted in the Union-Myrtle study area, also within the GMA, and provided benefits to the spotted owl population in the removal areas. This GMA provides connectivity with habitat and management areas within the province, and in the Oregon Coast Ranges and Western Oregon Cascades Provinces.




The West Oregon Klamath General Management Area, a Priority B GMA, includes large concentrations of habitat on more continuous Federal lands. This GMA provides connectivity within the province, making up a key part of the habitat connecting the northern and southern portions of the northern spotted owl range.

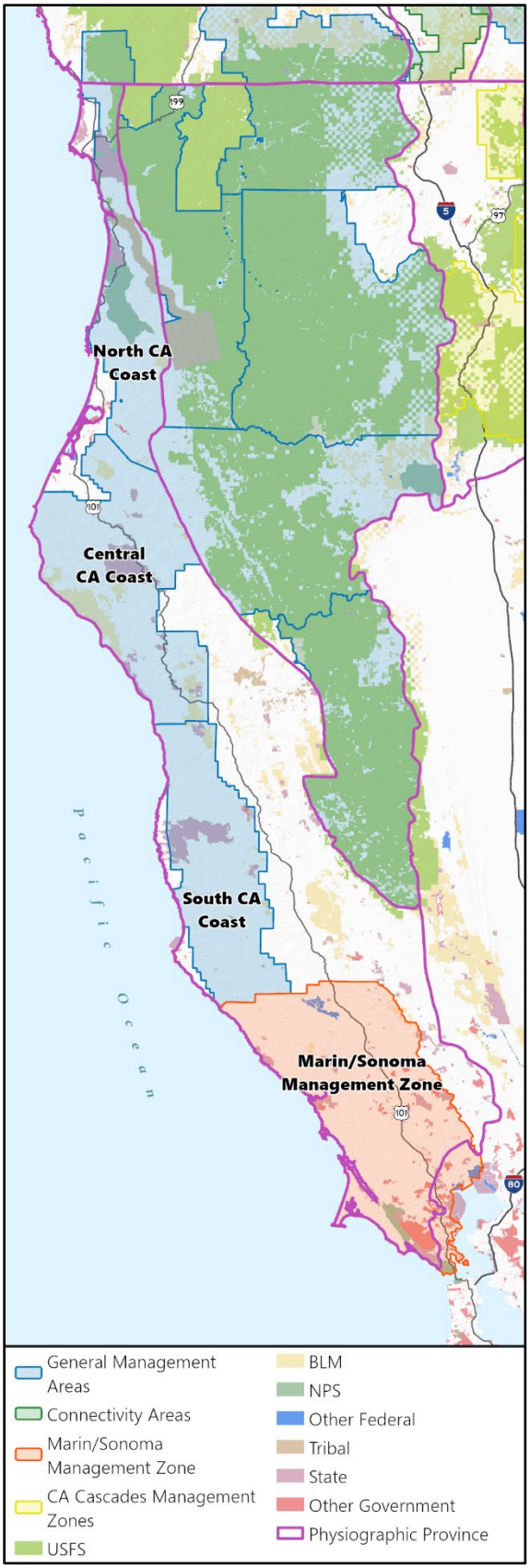
The South Oregon Klamath General Management Area, a Priority B GMA, includes large concentrations of habitat along the California border, and spotted owl habitat here is well-connected with spotted owl habitat and other management areas to the north, within the province, and to the south, in the California Klamath Province, with additional connections to a management area the east, in the Western Oregon Cascades Province, and to habitat within the California Cascades Province.

More detailed management recommendations are listed for each GMA in Appendix 4.8.B.2.a.

## 10.9 California Coast Province

Spotted owl and barred owl populations in the California Coast Province appear to follow a gradient, larger barred owl populations in the north causing some local extirpations of spotted owl populations, and few barred owls in the south, allowing for a relatively stable, though isolated, spotted owl population in Marin County. Private land is predominant in this province, with relatively small amounts of Federal and State lands. Two private land managers within this province operate under HCPs that include barred owl removal research. Barred owl removal research is also being conducted in this province by the Yurok Tribe and the University of Wisconsin. The Strategy in this province includes site management, three GMAs, and a special designated area.

Site management in this province is primarily intended to maintain the current spotted owl population to maximize the potential for recruitment and population expansion. In any areas of the province that have not been surveyed




consistently in recent years, we recommend that historical sites, particularly those that have been active within the past 10 years, be surveyed for activity. More detailed background and site management recommendations are listed in Appendix 4.9.B.

The North California Coast General Management Area, a Priority A GMA, includes large concentrations of habitat and is well connected with habitat and management areas in the California Klamath Province to the east. Although spotted owl populations in this GMA have been greatly impacted by barred owls, it retains good potential for recovery. The Green Diamond Demography Study Area, which is largely included within the GMA, provides long-term data and ongoing monitoring information, which are expected to support rapid implementation of effective barred owl management and increase the efficiency of effectiveness monitoring. Experimental barred owl removal is ongoing in several areas within this GMA, including the Yurok Reservation, Green Diamond Resource Company lands managed under their HCP, Six Rivers National Forest, Redwood National Parks, and Prairie Creek State Park. The beneficial effects to spotted owls from these efforts could easily be continued or augmented with barred owl management under the Strategy.

The Central California Coast General Management Area, a Priority B GMA, also includes large concentrations of habitat, but a smaller amount of public lands. Experimental barred owl removal is ongoing in several areas within this GMA, including on BLM lands in the Headwaters Forest Reserve and the King Range National Conservation Area, and on or near Sierra Pacific Industries lands as part of their HCP. The beneficial effects to spotted owls from these efforts could easily be continued or augmented with barred owl management under the Strategy.

The Central California Coast General Management Area, a Priority B GMA, also includes large concentrations of habitat, but a smaller amount of public lands. Experimental barred owl removal is

ongoing in several areas within this GMA, on the Jackson State Forest and Mendocino State Parks. The beneficial effects to spotted owls from these efforts could easily be continued or augmented with barred owl management under the Strategy.

The Marin/Sonoma Management Zone is an area with more fragmented habitat, smaller populations of barred owls, and a stable, but isolated spotted owl population. Due in part to previous barred owl removal research, the barred owl population here is small enough that an early detection, rapid response management paradigm is appropriate. Therefore, we recommend monitoring and removal of all barred owls detected on the lands of willing landowners and land managers. This will allow for the best protection of the spotted owl population here while also minimizing the number of barred owls that must be removed. This Management Zone is assigned Priority A. In case this management approach cannot be fully carried out, and barred owl populations increase, we also include management recommendations that resemble those for GMAs elsewhere in the range.

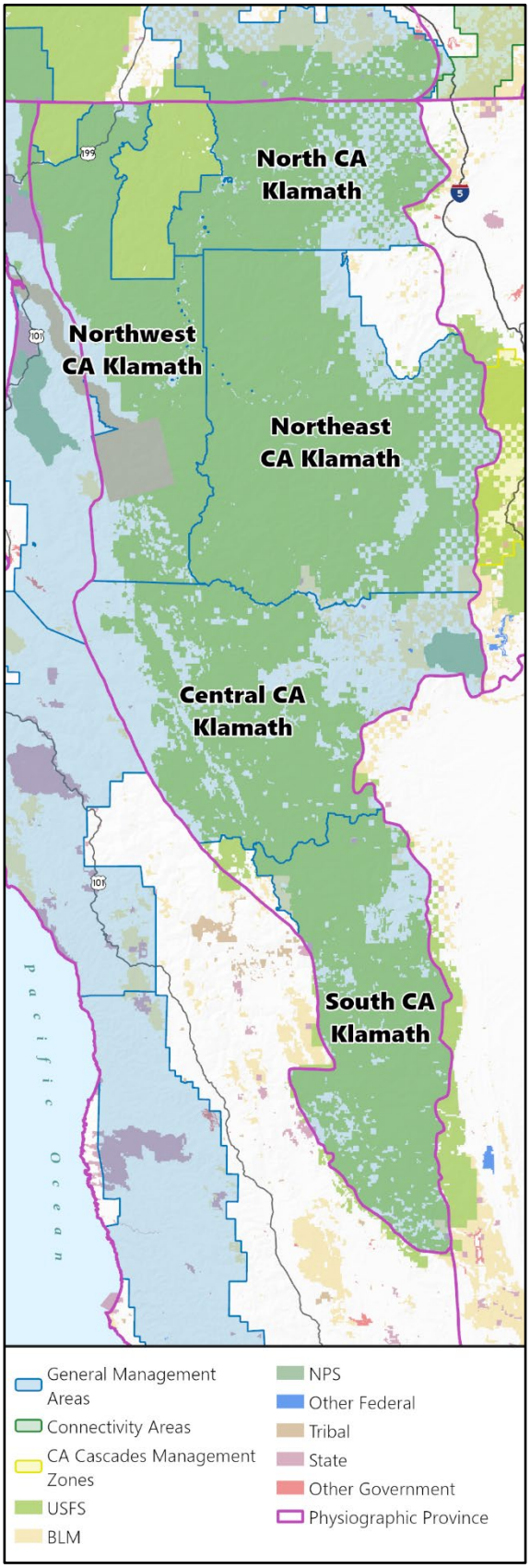
More detailed management recommendations are listed for each GMA in Appendix 4.9.B.2.a, and for the Management Zone in Appendix 4.4.B.2.b.

## 10.10 California Klamath Province

Spotted owl populations in the California Klamath Province are relatively robust, though still declining. Spotted owl populations in this province have a very high potential for recovery, and if it recovers, can act as a source population for other provinces. Much of the landscape is managed primarily by the Six Rivers, Klamath, Shasta-Trinity, and Mendocino National Forests. Other Federal lands, including BLM and National Park Service lands, Tribal lands, and private lands are important in some areas. Two private land managers within this province operate under HCPs that include barred owl removal research. Barred owl removal research is also being conducted in this province by the Hoopa Valley Tribe, the Yurok Tribe, and the University of Wisconsin. The Strategy in this province includes site management and five GMAs.

Site management in this province is primarily intended to maintain the current spotted owl population to maximize the potential for recruitment and population expansion. In areas of the province that have not been surveyed consistently in recent years, we recommend that historical sites, particularly those that have been active within the past 10 years, be surveyed for activity. More detailed background and site management recommendations are listed in Appendix 4.8.B.

The Northwest California Klamath General Management Area, a Priority A GMA, includes large concentrations of habitat and is well connected with habitat and management areas in the California Coast Province to the west. The Northwest California Demography Study Area, which overlaps the GMA, provides long-term data and ongoing monitoring information, which are expected to support rapid implementation of effective barred owl management and increase the efficiency of effectiveness monitoring. Experimental barred owl removal is ongoing on the Hoopa Valley study area, also within the GMA, and provides benefits to the spotted owl population. Barred owl removal research is also ongoing on the Yurok Reservation, the Six Rivers National Forest, and Green Diamond Resource Company lands managed under their HCP. The beneficial effects to spotted owls from these efforts could easily be continued or augmented with barred owl management under the Strategy.




The North California Klamath General Management Area, a Priority B GMA, includes concentrations of spotted owl habitat, but has also been affected by extensive recent habitat loss to fire. Habitat in this GMA is well connected to habitat and management areas to the south within the province, and to the north in the Oregon Klamath Province. Habitat in this GMA is also connected to habitat in the California Cascades Province.

The Central California Klamath General Management Area, a Priority B GMA, includes concentrations of habitat, but has also been affected by extensive habitat loss to fire. Habitat in this GMA is well-connected with spotted owl habitat and other management areas to the north, within the province, and to the west, in the California Coast Province. The Northwest California Demography Study Area, which overlaps the GMA, provides long-term data and ongoing monitoring information, which are expected to support rapid implementation of effective barred owl management and increase the efficiency of effectiveness monitoring. Barred owl removal research is currently ongoing in this GMA on Green Diamond Resource Company and Sierra Pacific Industries lands managed under their respective HCPs. The beneficial effects to spotted owls from these efforts could easily be augmented with barred owl management under the Strategy.

The Northeast California Klamath General Management Area, a Priority C GMA, includes concentrations of habitat, but has also been affected by extensive habitat loss to fire. This GMA also includes high elevation areas that naturally lack habitat. Habitat in this GMA is well-connected with spotted owl habitat and other management areas to the north, west, and south, within the province, and to the east, in the California Cascades Province. The Northwestern California Demography Study Area, which overlaps the GMA, provides long-term data and ongoing monitoring information, which are expected to support rapid implementation of effective barred owl management and increase the efficiency of effectiveness monitoring. Barred owl

removal research is currently ongoing in this GMA on Sierra Pacific Industries lands managed under their HCP. The beneficial effects to spotted owls from this effort could easily be augmented with barred owl management under the Strategy.

The South California Klamath General Management Area, a Priority C GMA, has experienced extensive habitat loss to fire, and the remaining spotted owl habitat is highly fragmented. Both spotted owl and barred owl populations are thought to be small here. Management recommendations here include focusing on support for spotted owls in the northern portion of the GMA, and on preventing barred owl population expansions within or through the southern portion of the GMA. Because the remaining habitat is widely scattered in this GMA, we expect FMA development here to focus on creating well-connected small blocks or clusters of sites, rather than large block management areas.

More detailed management recommendations are listed for each GMA in Appendix 4.10.B.2.a.

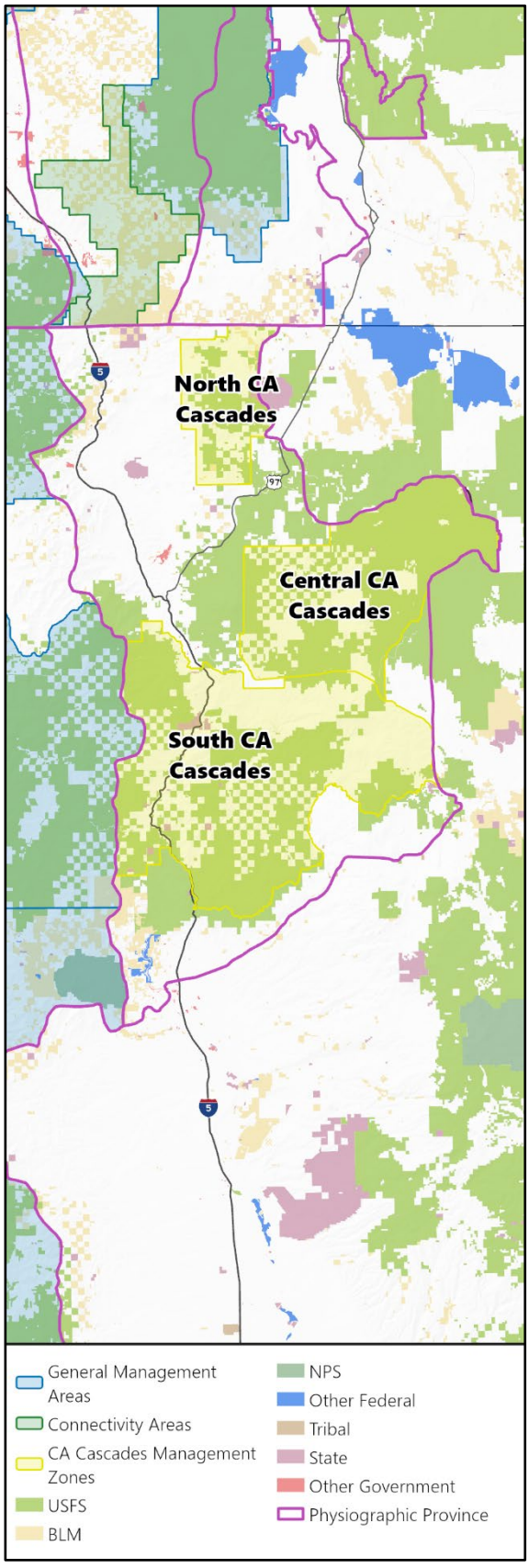
## 10.11 California Cascades Province

Both spotted owl and barred owl populations in the California Cascades Province are relatively small. Much of the spotted owl habitat here is marginal in quality and scattered in distribution. Nonetheless, the spotted owl population here appears to be relatively stable. The province includes large areas of private land, as Klamath, Shasta-Trinity, and Modoc National Forest lands, and small areas of BLM lands. One private land manager within this province operates under an HCP that includes barred owl removal research. For northern spotted owls, the Strategy in this province includes site management and three Management Zones.

The entire province is within the introgression zone where northern and California spotted owls intermix demographically and genetically. The southernmost portion of the province, south of the Pit River, overlaps the northern end of the California spotted owl range. The remainder of the province is a major invasion pathway for barred owls to reach the California spotted owl range. Therefore, the Strategy for California spotted owls also includes actions in this province, including monitoring and removal of all barred owls detected on the lands of willing landowners and land managers. See Section 12 and Appendix 4.12 for more information about these components of the Strategy for California spotted owls. If this early detection, rapid response approach is carried out throughout the province, no additional effort will be needed on behalf of northern spotted owls. However, if this approach cannot be fully carried out, the northern spotted owl Strategy components will help to prioritize efforts for the maximum benefit to northern spotted owls.

Northern spotted owl site management in this province is primarily intended to maintain the current spotted owl population to maximize the potential for recruitment and population stability. In any areas of the province that have not been surveyed consistently in recent years, we recommend that historical sites, particularly those that have been active within the past 10 years, be surveyed for activity. More detailed background and site management recommendations are listed in Appendix 4.11.B.

The South California Cascades Management Zone, a Priority A Management Zone, includes the largest concentrations of high-quality nesting and roosting habitat in the province, and provides the best connection between this province and the rest of the northern spotted owl range, with




habitat and management areas in the California Klamath Province to the west. Experimental barred owl removal is ongoing in on Sierra Pacific Industries lands as a component of their HCP. The beneficial effects to spotted owls from these efforts could easily be augmented with barred owl management under the Strategy. We recommend barred owl removal throughout this Management Zone, but if it cannot be carried out across the entire Zone, we recommend management similar to management for GMAs. We would expect FMA development here to focus on creating well-connected small blocks or clusters of sites, rather than large block management areas.

The North California Cascades Management Zone, a Priority C Management Zone, includes a small, isolated spotted owl population, largely on Klamath National Forest Lands. The isolation of the spotted owl habitat here may allow for more effective barred owl removal and exclusion. We recommend barred owl removal throughout this Management Zone, but if it cannot be carried out across the entire Zone, we recommend management similar to management for GMAs. We would expect FMA development here to focus on creating well-connected small blocks or clusters of sites, rather than large block management areas.

The Central California Cascades Management Zone, a Priority C Management Zone, includes a small spotted owl population, largely on Forest Service and checkerboard lands, that was affected by a large, recent fire. We recommend barred owl removal throughout this Management Zone, but if it cannot be carried out across the entire Zone, we recommend management similar to management for GMAs. We would expect FMA development here to focus on creating well-connected small blocks or clusters of sites, rather than large block management areas. More detailed management recommendations are listed for each Management Zone in Appendix 4.11.B.

# 11. Summary of the Strategy by Population in the California Spotted Owl Range

The following provides a summary of the Strategy components by the proposed California Spotted Owl Distinct Population Segment, including (1) survey, inventory, and monitoring for invading barred owls and (2) removal of any barred owls that are located. The application of these varies by population based on the current barred owl presence and general habitat conditions.

## 11.1 Sierra Nevada Population

### 11.1.1 Specific Goals for Barred Owl Management

1. Prevent colonization and population establishment of barred owls or hybrids across the Sierra Nevada, with the goal of maintaining barred owls at such low numbers they do not become a population-level threat to the Sierra Nevada population of California spotted owls.

2. Focus specific attention on the key dispersal pathway in the northern Sierra Nevada from the Shasta-Trinity and Modoc National Forests and surrounding areas.

3. Increase inventory and removal efforts if barred owl populations become established.

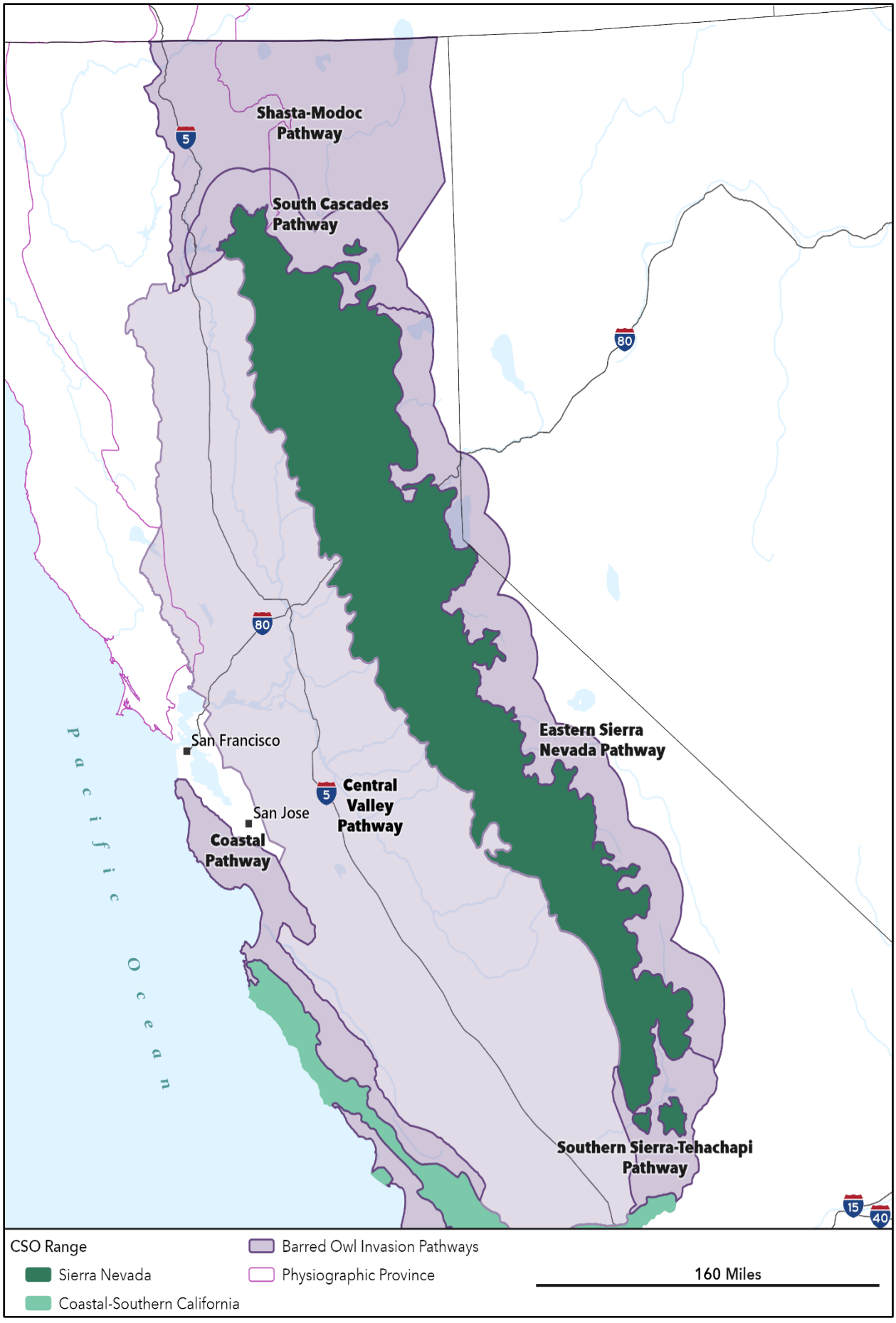
### 11.1.2 Management Strategy in the Sierra Nevada and Associated Invasion Pathways

The following is a summary of the management recommendations and priorities for the Sierra Nevada area. For more details, see Appendix 4.12.

1. Inventory and monitoring for barred owls.

    a. Make use of all existing information sources for barred owl detection across the Sierra Nevada and potential invasion pathways, including broad-scale systematic sampling, such as the ongoing passive acoustic monitoring effort, focal monitoring at sentinel spotted owl research sites, detections recorded during short-term project-level surveys, and anecdotal observations. **Priority A**

    b. Maintain and continue established monitoring network for the detection of barred and spotted owls across the Sierra Nevada. **Priority A**


Shasta-Modoc Pathway
South Cascades Pathway
Eastern Sierra Nevada Pathway
Central Valley Pathway
Coastal Pathway
Southern Sierra-Tehachapi Pathway
San Francisco
San Jose
Pacific Ocean
5
80
15
40
CSO Range
Sierra Nevada
Coastal-Southern California
Barred Owl Invasion Pathways
Physiographic Province
160 Miles

c. Develop a sampling design to inventory barred owls in areas that function as invasion pathways. Establish an extensive survey network:

   i. in the South Cascades Invasion Pathway, which is the area within 15 miles of the northern extent of the Sierra Nevada California spotted owl population. This overlaps with the northern spotted owl range in the California Cascades Province, and elements of the Strategy for northern spotted owls also apply here (see Section 10.11 above, Appendix 4.11 and 4.12.A). **Priority A**

   ii. in the Shasta-Modoc Dispersal Pathway, which includes the remainder of California Cascades Province in the northern spotted owl range of the Sierra Nevada California spotted owl population, and areas to the east of the California Cascades Province. This overlaps with the northern spotted owl range, and elements of the Strategy for northern spotted owls also apply here (see Section 10.11 above, Appendix 4.11 and 4.12.A). **Priority B**

d. Expand initial inventory and monitoring efforts to include lands not included in initial survey efforts:

   i. Develop an enhanced sampling design to monitor barred owl detections and occupancy in the northern Sierra Nevada, the area at highest risk for barred owl invasion. **Priority A**

   ii. Develop an enhanced sampling design to monitor barred owl detections and occupancy in the central and southern Sierra Nevada. These areas are more removed from the potential invasion source and pathway, though barred owls may disperse long distances and reach these areas. **Priority B**

   iii. Make use of all existing sources of information on barred owl detections within the Central Valley and the eastern Sierra Nevada, which are potential alternative sources for barred owl dispersal into the Sierra Nevada California spotted owl population. If the number of barred owl reports increases, establish additional monitoring to locate territorial barred owls. **Priority C**

e. Develop an interactive database and rapid-response system to collate all barred owl detections that are identified through ongoing demographic and research projects, project-level management surveys and anecdotal observations within both the Sierra Nevada population of California spotted owls and the key dispersal pathway areas. This includes development of a web-based portal where individuals outside of agencies may voluntarily provide data on locations of barred owls in this area. **Priority A**

2. Lethal removal of detected barred owls

    a. Conduct lethal removal of all barred owls located on surveys or otherwise identified in the Sierra Nevada population range and potential invasion pathways described above as soon as practicable from the lands of willing landowners and land managers. This may include capture and euthanasia in areas where firearms may not be used. **Priority A**

    b. Establish and maintain response team capacity to follow up on barred owl detections and conduct lethal removal of all barred owls. Support a rapid response capacity so that follow-up surveys and lethal removals can be conducted as soon as possible following reports of barred owl detections. **Priority A**

3. Detection of and response to the establishment of barred owl populations.

    a. The goal in the Sierra Nevada is to prevent self-sustaining barred owl populations from becoming established and creating a source of additional barred owls to colonize within the California spotted owl range. However, it may not be possible to detect and remove all barred owls. Using current and future research results, establish an occupancy level trigger that indicates barred owl populations are becoming self-sustaining and impacts to California spotted owls are eminent. Based on research in the northern Sierra Nevada, we recommend a starting threshold occupancy value of 0.10, though this would be modified as new information becomes available. Use systematic regional monitoring results to track the occupancy level. **Priority A**

    b. If annual surveys or inventory in the Sierra Nevada indicate that barred owl occupancy has increase beyond the occupancy trigger within the Sierra Nevada or the invasion pathways described above, intensify survey, monitoring, and removal efforts within the Sierra Nevada California spotted owl population and in the surrounding dispersal pathways. **Priority A**

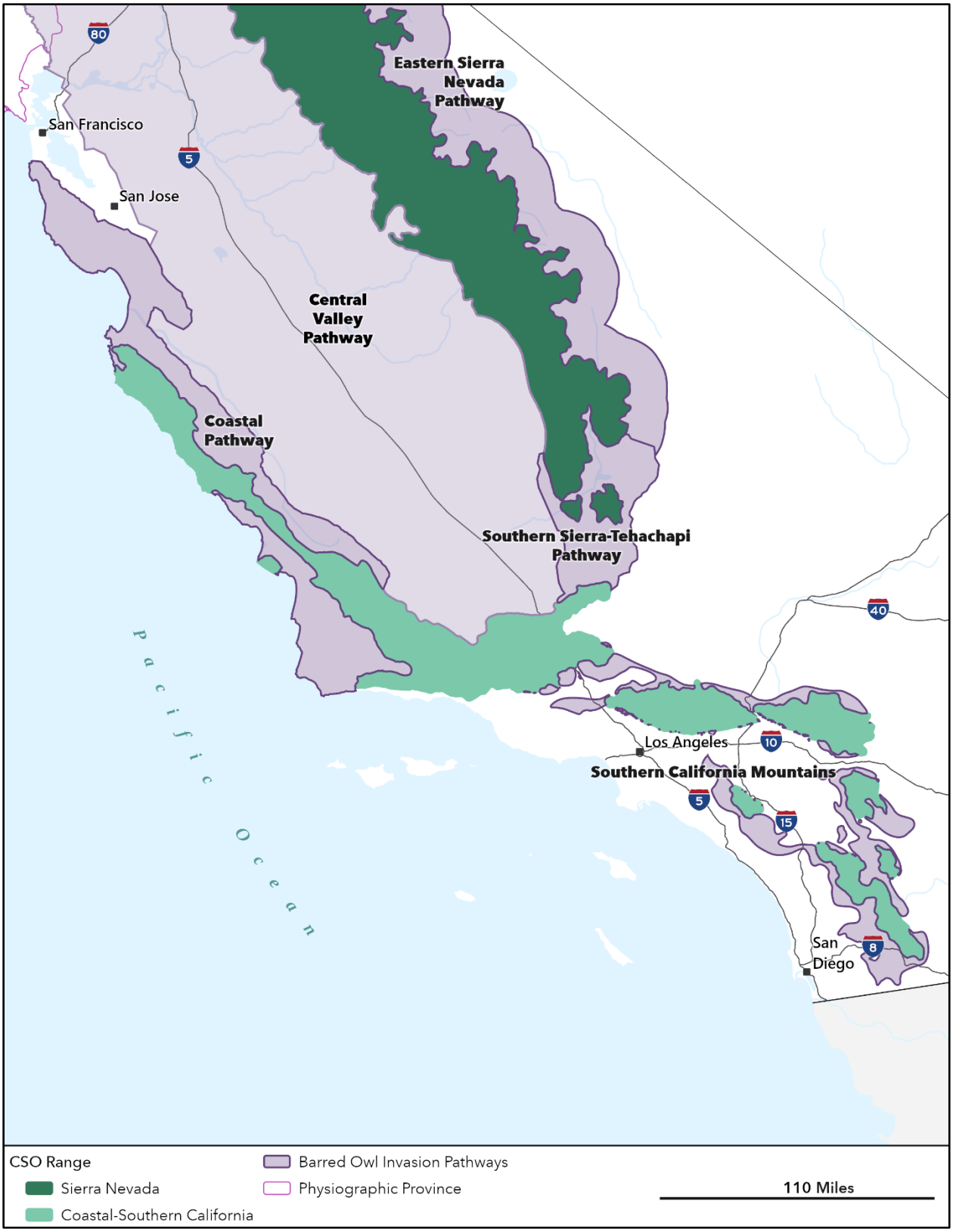
## 11.2 Coastal-Southern California Population

### 11.2.1 Specific Goals for Barred Owl Management

1. Prevent declines in California spotted owls in the Coastal-Southern California area from barred owl competition.

2. Limit the invasion of barred owls into the Coastal-Southern California portion of the range of the subspecies by removing all barred owls detected.

3. Increase inventory and removal efforts if barred owl populations become established.


Eastern Sierra Nevada Pathway
San Francisco
San Jose
Central Valley Pathway
Coastal Pathway
Southern Sierra-Tehachapi Pathway
Pacific Ocean
Los Angeles
Southern California Mountains
San Diego
80
5
40
10
15
8
CSO Range
Sierra Nevada
Coastal-Southern California
Barred Owl Invasion Pathways
Physiographic Province
110 Miles

### 11.2.2 Management Strategy in the Coastal-Southern California and Associated Invasion Pathways

The following is a summary of the management recommendations and priorities for the Coastal-Southern California area. For more detail, see Appendix 4.12.

1. Inventory and monitoring for barred owls.

    a. Make use of all existing information sources to monitor for barred owl detections across the Coastal-Southern California range, and within potential invasion pathways. These sources of information may include broad-scale systematic sampling, focal monitoring at sentinel spotted owl research sites, short-term project-level surveys, and anecdotal observations. **Priority A**

    b. Conduct an extensive initial inventory of barred owl status and distribution in the Coastal-Southern California population across the area on all public lands, and lands of willing private landowners and land managers, to establish baseline of current barred owl status and distribution across the area. Include the current range of the subspecies, and the likely invasion pathways between the Coastal-Southern California and Sierra Nevada California spotted owl ranges as well as the coastal forests south of San Francisco. **Priority A**

    c. Extend initial inventory efforts to all potential barred owl habitat in the southern California mountains and throughout the rest of the area, including lands of all willing landowners and land managers. **Priority B**

    d. Develop an interactive database and rapid-response system to collate all barred owl detections that are identified through ongoing demographic and research projects, project-level management surveys, and anecdotal observations. Provide opportunities for the public to provide locations. Develop an interagency database where records can be submitted that can facilitate a rapid-response follow-up to any detection. **Priority A**

    e. Develop focused long-term monitoring, with particular emphasis on early detection surveys in areas along any potential barred owl dispersal and invasion corridors into the northern portion of the area along the border closest to the Sierra Nevada Range and in the central coast nearest the southern end of the northern spotted owl range. **Priority B**

2. Lethal removal of detected barred owls.

    a. Conduct lethal removal of all barred owls located on surveys or otherwise identified in the Coastal-Southern California population range and potential invasion pathways described above. These should be conducted as soon as practicable from the lands of willing landowners and land managers. This may include capture and euthanasia in areas where firearms may not be used. **Priority A**

b. Establish and maintain response team capacity to follow up on barred owl detections and conduct lethal removal of all barred owls. Support a rapid response capacity so that follow-up surveys and lethal removals can be conducted as soon as possible following reports of barred owl detections. **Priority B**

# 12. Monitoring

Monitoring of both barred and spotted owl responses to the barred owl management are a requirement for the issuance of the MBTA Special Purpose permit. Monitoring would also provide information on the effectiveness of barred owl management. Appendix 5 contains the Implementation and Effectiveness Monitoring Plan. For both types of monitoring, the Service, as the permit-holder, would be responsible for assembling data contributed by any designated entities.

Implementation monitoring would be focused on documenting that actions are consistent with the Strategy and any additional terms and conditions of the MBTA permit. Implementation monitoring requirements include information on the qualifications of the removal specialists, the location of barred owl management activities, and the barred or hybrid owls removed on an annual basis (see Appendix 5 for additional details).

Effectiveness monitoring would be focused on assessing the success of the barred owl management effort and providing information on the effectiveness of management under different conditions across the range of the northern and California spotted owls. This information could be used for potential future modifications of the approaches and would allow us to determine when barred owl management was no longer required (Appendix 5).

Monitoring would address effects of management to both barred and spotted owls. Monitoring requirements would be focused on answering specific questions.

For spotted owls, these questions include:

- Has implementation of the Strategy met the goal of slowing or stopping population declines (or increasing the annual population growth rate) of northern spotted owls relative to population status in the same area prior to management, or in comparable areas without management?
- What is the status and trend in abundance, site occupancy/site use, or local (site or territory) colonization/extinction rates of spotted owls in managed areas relative to conditions prior to management or in comparable areas without management?

For barred owls, the questions include:

- Has implementation of the Strategy reduced the abundance of, or site use by, barred owls, thereby providing habitat for northern spotted owls with reduced competition from barred owls?
- Has implementation of the Strategy limited the colonization and establishment of barred owls into the range of California spotted owls?

- What is the status and trend in abundance, site occupancy/site use, or colonization rates of barred owls in managed areas?

The monitoring plan recommends integration with monitoring of northern spotted owl populations and old forests on Federal lands under the Northwest Forest Plan Effectiveness Monitoring Plan where feasible. This approach could reduce costs and effort required for monitoring. However, integration with Federal monitoring would not be feasible in all areas where barred owls may be managed. Additionally, some potentially willing landowners or land managers may not wish to integrate monitoring on their lands with the Federal system. Therefore, the Service will accept monitoring data obtained by other means or by similar means not integrated with the Northwest Forest Plan Effectiveness Monitoring, as long as it provided the necessary information for evaluation.

The Service will include monitoring for the effect on barred owls would occur at multiple scales, such as the individual northern spotted owl site (territory), management block, province or area (e.g., FMAs), and range-wide (northern and California spotted owls). Individual site and management block monitoring would be part of the management action. The Service will summarize the information in annual reports. Periodic assessments of monitoring data for barred owls and spotted owls will occur annually to update selected population indicators for barred and spotted owls, and at five-year intervals. The five-year assessment would be conducted coincident with meta-analyses of northern spotted owl population trends under the Northwest Forest Plan Effectiveness Monitoring Plan, allowing for formal analyses of the effectiveness in meeting Strategy goals as management is implemented. Detecting changes in population trend requires multiple years of data, and a five-year interval has proven effective in analyzing northern spotted owl demographic performance on the demography study areas (Franklin et al. 2021, entire) (See Appendix 4 for additional details).

# Literature Cited


Anthony, R.G., E.D. Forsman, A.B. Franklin, D.R. Anderson, K.P. Burnham, G.C. White, C.J. Schwarz, J. Nichols, J.E. Hines, G.S. Olson, S.H. Ackers, S. Andrews, B.L. Biswell, P.C. Carlson, L.V. Diller, K.M. Dugger, K.E. Fehring, T.L. Fleming, R.P. Gerhardt, S.A. Gremel, R.J. Gutiérrez, P.J. Happe, D.R. Herter, J.M. Higley, R.B. Horn, L.L. Irwin, P.J. Loschl, J.A. Reid and S.G. Sovern. 2006. Status and trends in demography of northern spotted owls, 1985–2003. Wildlife Monograph No. 163.

Baumbusch, R. C. 2023. Foraging Ecology of Barred Owls where they are Outcompeting the Threatened Northern Spotted Owl. Oregon State University. Dissertation. 173 pp.

BLM (Bureau of Land Management, U.S. Department of the Interior). 1993. Record of Decision Redding Resource Area Resource Management Plan and Environmental Impact Statement. Redding, California.

BLM. 1994. Record of Decision South Coast Planning Area Resource Management Plan and Environmental Impact Statement. Palm Springs, California.

BLM. 2016a. BLM Northwestern and Coastal Oregon Record of Decision and Resource Management Plan. Portland, Oregon. 320 pp.

BLM. 2016b. BLM Southwestern Oregon Record of Decision and Resource Management Plan. Portland, Oregon. 332 pp.

Campbell, I., McAndrews, J. 1993. Forest disequilibrium caused by rapid Little Ice Age cooling. Nature 366, 336–338. https://doi.org/10.1038/366336a0

Diller, L.V., K.A, Hamm, D.E. Early, D.W. Lamphear, K.M. Dugger, C.B. Yackulic, C.J. Schwarz, P.C. Carlson, and T.L. McDonald. 2016. Demographic response of northern spotted owls to barred owl removal. Journal of Wildlife Management 80:691-707.

Dugger, K.M., R. G. Anthony, and L.S. Andrews. 2011. Transient dynamics of invasive competition: Barred Owls, Spotted Owls, habitat, and the demons of competition present. Ecological Applications 21:2459-2468.

Dugger, K.M., E.D. Forsman, A.B. Franklin, R.J. Davis, G.C. White, C.J. Schwarz, K.P. Burnham, J.D. Nichols, J.E. Hines, C.B. Yackulic, P.F. Doherty Jr., L. Bailey, D.A. Clark, S.H. Ackers, L.S. Andrews, B. Augustine, B.L. Biswell, J. Blakesley, P.C. Carlson, M.J. Clement, L.V. Diller, E.M. Glenn, A. Green, S.A. Gremel, D.R. Herter, J.M Higley, J. Hobson, R.B. Horn, K.P. Huyvaert, C. McCafferty, T. McDonald, K. McDonnell, G.S. Olson, J.A. Reid, J. Rockweit, V. Ruiz, J. Saenz, and S.G. Sovern. 2016. The effects of habitat, climate, and Barred Owls on long-term demography of Northern Spotted Owls. The Condor 118:57–116. https://doi.org/10.1650/CONDOR-15-24.1

Forsman, E.D., S. DeStefano, M.G. Raphael, and R.J. Gutiérrez (Editors) 1996. Demography of the Northern Spotted Owl. Studies in Avian Biology 17. 0-122. 128 pp.

Forsman, E.D., R.G. Anthony, K.M. Dugger, E.M. Glenn, A.B. Franklin, G.C. White, C.J. Schwarz, K.P. Burnham, D.R. Anderson, J.D. Nichols, J.E. Hines, J.B. Lint, R.J. Davis,

S.H. Ackers, L.S. Andrews, B.L. Biswell, P.C. Carlson, L.V. Diller, S.A. Gremel, D.R. Herter, J.M. Higley, R.B. Horn, J.A. Reid, J. Rockweit, J. Schaberl, T.J. Snetsinger, and S.G. Sovern. 2011. Population demography of northern spotted owls: 1985-2008. Studies in Avian Biology No. 40. 106 pp.

Franklin, A.B., K. P. Burnham, G.C. White, R.G. Anthony, E.D. Forsman, C. Schwarz, J.D. Nichols, and J. Hines. 1999. Range-wide status and trends in northern spotted owl populations. Colorado Cooperative Fish and Wildlife Research Unit, Colorado State University, Fort Collins, and Oregon Cooperative Fish and Wildlife Research Unit, Oregon State University, Corvallis.

Franklin, A.B., Dugger, K.M., Lesmeister, D.B., Davis, R.J., Wiens, J.D., White, G.C., Nichols, J.D., Hines, J.E., Yackulic, C.B., Schwarz, C.J., Ackers, S.H., Andrews, L.S., Bailey, L.L., Bown, R., Burgher, J., Burnham, K.P., Carlson, P.C., Chestnut, T., Conner, M.M., Dilione, K.E., Forsman, E.D., Glenn, E.M., Gremel, S.A., Hamm, K.A., Herter, D.R., Higley, J.M., Horn, R.B., Jenkins, J.M., Kendall, W.L., Lamphear, D.W., McCafferty, C., McDonald, T.L., Reid, J.A., Rockweit, J.T., Simon, D.C., Sovern, S.G., Swingle, J.K., Wise, H., 2021. Range-wide declines of northern spotted owl populations in the Pacific Northwest: A meta-analysis. Biological Conservation 259, 109168. Https://doi.org/10.1016/j.biocon.2021.109168

Grant, J. 1966. The Barred Owl in British Columbia. Murrelet 47:39-45.

Gutiérrez, R.J., M. Cody, S. Courtney, and A.B. Franklin. 2007. The invasion of barred owls and its potential effect on the spotted owl: a conservation conundrum. Biological Invasions 9:181–196.

Gullett DW, Skinner WR. 1992. The state of Canada's climate: Temperature change in Canada 1895-1991. Ottawa (Canada): Environment Canada, Minister of Supply and Services. State of Environment Report no. 92-2.

Hamer, T.E., E.D. Forsman, and E.M. Glenn. 2007. Home range attributes and habitat selection of barred owls and spotted owls in an area of sympatry. Condor 109:750–768.

Hofstadter, D.F., N.F. Kryshak, C.M. Wood, B.P. Dotters, K.N. Roberts, K.G. Kelly, J.J. Keane, S.C. Sawyer, P.A. Shaklee, H.A. Kramer, R.J. Gutiérrez, and M.Z. Peery. 2022. Arresting the spread of invasive species in continental systems. Frontiers in Ecol & Environ 1–7. https://doi.org/10.1002/fee.2458

Holm, S.R., B.R. Noon, J.D. Wiens, and W.J. Ripple. 2016. Potential trophic cascades triggered by the barred owl range expansion. Wildlife Society Bulletin DOI: 10.1002/wsb.714.

Keane, J.J., M.M. Connor, L.R. Gallagher, T.E. Munton, P.A. Shaklee and R. Gerrard. 2023. California spotted owl demographic monitoring study: 2022 annual report. Unpublished Report. Pacific Southwest Research Station, USDA Forest Service, CA.

Kelly, E.G., E.D. Forsman, and R.G. Anthony. 2003. Are barred owls replacing spotted owls? Condor 105:45-53.

Kelly, K.G., Wood, C.M., McGinn, K., Kramer, H.A., Sawyer, S.C., Whitmore, S., Reid, D., Kahl, S., Reiss, A., Eiseman, J. and Berigan, W., 2023. Estimating population size for

California spotted owls and barred owls across the Sierra Nevada ecosystem with bioacoustics. Ecological Indicators, 154, p.110851.

Kryshak, N.F., E.D. Fountain, D.F. Hofstadter, B.P. Dotters, K.N. Roberts, C.M. Wood, K.G. Kelly, I.F. Papraniku, P.J. Kulzer, A.K. Wray, H.A. Kramer, J.P. Dumbacher, J.J. Keane, P.A. Shaklee, R.J. Gutiérrez, and M.Z. Peery. 2022. DNA metabarcoding reveals the threat of rapidly expanding barred owl populations to native wildlife in western North America. bioRxiv preprint version posted April 20, 2022 30. https://www.biorxiv.org/content/10.1101/2022.04.19.488820v1

La Haye, W. 2004. Chapter two: Northern spotted owl biology. Pages 2-1 to 2-11 in S.P. Courtney, J.A. Blakesley, R.E. Bigley, M.L. Cody, J.P. Dumbacher, R.C. Fleischer, A.B. Franklin, J.F. Franklin, R.J. Gutiérrez, J.M. Marzluff, and L. Sztukowski. Scientific evaluation of the status of the northern spotted owl. Sustainable Ecosystems Institute, Portland, Oregon.

Livezey, K. B. 2009a. Range Expansion of Barred Owls, Part I: Chronology and Distribution. The American Midland Naturalist, 161(1), 49–56.

Livezey, K. B. 2009b. Range Expansion of Barred Owls, Part II: Facilitating Ecological Changes. The American Midland Naturalist, 161(2), 323–349. http://www.jstor.org/stable/20491442

Olson, G.S., R.G. Anthony, E.D. Forsman, S.H. Ackers, P.J. Loschl, J.A. Reid, K.M. Dugger, E.M. Glenn, and W.J. Ripple. 2005. Modeling of site occupancy dynamics for northern spotted owls, with emphasis on the effects of barred owls. Journal of Wildlife Management 69:918–932.

Peery, M.Z., R.J. Gutiérrez, D.J. Temple, W.J. Berigan and S.A. Whitmore. 2021. Population ecology of the California spotted owl in the central Sierra Nevada: annual results 2020. Unpublished Report, University of Wisconsin, WI.

Schindler, D. W. 1998. A Dim Future for Boreal Waters and Landscapes. BioScience, 48(3), 157–164. https://doi.org/10.2307/1313261

Sierra Pacific Industries. 2021. Habitat Conservation Plan for Northern and California Spotted Owl. Sierra Pacific Industries, Forestland Management Program in the Klamath, Cascade, and Sierra Nevada Mountains, California

Smith, M. R., P. W. Mattocks Jr., and K. M. Cassidy 1997. Breeding birds of Washington State. In Washington State Gap Analysis - Final Report (K. M. Cassidy, C. E. Grue, M. R. Smith, and K. M. Dvornich, Editors). Seattle Audubon Society Publications in Zoology no. 1., Seattle, WA, USA.

Sovern, S.G., E.D. Forsman, G.S. Olson, B.L. Biswell, M. Taylor, and R.G. Anthony. 2014. Barred owls and landscape attributes influence territory occupancy of northern spotted owls. Journal of Wildlife Management 78(8):1436-1443.

Tempel, D.J., H.A. Kramer, G.M. Jones, R.J. Gutiérrez, S.C. Sawyer, A. Koltunov, M. Slaton, R. Tanner, B.K. Hobart, and M.Z. Peery. 2022. Population decline in California spotted

owls near their southern range boundary. The Journal of Wildlife Management 86:. https://doi.org/10.1002/jwmg.22168

Thomas, J.W., E.D. Forsman, J.B. Lint, E.C. Meslow, B.R. Noon, and J. Verner. 1990. A conservation strategy for the northern spotted owl. Interagency scientific committee to address the conservation of the northern spotted owl. U.S. Forest Service, U.S. Bureau of Land Management, U.S. Fish and Wildlife Service, and U.S. National Park Service, Portland, Oregon.

USDA and USDI (U.S. Department of Agriculture and U.S. Department of the Interior). 1994. Record of decision for amendments to Forest Service and Bureau of Land Management planning documents within the range of the northern spotted owl; standards and guidelines for management of habitat for late-successional and old-growth forest related species within the range of the northern spotted owl. Portland, Oregon. 74 pp.

USFS (USDA Forest Service). 1988. Final supplement to the environmental impact statement for an amendment to the Pacific Northwest Regional Guide. Spotted Owl Guidelines. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Region. 2 vols.

USFS (USDA Forest Service) 2004. Sierra Nevada Forest Plan Amendment, Final Supplemental Environmental Impact Statement, Volume 1. U.S. Forest Service, Pacific Southwest Region. Vallejo CA. R5-MB-046.

USFS (USDA Forest Service). 2005. Final environmental impact statement: land management plans: Angeles National Forest, Cleveland National Forest, Los Padres National Forest, San Bernardino National Forest. [Vallejo, California: U.S. Department of Agriculture, Forest Service, Pacific Southwest Region] United States Forest Service. Pacific Southwest Region, I. B..

USFS (USDA Forest Service). 2016. Land Management Plan for the Lake Tahoe Basin Management Unit. USDA Forest Service, Pacific Southwest Region. Vallejo CA. R5-MB-293a. 168 pp.

USFS (USDA Forest Service). 2019. Land Management Plan for the Inyo National Forest. USDA Forest Service, Pacific Southwest Region. Vallejo CA. R5-MB-323a. 196 pp.

USFS (USDA Forest Service). 2023a. Land Management Plan for the Sierra National Forest. USDA Forest Service, Pacific Southwest Region . Vallejo CA. R5-MB-331a. 214 pp.

USFS (USDA Forest Service). 2023b. Land Management Plan for the Sequoia National Forest. USDA Forest Service, Pacific Southwest Region, Vallejo, CA. R5-MB-330a. 226 pp.

USFWS (U.S. Fish and Wildlife Service). 2004. Northern spotted owl: Five Year Review Summary and Evaluation. U.S. Fish and Wildlife Service, Portland, Oregon.

USFWS (U.S. Fish and Wildlife Service). 2011. Revised Recovery Plan for the Northern Spotted Owl (*Strix occidentalis caurina*). U.S. Fish and Wildlife Service, Portland, Oregon.

USFWS (U.S. Fish and Wildlife Service). 2023. Species Status Assessment for the California Spotted Owl (*Strix occidentalis occidentalis*), Version 2.0. November 2022. Sacramento, California.

Verner, J., K.S. McKelvey, B.R. Noon, R.J. Gutiérrez, G.I. Gould Jr., and T.W. Beck. 1992. The California spotted owl: a technical assessment of its current status. U.S. Department of Agriculture, Forest Service, Pacific Southwest Research Station, Albany, CA

Wiens, J.D., R.G. Anthony, and E.D. Forsman. 2014. Competitive interactions and resource partitioning between northern spotted owls and barred owls in western Oregon: Competition Between Spotted and Barred Owls. Wild Mon 185:1–50. https://doi.org/10.1002/wmon.1009

Wiens, J.D., K.M. Dugger, D.B. Lesmeister, K.E. Dilione, and D.C. Simon. 2020. Effects of barred owl (Strix varia) removal on population demography of northern spotted owls (*Strix occidentalis caurina*) in Washington and Oregon - 2019 annual report. U.S. Geological Survey

Wiens, J. D., K. M. Dugger, J. M. Higley, D. B. Lesmeister, A. B. Franklin, K. A. Hamm, G. C. White, K. E. Dilione, D. C. Simon, R. R. Bown, P. C. Carlson, C. B. Yackulic, J. D. Nichols, J. E. Hines, R. J. Davis, D. W. Lamphear, C. McCafferty, T. L. McDonald, and S. G. Sovern. 2021. Invader removal triggers competitive release in a threatened avian predator. Proceedings of the National Academy of Sciences 118. <https://www.pnas.org/content/118/31/e2102859118>.

Wood, C.M., R.J. Gutiérrez, J.J. Keane, and M.Z. Peery. 2020. Early detection of rapid Barred Owl population growth within the range of the California Spotted Owl advises the Precautionary Principle. The Condor 122:duz058. https://doi.org/10.1093/condor/duz058

Yackulic, C.B., J. Reid, J.D. Nichols, J.E. Hines, R. Davis, and E. Forsman. 2014. The roles of competition and habitat in the dynamics of populations and species distributions. Ecology 95:265–279

**Personal Communications:**

Franklin, A. 2023. Personal communication. Email with data on spotted owl population trends.

# Proposed Barred Owl Management Strategy Appendices

## Appendix 1: The Barred Owl in Western North America – Invasive Species Evaluation for Barred Owl Management Strategy

*The following analysis is specific to the appropriate characterization for the barred owl in the West, specifically within the ranges of the northern and California spotted owls. It should not be considered a policy decision or applied directly to other species or situations, as each situation is unique.*

### A1.0 Changes between Draft and Final EIS

- Updated the definitions and analyses to conform to the most recent Executive Order on invasive species, E.O. 13751.
- Updated information on the potential effect of climate change on the expansion route for barred owls.

### A1.1 Invasive Species Definitions

**Direction:** Executive Order (E.O.) 13751 (81 FR 88609) was created to prevent the introduction of invasive species, to provide for their control, and to minimize the economic, ecological, and human health impacts that invasive species cause.

**Question: Is the barred owl in the ranges of the northern and California spotted owl an invasive species as defined under E.O. 13751?** To determine the correct characterization under the E.O. 13112, as amended by E.O. 13751, we compare the components and definitions of the Executive Orders to the situation with the barred owl in western North America.

Under E.O. 13751:

> **"Invasive species"** means, with regard to a particular ecosystem, a non-native organism whose introduction causes or is likely to cause economic or environmental harm, or harm to human, animal, or plant health [emphasis added].
>
> **"Non-native species"** means, with respect to a particular ecosystem, an organism, including its seeds, eggs, spores, or other biological material capable of propagating that species, that occurs outside of its natural range.
>
> **"Introduction"** means, as a result of human activity, the intentional or unintentional escape, release, dissemination, or placement of an organism into an ecosystem to which it is not native [emphasis added].

**"Pathway"** means the mechanisms and processes by which non-native species are moved, intentionally or unintentionally, into a new ecosystem.

The Executive Order provides direction to Federal agencies, as follows:

> *"Sec. 2. Federal Agency Duties.* (a) Each Federal agency for which that agency's actions may affect the introduction, establishment, or spread of invasive species shall, to the extent practicable and permitted by law, . . . .
>
> - prevent the introduction, establishment, and spread of invasive species;
> - detect and respond rapidly to eradicate or control populations of invasive species in a manner that is cost-effective and minimizes human, animal, plant, and environmental health risks;
> - monitor invasive species populations accurately and reliably;
> - provide for the restoration of native species, ecosystems, and other assets that have been impacted by invasive species; . . .

## A1.2 Barred Owl History, Impact, and Range Expansion

Barred owls (*Strix varia*) are native to eastern North America and were historically found east of the Great Plains and south of the 49th parallel (Livezey 2009a, p. 53), with a subspecies in central Mexico. Around the turn of the century their range began to expand westward. The barred owl's arrival in the West is a relatively recent occurrence. Based on genetic studies, the spotted and barred owls are distinct species, separated from a common ancestor for a very long time prior to this expansion (Haig et al. 2004, p. 1353; Hanna et al. 2017, p. 2537, 2539).

Spotted owls (*Strix occidentalis*) are native to western North America. The northern spotted owl subspecies (*Strix occidentalis caurina*) is found in British Columbia, Washington, Oregon, and northern California. The California spotted owl subspecies (*Strix occidentalis occidentalis*) is found in the Sierra Nevada and the coastal mountains of southern California, and its historical range extends into northern Baja California, Mexico.

### A1.2.1 Barred owl range expansion.

Barred owl populations began to expand westward in the early 1900s (Livezey 2009a, p. 50). The first record of barred owls within the range of the northern spotted owl was in 1959 in British Columbia, Canada. Barred owls established populations, subsequently spreading south (Grant 1966, p. 42). Barred owls were first located in western Washington within the range of the spotted owl in 1972 and the first breeding record was 1974 (Smith et al. 1997, p. 230, Rogers 1966, p. 3). The first record in Oregon was from 1974 and California in 1976, with breeding documented by 1991 (Livezey 2009a, p. 40, 51; Gilligan et al. 1994 p. 321, cited in Mazur and James 2021, p. 5; Dark et al. 1998, p. 53.).

Barred and spotted owl are both forest owls, whose ranges were separated by the relatively treeless Great Plains and harsh conditions in the northern boreal forest, both likely formidable barriers to expansion (Livezey 2009b, entire). Given the limited data and observations from that

time period, the mechanism and route that facilitated westward expansion after so many millennia of separation are not documented. Theories point to changes in the conditions on the northern Great Plains and northern boreal forest as probable explanations. These include anthropogenic impacts such as fire exclusion and suppression, bison and beaver extirpation, deer and elk overhunting, establishment of riparian forests, and extensive planting of trees and shelterbelts in the northern Great Plains and southern edges of northern boreal forests, all of which may have contributed to tree and forest expansion (Livezey 2009b, p. 334). In addition, Central Canada, particularly the Canadian Prairie and the northern boreal forests experienced a continued statistically significant increase in temperatures starting in the late 1800s as $CO_2$ levels in the atmosphere rose, with pronounced warming periods in the early to mid-1900s (Campbell et al. 1993, entire; Gullett and Skinner 1992, entire; Schindler et al. 1998, p. 157-158).

Livezey (2009b, entire), using strength of evidence analysis, evaluated the plausibility of five ecological or behavioral changes proposed in the literature to have facilitated the range expansion. He concluded that the historical lack of trees in the northern Great Plains acted as a barrier to the range expansion and that increases in forest caused by European settlers excluding fires historically set by Native Americans and planting trees created conditions that allowed barred owls to expand across the previous barrier.

Two potential routes for expansion have been suggested, one across the northern Great Plains and the other through the southern portion of the northern boreal forest in Canada. Each are affected by anthropogenic impacts, and both may have been factors in the expansion of barred owls. Both may have played a role in creating pathways to allow barred owls to invade western forests.

*Great Plains Potential Route*

The changes brought to the northern Great Plains as a result of European settlement are a likely and reasonable explanation for the breakdown of the barrier (Livezey 2009b, p. 338).

Settlement and homesteading, resulting in the extensive planting and caring for trees (Livezey 2009b, pp. 333-4) including shelter belts around homes and communities and the establishment of woodlots and orchards as part of tree claims under the homestead laws, all leading to significant expansion of small, forested patches on the Great Plains. These patches were often associated with farming, and grain storage which in turn likely lead to an increase with potential barred owl prey in these forest patches. The U.S. Bureau of Forestry reported in 1890 that ‘‘every year the treeless belt becomes narrower through constant planting’’ (as recorded in Droze 1977, p. 16). In Manitoba, some 60 million trees were planted from 1901–1920 as a result of an anti-erosion shelterbelt program (Williams 1989, as cited in Livezey 2009b, p. 333). With the consolidation and intensification of agriculture and the death of planted trees from age and stress, many of these have been lost in recent decades.

The removal of bison and beaver from the Great Plains occurred prior to the expansion of barred owls. Beaver were extensively trapped in the 1800s, including along the waterways that served as major transportation networks for moving hides to the eastern markets. Beaver are very efficient at removing small and large trees alike, particularly in areas where this resource is

limited, and could suppress the development of riparian forests along rivers in the Great Plains. Ungulates, including bison, previously occurred in large numbers and may have reduced riparian forest development through mechanical damage and browsing by deer. These changes may have allowed the development of riparian forests along major waterways that cross the Great Plains, such as the Missouri River system. Cattle grazing and the slow return of beaver, along with the development of extensive reservoirs with highly variable water levels have greatly reduced these riparian forests in recent decades.

Fire reduction resulting from fire breaks created by fallow fields and agriculture, and the cessation of Aboriginal burning, may have allowed forests to develop or expand (Livezey 2009b, pp. 327-330), particularly in areas with sufficient rain to support trees.

*Northern Boreal Forest Potential Route*

Treeline along the southern edge of the northern boreal forest was affected by the same factors listed above. Extensive tree planting/forest expansion and both direct and indirect fire exclusion/suppression by settlers occurred at the southern edge of northern boreal forests in Canada (Livezey 2009b, p. 327-336, Smith 1996, Houston and McGowan 1999, pp. 190-191).

Conditions within the northern boreal forest have also likely changed with the early effects of climate change. There has been a general warming trend since at least 1860 in Canada, including in the northern boreal forest. This warming trend may have begun at the end of the last mini-ice age, but likely increased as a result of anthropogenic factors resulting in an increase in greenhouse gases in the atmosphere (Campbell et al. 1993, p. 336; Gullett and Skinner 1992, entire; Schindler et al. 1998, p. 157-158). The period from the late 1800s through the 1940s experienced a pronounced warming trend in Central Canada especially in the northern boreal forest and Canadian prairie, with the 1930s to 1940s being particularly warm. (Schindler et al. 1998 p. 157-158; Gullett and Skinner 1992, entire). While the northern boreal forest structure did not substantially change as a result of climate changes in the past 100-150 years (Campbell et al. 1993, p. 336-337), small changes in the general or extreme temperatures may have allowed barred owls to survive and reproduce in the southern portion of the northern boreal forest where they had not previously existed.

Monahan and Hijmans (2007, p. 61) concluded that the warming trend in the mid-1800s that coincided with barred owl range expansion supported the conclusion of a natural range expansion. However, more recent climate change research (Abram et al. 2016, entire), which evaluated other potential causes of the warming trend in the mid-1800s, indicates there is substantial and well documented evidence that effects of human-caused climate change on temperature (i.e. the beginning of the human-caused warming trend on oceans and continents) began in the 1830s and was most pronounced in the tropical oceans and the continental Arctic area of North America at that time; and a significant, sustained, human-caused warming trend in the northern hemisphere emerged in the mid-1800s. The IPCC notes that human-caused climate change began in the mid-19$^{th}$ century (Arias et al. 2021 p. 60). The weight of the evidence and best available science supports that warming temperature trends in North America (including the boreal forest) in the mid to late 1800s and in the 1900s was the result of human-caused climate change.

Therefore, if barred owls utilized the northern boreal forest for their range expansion, the changes that allowed for this were most likely human-caused or -facilitated.

*Current Range of Barred Owls*

Barred owls now occur throughout virtually all of the northern spotted range, and in high to very high densities throughout most of the range throughout most of the northern spotted owl range (Wiens et al. 2021, p. 7; Gutiérrez et al. 1995, p. 3; Crozier et al. 2006, p. 761).). Within the California spotted owl range, barred owls have been documented as individuals and small populations in the Sierra Nevada within the California spotted owl range (Keane et al. 2017, p. 207-208; Keane et al. 2018, p. 5)

## A1.2.2. Impact of Barred Owls on Western North American Biota

Competition from barred owls had been identified as one of primary threats to the survival of the northern spotted owl, with increasing urgency (USFWS 2004, p. 43; USFWS 2011, p. II-4, III-62; Franklin et al. 2021, p. 9-19; Yackulic et al. 2019, p. 1, 4-5; Davis et al. 2022, p. 1). Most recently, authors have concluded that failure to reduce barred owl populations will likely lead the extirpation of the northern spotted owls the near future (Franklin et al. 2021, p. 19; Wiens et al. 2021, pp. 7-8; Yackulic et al. 2019, p. 1, 5). Competition from barred owls has been identified as a significant threat to the California spotted owl and is expected to increase in magnitude without management of invading barred owls (88 FR 11600, at 11619).

Barred owls are generalists, consume a much wider variety of prey than spotted owls, and can develop higher density populations (Baumbusch 2023, entire). Therefore, they are not an ecological replacement for spotted owls. The increasing populations of barred owls are likely impacting native species that are evolutionarily naïve to its presence, through predation or competition for prey (Baumbusch 2023, pp. 135, 137; Holm et al. 2016, entire). Unfortunately, we do not have sufficient monitoring data for these species to verify species-specific effects in most cases. Data on the diet of barred owls in the West includes groups that contain at-risk or listed species (Baumbusch 2023, p. 23; Kryshak et al. 2022, p. 7), including, but not limited to, small mammals, amphibians, reptiles, and other birds (Baumbusch 2023, pp. 135, 137). Studies have documented predation on red tree voles, a candidate for listing under the Endangered Species Act (Baumbusch 2023, p. 23-25), and heavy predation on amphibians, a group that includes several at-risk endemic species. Additional groups found in barred owl prey studies that contain some listed and protected species or populations include mountain beaver, crayfish, and birds.

Even for prey species not currently at risk, the density and high energetic requirements of barred owls may lead to significantly greater pressure on these species and potentially unsustainable levels of predation (Baumbusch 2023, p. 30-31, 135). Scientists have expressed concern that the barred owl's breadth of prey and intensity of use could lead to cascading effects on the ecosystem and its food webs (Holm et al. 2016, entire). This could affect not only spotted owls, but entire ecosystems.

## A1.3. Barred Owls in the Western US and the Invasive Species Definition

Under E.O., 13751: "Invasive species" means, with regard to a particular ecosystem, a non-native organism whose introduction causes or is likely to cause economic or environmental harm, or harm to human, animal, or plant health [emphasis added]. We address these elements individually.

**"With regard to a particular ecosystem"**: For the purposes of this analysis, we are addressing the presence of barred owls in the ecosystems defined by the ranges of the northern and California spotted owls. These include the forests of western Washington, western Oregon, and California.

**"Non-native organism" -- an organism, outside of its natural range:** Barred owls did not historically occur in the western United States. They were historically found in eastern North America, generally east of the Mississippi River, with a subspecies in central Mexico, separated from the western United States by the Great Plains and arid parts of the American southwest and northwestern Mexico. Barred owls were first reported in the range of the northern spotted owl around 1959 in British Columbia.

Barred owls have long been one of the most common, easily recognizable, and vocal owl species in the eastern forests of North America, with a distinctive 'who-cooks-for-you' call that carries over long distances in the forest. They have an easily identifiable appearance, and are conspicuous and territorial, even to humans. It is very unlikely that barred owls had been overlooked in the West prior to the turn of the 20$^{th}$ century or in the range of northern spotted owl in the mid to late 1900s. Given the apparent rapid and recent impact of barred owls on northern spotted owl population demographics over the last few decades, there is little chance that barred owls have been in contact with northern spotted owls for much more than 50 to 70 years.

**"Introduction"** means, as a result of human activity, the intentional or unintentional escape, release, dissemination, or placement of an organism into an ecosystem to which it is not native.

An introduction does not require the intention to move a species to a new ecosystem. It can be the result of creating the habitat or conditions necessary that allows a species to move or expand across what was previously a barrier to such movement. For example, building a bridge between two islands, thereby allowing terrestrial species to cross the previous water barrier is an "introduction". E.O. 13751 includes a definition of pathways as mechanisms and processes by which non-native species are moved, intentionally or unintentionally, into a new ecosystem.

The expansion of barred owls into the West is likely the result of a breakdown of the barrier previously established and maintained by conditions in relatively treeless conditions in the northern Great Plains and harsh weather of northern boreal forest, as described above, creating a pathway for movement of barred owls westward. "Pathway" means the mechanisms and processes by which non-native species are moved, intentionally or unintentionally, into a new ecosystem. Therefore, this expansion represents release or escape from previously range

limitations created by the above barriers, allowing barred owls to spread into the forests of the West.

Human actions, in particular changes brought to the northern Great Plains and northern boreal forest as a result of European settlement and potential effects of early anthropogenic climate change on winter conditions in these areas are the most likely and reasonable explanations for the breakdown of the barrier and creation of a pathway, as described above.

**"Causes or is likely to cause economic or environmental harm, or harm to human, animal, or plant health":** Barred owls have been identified as one of the two primary threats to the survival of northern spotted owls (USFWS 2011, p. II-4, III-62) and a significant threat to the persistence of California spotted owls (88 FR 11600). There is a high potential for other species being adversely affected by this new predator through direct predation or competition for prey, including other listed species or species at risk. Barred owls have the ability to exist in dense populations, which increases the impact on even common species.

## A1.4. Conclusion

Based on the summarized information above, we conclude that the barred owl in western North America meets the definition of an invasive species in E.O. 13751. The barred owl is a non-native species, not historically present in the range of the northern and California spotted owls. Barred owls were introduced unintentionally through dissemination across the previous barriers to movement of this forest owl created by the generally treeless conditions of the Great Plains and harsh conditions of the northern boreal forest. This movement was made possible by human-caused changes to the northern Great Plains and northern boreal forest. Barred owls are causing significant environmental harm to northern spotted owls, a subspecies listed as threatened under the ESA, and are likely to cause significant harm to California spotted owls as barred owl populations continue to expand. They are likely harming other species on which they prey and are considered a risk to create a trophic cascade in some forest systems.

## Literature Cited

Abram, N.J., H.V. Gregor, J.E. Tierney, M.N. Evans, N.P. McKay, D.S Kaufman and the PAGES 2k Consortium. 2016. Early onset of industrial-era warming across the oceans and continents. Nature 536, 411–418. https://doi.org/10.1038/nature19082

Arias, P.A., N. Bellouin, E. Coppola, R.G. Jones, G. Krinner, J. Marotzke, V. Naik, M.D. Palmer, G.-K. Plattner, J. Rogelj, M. Rojas, J. Sillmann, T. Storelvmo, P.W. Thorne, B. Trewin, K. Achuta Rao, B. Adhikary, R.P. Allan, K. Armour, G. Bala, R. Barimalala, S. Berger, J.G. Canadell, C. Cassou, A. Cherchi, W. Collins, W.D. Collins, S.L. Connors, S. Corti, F. Cruz, F.J. Dentener, C. Dereczynski, A. Di Luca, A. Diongue Niang, F.J. Doblas-Reyes, A. Dosio, H. Douville, F. Engelbrecht, V. Eyring, E. Fischer, P. Forster, B. Fox-Kemper, J.S. Fuglestvedt, J.C. Fyfe, N.P. Gillett, L. Goldfarb, I. Gorodetskaya, J.M. Gutierrez, R. Hamdi, E. Hawkins, H.T. Hewitt, P. Hope, A.S. Islam, C. Jones, D.S. Kaufman, R.E. Kopp, Y. Kosaka, J. Kossin, S. Krakovska, J.-Y. Lee, J. Li, T. Mauritsen, T.K. Maycock, M. Meinshausen, S.K. Min, P.M.S. Monteiro, T. Ngo-Duc, F. Otto, I.

Pinto, A. Pirani, K. Raghavan, R. Ranasinghe, A.C. Ruane, L. Ruiz, J.-B. Sallée, B.H. Samset, S. Sathyendranath, S.I. Seneviratne, A.A. Sörensson, S. Szopa, I. Takayabu, A.-M. Tréguier, B. van den Hurk, R. Vautard, K. von Schuckmann, S. Zaehle, X. Zhang, and K. Zickfeld. 2021. Technical Summary. In Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [Masson-Delmotte, V., P. Zhai, A. Pirani, S.L. Connors, C. Péan, S. Berger, N. Caud, Y. Chen, L. Goldfarb, M.I. Gomis, M. Huang, K. Leitzell, E. Lonnoy, J.B.R. Matthews, T.K. Maycock, T. Waterfield, O. Yelekçi, R. Yu, and B. Zhou (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, pp. 33−144. doi:10.1017/9781009157896.002.

Baumbusch, R.C. 2023. Foraging Ecology of Barred Owls where they are Outcompeting the Threatened Northern Spotted Owl. Oregon State University. Dissertation. 173 pp.

Campbell, I. and J. McAndrews. 1993. Forest disequilibrium caused by rapid Little Ice Age cooling. Nature 366, 336–338. https://doi.org/10.1038/366336a0

Crozier, M.L., M.E. Seamans, R.J. Gutiérrez, P.J. Loschl, R.B. Horn, S.G. Sovern and E.D. Forsman. 2006. Does the presence of barred owls suppress the calling behavior of spotted owls? Condor 108:760-769.

Dark, S.J., R.J. Gutiérrez and I. Gould Jr., I. 1998. The Barred Owl (Strix varia) invasion in California. Auk 115:50-56.

Davis, R.J., D.B. Lesmeister, Z. Yang, B. Hollen, B. Tuerler, J. Hobson, J. Guetterman and A. Stratton. 2022. Northwest Forest Plan—the first 25 years (1994-2018): status and trends of northern spotted owl habitats. General Technical Report PNW-GTR-1003. Pacific Northwest Research Station, U.S. Forest Service. Portland, Oregon. 46 pp.

Droze, W.H. 1977. Trees, prairies, and people: a history of tree planting in the Plains States. Texas Women's University, Denton, Texas.

Franklin, A.B., K.M. Dugger, D.B. Lesmeister, R.J. Davis, J.D. Wiens, G.C. White, J.D. Nichols, J.E. Hines, C.B. Yackulic, C.J. Schwarz, S.H. Ackers, L.S. Andrews, L.L. Bailey, R. Bown, J. Burgher, K.P. Burnham, P.C. Carlson, T. Chestnut, M.M. Conner, K.E. Dilione, E.D. Forsman, E.M. Glenn, S.A. Gremel, K.A. Hamm, D.R. Herter, J.M. Higley, R.B. Horn, J.M. Jenkins, W.L. Kendall, D.W. Lamphear, C. McCafferty, T.L. McDonald, J.A. Reid, J.T. Rockweit, D.C. Simon, S.G. Sovern, J.K. Swingle, and H. Wise. 2021. Range-wide declines of northern spotted owl populations in the Pacific Northwest: A meta-analysis. Biological Conservation 259, 109168. Https://doi.org/10.1016/j.biocon.2021.109168

Gilligan, J., D. Rogers, M. Smith and A. Contreras 1994. Birds of Oregon: Status and Distribution. Cinclus Publications, McMinnville, OR, USA.

Grant, J. 1966. The Barred Owl in British Columbia. Murrelet 47:39-45.

Gullett D.W. and W.R. Skinner. 1992. The state of Canada's climate: Temperature change in Canada 1895-1991. Ottawa (Canada): Environment Canada, Minister of Supply and Services. State of Environment Report no. 92-2.

Gutiérrez, R.J., A.B. Franklin and W.S. LaHaye. 1995. Spotted owl (Strix occidentalis) in A. Poole and F. Gill (editors), The birds of North America, No. 179. The Academy of Natural Sciences and The American Ornithologists' Union, Washington, D.C.

Haig, S.M., T.D. Mullihans, E.D. Forsman, P.W. Trail and L. Wennerberg. 2004. Genetic Identification of Spotted Owls, Barred Owls, and Their Hybrids: Legal Implications of Hybrid Identity. Conservation Biology, 18: 1347-1357. https://doi.org/10.1111/j.1523-1739.2004.00206.

Hanna, Z.R., J.B. Henderson, J.D. Wall, C.A. Emerling, J. Fuchs, C. Runckel, D.P. Mindell, R.C.K. Bowie, J.L. DeRisi and J.P. Dumbacher. 2017. Northern Spotted Owl (Strix occidentalis caurina) Genome: Divergence with the Barred Owl (Strix varia) and Characterization of Light-Associated Genes. Genome Biol. Evol. 9: 2522– 2545.

Holm, S.R., B.R. Noon, J.D. Wiens, and W.J. Ripple. 2016. Potential trophic cascades triggered by the barred owl range expansion: Barred Owl Trophic Cascade. Wildlife Society Bulletin. <http://doi.wiley.com/10.1002/wsb.714>. Accessed 13 Dec 2016.

Houston, C.S. and K.J. McGowan. 1999. The westward spread of the barred owl. Blue Jay, 57(4). https://doi.org/10.29173/bluejay5645.

Keane, J.J. 2017. Threats to the viability of California Spotted Owls. USDA Forest Service Technical Report PNW-GTR-254.

Keane, J.J., R.A., Gerrard, C.V. Gallagher, P.A. Shaklee, T.E. Munton and J.M. Hull. 2018. Range Expansion of the Barred Owl in the Sierra Nevada, California. PowerPoint Presentation for The Wildlife Society-Western Section Conference. Santa Rosa, CA

Kryshak, N.F., E.D. Fountain, D.F. Hofstadter, B.P. Dotters, K.N. Roberts, C.M. Wood, K.G. Kelly, I.F. Schwarcz, P.J. Kulzer, A.K. Wray, H.A. Kramer, J.P. Dumbacher, J.J. Keane, P.A. Shaklee, R.J. Gutiérrez, and M.Z. Peery. 2022. DNA metabarcoding reveals the threat of rapidly expanding barred owl populations to native wildlife in western North America. Biological Conservation 273, 109678. https://doi.org/10.1016/j.biocon.2022.109678

Livezey, K.B. 2009a. Range Expansion of Barred Owls, Part I: Chronology and Distribution. The American Midland Naturalist, 161(1), 49–56.

Livezey, K.B. 2009b. Range Expansion of Barred Owls, Part II: Facilitating Ecological Changes. The American Midland Naturalist, 161(2), 323–349. http://www.jstor.org/stable/20491442

Mazur, K.M. and P.C. James. 2021. Barred Owl (Strix varia), version 1.1. In Birds of the World (A. F. Poole and F. B. Gill, Editors). Cornell Lab of Ornithology, Ithaca, NY, USA. https://doi.org/10.2173/bow.brdowl.01.1. Accessed on September 2, 2023.

Monahan, W.B. and R.J. Hijmans. 2007. Distributional Dynamics of Invasion and Hybridization by Strix spp. in Western North America. Ornithological Monographs, 63, 55–66. https://doi.org/10.2307/40166898.

Rogers, T.H. 1966. The fall migration: Northern Rocky Mountain-Intermountain region. Audubon Field Notes 20:74. 212 pp.

Schindler, D.W. 1998. A Dim Future for Boreal Waters and Landscapes. BioScience, 48(3), 157–164. https://doi.org/10.2307/1313261

Smith, A.R. Atlas of Saskatchewan birds. No. 4. Regina: Saskatchewan Natural History Society, 1996.

Smith, M.R., P.W. Mattocks Jr. and K.M. Cassidy 1997. Breeding birds of Washington State. In Washington State Gap Analysis - Final Report (K.M. Cassidy, C.E. Grue, M.R. Smith, and K.M. Dvornich, Editors). Seattle Audubon Society Publications in Zoology no. 1., Seattle, WA, USA.

USFWS (U.S. Fish and Wildlife Service). 2004. Northern spotted owl: Five Year Review Summary and Evaluation. U.S. Fish and Wildlife Service, Portland, Oregon.

USFWS (U.S. Fish and Wildlife Service). 2011. Revised Recovery Plan for the Northern Spotted Owl (Strix occidentalis caurina). USFWS, Portland, Oregon. 258 pp.

USFWS (U.S. Fish and Wildlife Service). 2023. 2023 Proposed Rule: Endangered and Threatened Wildlife and Plants; California Spotted Owl; Endangered Status for the Coastal Southern California Distinct Population Segment and Threatened Status With Section 4(d) Rule for the Sierra Nevada Distinct Population Segment. (88 FR 11600)(50 CFR Part 17) 40 pp

Wiens, J.D., K.M. Dugger, J.M. Higley, D.B. Lesmeister, A.B. Franklin, K.A. Hamm, G.C. White, K.E. Dilione, D.C. Simon, R.R. Bown, P.C. Carlson, C.B. Yackulic, J.D. Nichols, J.E. Hines, R.J. Davis, D.W. Lamphear, C. McCafferty, T.L. McDonald and S.G. Sovern. 2021. Invader removal triggers competitive release in a threatened avian predator. Proceedings of the National Academy of Sciences 118. <https://www.pnas.org/content/118/31/e2102859118>.

Williams, M. 1989. Americans and their forests: a historical geography. Cambridge University Press, New York, New York. 599 p.

Yackulic, C.B., L.L. Bailey, K.M. Dugger, R.J. Davis, A.B. Franklin, E.D. Forsman, S.H. Ackers, L.S. Andrews, L.L. Diller, S.A. Gremel, K.A. Hamm, D.R. Herter, J.M. Higley, R.B. Horn, C. McCafferty, J.A. Reid, J.T. Rockweit, and S.G. Sovern. 2019. The past and future roles of competition and habitat in the range-wide occupancy dynamics of northern spotted owls. Ecological Applications 29:e01861.

# Appendix 2: Methodology for the Removal of Barred Owls

The following is the protocol developed for removal under the proposed Barred Owl Management Strategy (Strategy), including documentation requirements for designation as an implementer and removal specialist. It would apply to all implementers involved in lethal removal the Strategy as well as the capture and euthanize option.

The U.S. Fish and Wildlife Service (Service) intends that any removal of barred owls for purposes of the Strategy and associated MBTA permit would be conducted in a professional manner using methods that are safe, humane, and effective while meeting the need to reduce barred owl populations in treatment areas. We adopt the following guidelines and protocols to ensure that barred owl removal meets this intent through appropriate consideration of methods, timing, and safety. The included removal methods would ensure humane treatment of all affected barred owls. Every effort would be made to minimize the risk of unnecessary injury or trauma to barred owls or non-target species.

Barred/spotted owl hybrids may also be removed, as they have the same impact on spotted owls as barred owls, though this is not required. Implementers may choose to leave hybrids extant. Because visual identification of hybrids is more difficult, particularly at night, there is a specific protocol for the identification of hybrids prior to removal (See Section A2.3.3).

Minor changes to this methodology may occur during the implementation of the Strategy if information and experience justify such changes to make removal safer or more effective, while maintaining the intended high standards for humane and ethical treatment of affected animals. Any proposed changes would require approval by the Service prior to their adoption and implementation. These guidelines and protocols, as presented here, apply specifically to actions conducted under the Strategy, but may be used or adapted to other projects following any needed environmental review of those future projects.

## A2.0 Changes between Draft and Final EIS

- Clarified the requirement for removal specialists to have firearms safety training.
- Added recommendations for the timing of barred owl removal, where practicable, to reduce the injury or death of dependent barred owl young.
- Added a requirement to avoid shooting in marbled murrelet nesting habitat in the two hours before and after dawn during the murrelet nesting season.
- Clarified that removal specialists may remove fledgling and juvenile barred owls if they can be positively identified.
- Clarified the requirement for the presence of two trained specialists or observers for removal of hybrid spotted and barred owls and to submit the carcass for genetic testing.

## A2.1. Requirements for designation as an implementer.

To receive designation as an implementer for actions under the Strategy, requesting entities must provide the following information.

### A2.1.1 Information for specific removal efforts:

For barred owl removal in the range of the northern spotted owl (excluding Marin and Sonoma County and the California Cascades Province), before beginning barred owl removals, each individual or group designated to implement the Strategy must submit the following information:

- Maps of the approximate area where barred owls will be removed, preferably in the form of geospatial data (e.g., a geodatabase), but paper or electronic maps would also be acceptable, as long as the maps provide adequate reference points. These maps should also include locations of primary human dwellings, established open campgrounds, and other locations with regular human use, showing the 0.25 mile no-shooting buffer zone around these areas, and locations of known spotted owl sites.
- A list of veterinary resources and wildlife rehabilitation facilities and specialists to be contacted in case of accidental injury of non-target wildlife.
- A list of requested individuals to be designated as removal specialists. These individuals must be approved by the Service as the permit-holder, prior to any removal work.

For barred owl removal in Sonoma or Marin County, or within the California spotted owl range or potential invasion pathways (including the California Cascades Province in the northern spotted owl range):

- A general map or description of the areas where barred owl removal may occur. This can be at a regional or county scale.
- A list of veterinary resources and wildlife rehabilitation facilities and specialists to be contacted in case of accidental injury of non-target wildlife.
- A list of requested individuals to be designated as removal specialists. These individuals must be approved by the Service as the permit-holder, prior to any removal work.

Any proposed changes to the above information must be submitted with the annual report. Changes in in the boundaries of the barred owl removal area may be updated at any time, but must be approved by the Service prior to implementation.

### A2.1.2 Information required for designation as a removal specialist:

Prior to being designated as a removal specialist authorized to remove barred owls under the Strategy, each individual requesting designation must provide documentation of training or experience in the following areas. The Service will review the request and may ask for additional information. The Service reserves the right to determine who would be designated as a removal specialist under the Service MBTA permit.

- Barred owl and spotted owl identification, using visual and auditory means.
- Firearm Safety Training.
- Firearm skill and accuracy.
- Understanding of the methods for removing barred owls with firearms.
- Barred owl handling and human field euthanasia methods.
- Experience with barred owl removal.

Experienced removal specialists should ensure that their documentation includes:

- Total number of years and dates of previous removal experience.
- Number of barred owls removed.
- Number of barred owls injured and not recovered.
- Any injury to non-target wildlife.
- To demonstrate understanding of the protocol, describe at least one situation where they decided not to shoot the target bird, or if that situation has not occurred, a hypothetical situation in which they would not shoot an owl.

Individuals who have received training but have not yet conducted independent barred owl removal should ensure that their documentation includes:

- The name of the trainer who provided training in barred owl removal methodology.
- Dates on which they observed at least three separate successful barred owl removals by the trainer.
- Dates on which they identified and successfully removed at least four barred owls under the supervision of the approved trainer.
- Documentation that the trainer has certified them as being ready for independent removal.

Changes in personnel wishing to be designated may be updated at any time by requesting addition or removal of individuals as removal specialists and submitting the information describing their qualifications as described above. The Service must approve the request before the individual is authorized to remove barred owls under the Service's MBTA permit. The Service reserves the right to disapprove a proposed removal specialist for any reason. Any removal specialist found to violate the protocol may have their designation revoked. The Service reserves the right to conduct field visits at any time to observe any barred owl removal conducted under the Strategy.

## A2.2. Considerations Prior to Conducting Removal Activities

Prior to initiating removal, any preliminary monitoring required for the permit should be completed (See Appendix 5.1.1.).

### A2.2.1. Timing of Barred Owls Removal

Removal of barred owls may occur at any time of the year. However, we recommend focusing activities before and during the barred owl nesting season (early spring through mid-summer), and in the fall. Past studies have demonstrated that barred owls are easier to locate and remove during these periods.

To reduce injury and death of dependent young, we recommend, but do not require, the following:

- initiate barred owl removal on management areas in the fall, where practicable. This reduces the population at a time when there are no dependent young. However, these areas may be recolonized quickly, requiring additional removal the following spring.

- initiate removal as early as possible in the spring, prior to barred owl nesting and the hatching of eggs, where practicable. This is a very effective time for removal, opening sites to potential colonization by spotted owls prior to their breeding season and reducing pressure on any nearby occupied spotted owl sites for nesting. The time of nest initiation and egg hatching will vary across the range of the Strategy, therefore implementers should use the best available information for their areas in defining these dates.
- If barred owl nests are found during the period when they are likely to have dependent young, consider delaying removal of the adults until the young can be removed or are independent, if practicable.
- If fledgling barred owls are located with adults, or have acquired adult feather characteristics, remove young prior to removing adults.

To reduce the potential to disturb marbled murrelets during critical nesting and feeding periods, no shooting is allowed within 0.25 miles of marbled murrelet nesting habitat during the marbled murrelet breeding season for the two hours before and after dawn. Marbled murrelet nesting habitat definition can be found in the most recent marbled murrelet inland survey protocol (Pacific Seabird Group 2024) or by checking with the USFWS prior to initiating removal efforts.

### A2.2.2. Identification of Barred Owls Prior to Removal

Positive identification of barred owls prior to removal must be confirmed by either two individuals (removal specialist and a trained observer) or by a single removal specialist ideally identifying the bird by both visual and auditory cues. In the absence of auditory cues, barred owls may be removed by visual identification only **if** an experienced removal specialist has a clear and unobstructed view of the owl and is able to detect multiple components of the species' characteristics. Note that barred owls in the West may exhibit muted visual characteristics such as the extent of barring on the front chest. If there is any doubt about the species identification, no removal attempt shall occur, and a new attempt may be conducted at a later time.

Fledgling and juvenile barred owls may be removed **if** they can be positively identified as barred owls, such as older juveniles with developed chest and abdominal contour feathers. Young birds in the nest and/or direct contact with adult barred owls may also be taken. As with adults, if there is any doubt as to their identification, no removal attempt shall occur, and a new attempt conducted at a later time.

Persons participating in removal activities must be able to accurately identify spotted owls and barred owls using both visual and auditory means, and confidently distinguish between the two species. Individuals not experienced with such identification must receive training and testing in owl identification prior to removal activities (see training section below). Individuals who have not completed at least a year of removals or over 25 removals would need to receive testing on owl identification.

### A2.2.3. Preparation for Injury of Barred Owls or Accidental Injury of Non-Target Species

While the protocol is designed to substantially avoid injury to non-target species, such injury may still occur. Prior to conducting barred owl removal activities, parties responsible for removal shall identify veterinary resources and wildlife rehabilitation facilities and specialists within reasonable transport distance of the removal sites. Those involved in removal should have contact information available during field work. Removal specialists should be aware of appropriate handling techniques for safe and humane transport of injured animals to rehab facilities and have any needed equipment (e.g., carriers).

Any barred owls wounded, but not killed, during removal shall be humanely euthanized using methods approved by the Service or by the American Veterinary Medical Association, where possible. All people involved in removal should be trained in effective, humane methods of field euthanasia and have all the necessary material available at all times during removal.

## A2.3. Guidelines and Precautions for Lethal Removal

The following guidelines are designed to minimize the risk of nonlethal injury or suffering of barred owls, or the injury or death of non-target species, during lethal barred owl removal, while ensuring the safety of field personnel and the public.

### A2.3.1 Lethal Removal Methods

When setting up the location for barred owl removal, reasonable effort should be made to limit the shooting distance to no more than 30 yards to minimize the risk of nonlethal injury or prolonged death. Removal specialists should seek a removal location that offers multiple unobstructed perch sites with clear shooting opportunities within the preferred distance of 20 to 30 yards prior to attempting to attract the barred owl into shooting range.

Barred owls will be lured to the removal specialist using an amplified megaphone, or similar device, to broadcast digitally recorded barred owl calls, alternating with listening for responses. The calls and mix of calls are at the discretion of the removal specialist, but generally include single-note hoot, 2-phrase hoot, ascending hoot, and pair duet calls. Generally, removal specialists will call for about 15 minutes at a location before moving on if no barred owls are heard. However, conditions or topography may require a longer period, at the discretion of the specialist. If barred owls are heard, calling may continue intermittently as long as there is some potential for the barred owl to be lured in. The specialist may also relocate to better access the barred owl.

For area-based removal, calling stations should be located about ¼ to ½ mile apart, taking advantage of topographical features to cover the forest lands within the area. For efforts to locate and remove previously reported barred owls, multiple calling stations may be required to find the barred owls for removal.

Before any removal, positive identification of the barred owl is required, confirmed by either two qualified observers (two qualified removal specialists or one specialist and one individual

skilled in owl identification) or by a single qualified removal specialist identifying the bird by both visual and auditory cues. Barred owls may be removed in the absence of vocalizations, but only if the observer has a clear and unobstructed view of the front of the owl and is able to detect multiple components of the species' characteristics.

If spotted owls are detected in the immediate vicinity of barred owls, it may become difficult to "track" individual birds, especially during agonistic encounters between the two species. Unless the barred owl can be "pulled" at least one-half mile away from the spotted owls, lethal removal at that location shall be postponed to a later date to minimize the risk of accidental injury or death of a spotted owl, either from removal or inter-species encounters. If a second observer is available who can keep track of the spotted owl, the removal effort can continue as long as the spotted owl's location remains known.

To avoid disturbing nesting spotted owls, removal should generally not occur within 300 yards of a known active spotted owl nest during the critical breeding period for spotted owls (March 1 to July 31, or as established locally). To avoid drawing barred owls close to an active spotted owl nest, we recommend that any barred owl removal location be at least 0.25 miles from known active spotted owl nests, and in a direction that would not pull the barred owls towards the spotted owl nest.

Lethal removal shall be done by shotgun of 20 gauge or larger bore, using non-toxic lead-substitute shot **(**e.g., Hevi-shot, steel). Lead shot may not be used. Rifles, pistols, or other firearms or methods are not authorized under this protocol unless explicitly approved by the Service for specific situations or occasions. "Quiet" shotguns (e.g., shotguns modified to reduce noise) may be used to reduce impacts to wildlife or humans, if allowed under State or local agency rules and regulations. Before initiating removal efforts, and periodically during the season, removal specialists should test the pattern and distance characteristics of their gun to ensure they know the capabilities of the gun and loads. We recommend that shotguns be equipped with an attached night scope or other gunsight designed specifically for night use for accurate and precise aiming in dark or low light conditions (e.g., red dot sight mount).

All shots must be directed at barred owls which are **stationary** on an unobstructed perch and present a full, frontal and unobstructed view. On-the-wing shots are not authorized under this protocol.

If barred owls are wounded, but not killed, every reasonable effort shall be made to locate any injured barred owls and euthanize it quickly and humanely. All personnel must be trained in field euthanasia and carry the needed equipment at all times during any removal attempt.

Any injury or death of a non-target species must be immediately reported to the designated Service contact. Any injured animals other than barred owls should be transported to a licensed rehabilitation facility. In addition to the immediate reporting to the Service contact, the circumstances surrounding such unintended injury or death must be described in a written incident report sent to the designated Service contact within 3 business days of the incident; this information must also be included in the annual report. If the non-target species is a listed threatened or endangered species (e.g., spotted owl) no further removal activities may be

conducted until the Service reviews the incident report and authorizes such activities to resume.

In situations where firearms cannot be used or their use is inadvisable due to safety concerns, local regulations, or the density of human habitation, removal specialists may capture and euthanize barred owls, see Section 2.4 for additional details.

Carcass Recovery and Disposition: Reasonable effort should be made to retrieve barred owl carcasses immediately after the shot while allowing for safety considerations, particularly at night in rough terrain. If the carcass cannot be located at the time of shooting, the removal specialist should return to the site as early as feasible the next day to resume the search. If the carcass cannot be located within a reasonable time, the removal specialist will describe the situation on the data card, including any information regarding the likelihood that the shot may have missed, or that the bird was injured and escaped. Any such incident reports will be appended to the annual report for the project.

The following data must be recorded for each carcass:

> Removal date and time, removal specialist's name, specific location (Universal Transverse Mercator (UTM) coordinates are recommended), name of other persons assisting or observing, and permit number under which the specimen was collected.
>
> To improve our understanding of barred owl populations, the following physical measurements should be taken from the carcass if possible: body mass, foot-pad length, and sex (if known) (Baumbusch 2023, pp. 85, 113). This information allows estimation of the body condition of the barred owl.
>
> For each carcass recovered, three photographs of the carcass are required – 1) the front – including head, chest, and tail, including a clear view of the lower abdomen; 2) the underside of the tail, flared out; and 3) the underside of the spread wings to allow aging of the specimen. If a carcass could not be safely recovered, this should be noted on the data form.

Once the data and photographs are collected, the carcass should be "buried" on site by placing under duff, branches, or logs to secure the carcass without disturbing the soil. The location should be out of sight of roads, trails, or human habitation. If this is not possible or advisable, carcasses may be transported to an appropriate disposal facility. If transported from the removal site, carcasses must be tightly double bagged to avoid spread of disease. Carcasses may also be transmitted to an entity that has indicated interest and holds the appropriate MBTA and State permits to receive or dispose of the specimen and who have indicated with an official letter their interest in accepting the donation.

### A2.3.2 Safety

Lethal removal involving firearms is inherently dangerous; more so under the evening or darkness conditions likely to be optimal for barred owl removal. The safety of the public and

the persons involved in the activities is of utmost importance. Therefore, the following measures must be employed to ensure the safety of all involved.

All personnel involved in lethal removal must have received firearm safety training and demonstrated skill, accuracy, and precision with the shotgun to be used prior to conducting removal activities. Accuracy is critical to avoid wounding barred owls. Training should cover shotgun use and protocol, along with the ethical, logistical, and safety considerations of conducting the removal. Removal specialists or their employers are responsible for obtaining firearms safety training.

Removal specialists are responsible for obtaining all applicable State, Tribal, and Federal licenses and permits necessary for possession and use of firearms, and for their transport to and from the study area. Removal specialists are responsible for meeting all safety and operational requirements pertaining to those permits.

Removal specialists must observe all laws, regulations, ordinances, (including State, Tribal, and local, as applicable) and site-specific requirements regarding use of firearms on public lands, near human habitation, within parks, etc. At a minimum, we require a no-shooting buffer zone of 0.25 mile around occupied dwellings, established open campgrounds, and other locations with regular human use. Prior to and during removals, the removal specialists or observers must assess the area for potential human presence (homes, tents, vehicles) and appropriate buffers must be applied.

Individual landowners or managers may establish other requirements based on their knowledge of particular conditions or areas within the study area. Where conflicts with other human uses may occur, the removal specialists should attempt to draw the barred owls away from such situations to favorable removal locations through well-planned calling. A “silent” or other legal sound-suppressed shotgun may be used in areas where people may be disturbed if these are allowed under State, Tribal, and local laws or with the appropriate permits.

Appropriate local law enforcement, and agency law enforcement for the lands on which removals will occur, should be contacted prior to field work to minimize public concerns over nighttime discharge of firearms, or their use in areas where they are generally prohibited (e.g., parks), thus avoiding unnecessary law enforcement response. Coordinate with State, Tribal, and Federal agency biologists for the area where the removal will occur. Consider contacting local landowners to minimize public concern. No removal may be conducted in any area without the permission of the landowner on which the removal occurs.

### A2.3.3 Lethal Removal of Hybrids

Hybrids between barred owls and spotted owls are generally rare and obvious hybrids are not commonly encountered. Hybrids are not specifically the focus of this Strategy but have the same effect on spotted owl populations and may be removed under this Strategy and protocol. Many first-generation hybrids (one parent of each species) do exhibit physical or vocal characteristics (or both) intermediate to the parent stock, but even these characteristics may be difficult to identify under removal conditions. Second or third generation back-cross

individuals (e.g., cross between a hybrid and a barred owl) are difficult to detect even in hand and usually closely resemble the non-hybrid parent.

Since the prescribed method for lethal removal does not provide an opportunity to inspect the individual "in hand" prior to the commitment to remove, identification will rely on a reasonable consideration of observational evidence under field conditions. All removal of hybrids requires two individuals, including at least one removal specialist, both of which are specifically trained or experienced in the identification of hybrids. **If in doubt, removal specialists shall not remove the individual owl until additional follow-up can verify its identification as a hybrid.** If an owl is identified as a hybrid based on field characteristics, it may be removed with appropriate protocols ensuring the identity of the individual. We anticipate that most second-generation and later-generation hybrids that back-cross with barred owls will appear in the field as barred owls and will be removed as such.

Given the difficulty in identifying hybrids, inadvertent lethal removal of even a first-generation hybrid may occur and the hybrid characteristics may not be evident until the specimen is in hand. If an owl carcass appears to be a hybrid once in hand, the specimen should be tagged for future analysis. All confirmed incidences of the removal of hybrids should be reported to the Service as part of required annual reports. These are not considered a take of spotted owls.

#### A2.3.3.1. Identification of Hybrid Owls Prior to Removal

Identification of hybrid owls requires both visual and auditory observations. If there is any possibility that it could be a spotted owl, the bird must not be removed. The following identification protocol is specific to the removal of suspected hybrid owls. It is focused on insuring that spotted owls are not removed by accident but accepts a higher risk for barred owls to be removed, even if initially identified as hybrids. Hybrids are very uncommon in most areas, and removal specialists may have little experience with their identification. Therefore, we require two individuals (removal specialist and a trained observer) make a positive identification prior to removal. It may be worth waiting until an expert with experience of hybrid owls can verify the identification.

Visual identification of hybrids in the field can be very difficult, particularly at night when most removal occurs, so visual identification alone is not adequate for removal of suspected hybrid owls. The defining visual features for hybrids vary across specimens and are understandably more subtle in nature than the difference between the two species. The focus of this identification is to ensure that spotted owls are not identified as hybrids. While visual identification alone of a free ranging owl is often insufficient to positively verify a hybrid individual, it is still an important part of the identification protocol. Before removal, the shooter must observe a frontal view of the bird to eliminate the possibility that the targeted bird may be a spotted owl.

To ensure the suspected hybrid owls are correctly identified, the observers must hear the bird use a territorial defense song (e.g., 8-note hoot or descending hoot of the barred owl) numerous times (at least 6). The observer must hear multiple complete calls before making a decision to remove the hybrid.

If a suspected hybrid uses a standard barred owl territorial defense song eight-note hoot (sometimes called two-phrase-hoot = who-cooks-for-you who-cooks-for-you-too) and shows some definitive evidence of barred owl plumage characteristics, it can be removed per the barred owl removal protocol. Examine the specimen in hand and if there is any question, note this in the records.

If a bird **at any time** uses a typical spotted owl territorial defense song (4-note - hoot, hoot-hoot hoooooot) in its repertoire, then it may be a spotted owl. It is critical to realize that individual spotted owls do not always use the complete standard hoot. For example, individuals have been known to consistently drop the first note or add a tag note at the end, and different parts of the call attenuate at different rates over distance. **If there is any question as to whether the bird may be a spotted owl, no removal shall occur.**

If a bird gives multiple complete territorial defense song calls while visible, none of which can be clearly classified as typical spotted owl calls, the calls sound like a mix of barred and spotted owl characteristics, and the bird shows some definitive evidence of barred owl plumage characteristics, the bird may be removed. Examine the bird in hand for hybrid features.

All suspected hybrids should be recorded prior to removal, if it can be done without interfering with the positive identification of targeted owls in the field. While this is not required, it will assist in developing more definitive methods for identifying hybrid owls. All other aspects and requirements of barred owl removal apply to removal of hybrid owls.

#### A2.3.3.2. Hybrid Owl Carcasses

All suspected hybrid carcasses will be tested for genetic confirmation. Carcasses may be frozen and sent to the USFWS or other qualified lab for genetic testing, and the result shared with the USFWS.

Given the difficulty in identifying hybrids, inadvertent lethal removal of even a first-generation hybrid may occur and the hybrid characteristics may not be evident until the specimen is in hand. If an owl carcass appears to be a hybrid once in hand, the specimen must be tagged for future analysis. All confirmed incidences of the removal of hybrids must be reported to the Service as part of required annual reports. These are not considered a take of spotted owls.

## A2.4. Guidelines and Precautions for Capture and Euthanasia

While most removal will involve lethal removal in the field, there may be occasional situations where firearms cannot be used. In those cases, the owls may be captured and euthanized. We do not recommend this as a primary removal method as it includes added stress for the barred owls.

The following guidelines and precautions apply specifically during nonlethal removal of barred owls. They are designed to minimize the risk of injury, excessive stress, or suffering of barred owls during capture or the injury or death of non-target species.

### A2.4.1. Live Capture Methods

Capture would be accomplished using techniques that minimize the risk of injury or mortality to barred owls, yet prove effective in capture. Any technique must be designed to secure the barred owl quickly, with the minimum potential for injury, and be approved by the Service.

Any captured animal must be removed immediately from the capture device. Personnel responsible for barred owl capture must be trained and experienced with the capture technique. When deployed, capture devices must be attended at all times by a person trained in the employed capture method. Euthanasia may be conducted immediately upon capture, or barred owls may be moved to a better spot for euthanasia, as long as this occurs as quickly as practicable after capture.

Any non-target species inadvertently or incidentally captured during the attempted capture of a barred owl must be inspected for injury and, if uninjured, released immediately at the capture site. Injured animals should be transported to a licensed rehabilitation facility immediately. Any injury or death of a non-target species must be immediately reported to the designated Service contact and a written incident report sent to the designated Service contact within 3 business days of the incident; this information must also be included in the annual report. If the non-target species is a listed threatened or endangered species (e.g., northern spotted owl) no further removal activities may be conducted by the designated entity until the Service authorizes such activities to resume.

## A2.5 Training and qualifications.

All individuals conducting removal under the Strategy will be required to provide documentation of their experience or training to the Service, or the Service's designated representative, for the Service's approval. This should cover the following areas:

1. Barred and spotted owl identification, using visual and auditory means.
2. Firearm skill and accuracy.
3. Understanding of the methods for removing barred owls with firearms
4. Barred owl handling and humane field euthanasia methods
5. Experience with barred owl removal.

For individuals experienced with the removal of barred owls, the above information will be sufficient. This should include the number of years (and dates) of removal experience, number of barred owls removed and of any barred owls injured and not recovered, and any injury to non-target wildlife. To evaluate the individual's understanding of the protocol, they must describe at least one situation where they decided not to shoot the target bird or if a real-life example is not available, describe a hypothetical situation in which this might take place.

For individuals not experienced with the removal of barred owls, include documentation of the following training:

1. Barred and spotted owl identification. This will be part of the classroom and field training and include a visual and auditory owl identification test. Specific training in the identification of hybrids is required for authorization to remove hybrids.

2. Firearm use, including shooting from various distances, and angles, shots taken at 20 to 25 yards, and using a target the size and shape of a Barred Owl with identified kill zones.
3. Training in the ethics of conducting lethal removal, including when to walk away and skill in the use of rapid and approved euthanasia methods for barred owls.
4. Understanding of the removal protocol and equipment, including
    a. equipment requirements and safety check;
    b. assessing surroundings and potential nearby human presence prior to any collection activity at a given location (i.e., dwellings, hiking trails, tent campers);
    c. determining if spotted owls may be nearby;
    d. selection of favorable removal locations, placement of callers, and call sequences
    e. criteria for taking a shot or deciding when to walk away
    f. data collection, including use of equipment and information/photos required.
5. All inexperienced personnel requesting barred owl removal authorization must obtain experience with identification and removal of barred owls in the field under the direct supervision of an approved trainer experienced in barred owl removal methodology. This includes:
    a. Observe at least 3 separate successful barred owl removals by an approved trainer.
    b. Correctly identify and successfully remove at least 4 barred owls under supervision of an agency-approved trainer.
    c. Be certified by the trainer as ready for independent removal. The trainer may require more removals for a particular trainee if the trainer feel the trainee needs more experience to effectively and carefully conduct the activity.

The Service retains the right to require additional training or documentation, and to refuse to qualify individuals to operate under the Service MBTA permit at our sole discretion.

## Literature Cited

Baumbusch, R. C. 2023. Foraging Ecology of Barred Owls where they are Outcompeting the Threatened Northern Spotted Owl. Oregon State University. Dissertation. 173 pp.

# Appendix 3: Prioritization of Actions in the Northern and California Spotted Owl Range

All actions described in the Barred Owl Management Strategy (Strategy) are prioritized within each province or area to provide focus and recommendations to implementing entities, though it is non-binding and any action described by the Strategy would be allowed at any time.

## A3.1. Northern spotted owl

Within the northern spotted owl range, the strategy used a 5-level prioritization system (A to E), applied at the province level, ranging from actions that should be implemented immediately to those that are not urgent but that could still assist in stabilizing or providing additional support to spotted owl populations.

> **Priority A** defines actions that should, and can, be implemented immediately to prevent extinction or extirpation of spotted owls in the province or significant areas in the province, particularly in areas with very low spotted owl populations. This focuses actions on the highest risk areas and actions with the highest urgency in each province.
>
> Additionally, in areas where spotted owl populations are not critically low, this defines actions needed to secure key areas with remaining populations as anchors to eventual expansion. This focuses actions on areas with remaining spotted owl populations in provinces where extirpation is not imminent, to secure and improve spotted owl populations, thereby creating refuge populations that may serve as sources of natural or human-facilitated expansion to other areas where barred owl populations have been reduced.

In general, Priority A applies to site and block management of areas where spotted owl presence is known, allowing for quick implementation where it will be most effective. For block management areas, the presence of study areas and/or previous or ongoing barred owl removal research are likely to contribute to faster, more effective implementation, and contribute to the classification of actions as Priority A.

> **Priority B** defines actions that should be implemented as soon as possible to slow spotted owl population declines. This is intended to reduce ongoing population declines in at least some areas within the province (e.g., management areas) that if unchecked could lead to extirpation or extinction all or a significant portion of the province. In some cases, this focuses on avoiding declines in spotted owl populations to the degree that the populations are incapable of recovering without human intervention, such as augmentation through translocation or captive breeding.

In general, Priority B also applies to site and block management of areas where spotted owl presence is known, or at least suspected. Some Priority B block management areas are well-known and easily accessible, whereas others may require survey effort prior to implementation.

Priority B actions are urgent and high priority, but are generally either more difficult to implement, or slightly less urgent, than Priority A actions.

> **Priority C** defines actions that should be implemented in the near future to establish areas for spotted owl populations to stabilize and increase to sustainable levels. This includes efforts to stop ongoing population loss in management areas and provide opportunities for recolonization. This focuses on creating landscapes for the stabilization and increase in spotted owl populations, building beyond the current populations where they exist, or providing areas for potential augmentation. This is a focus on creating viable populations, likely at the management block level. This is still focused on the near future, but not as urgent as Priority A and B elements.

Priority C site management and block management may apply to areas where spotted owls are not currently present, or where their presence is unknown. Priority C block management areas include some areas where population stabilization is possible, but increases in spotted owl populations are unlikely, due to habitat limitations. Other Priority C block management areas currently have very low or unknown spotted owl populations, and any population response to barred owl management is likely to be very slow.

> **Priority D** defines action that, if implemented, would further assist in stabilizing or increasing spotted owl populations. Some have value in the near future, while some will provide their greatest value later in time, when nearby areas develop spotted owl populations. This allows for identification of actions that, while not urgent, could be important to the recovery of spotted owls over the intermediate or longer term.

Priority D site management and block management may apply to areas where spotted owls are not currently present, or where their presence is unknown. Most Priority D block management areas are focused on creating or protecting demographic connections between populations in adjacent, higher-priority management areas.

> **Priority E** defines actions that, if implemented, would provide additional support to spotted owl populations. This allows for actions that are not urgent but could still contribute to the recovery of the spotted owl. These may be focused on actions that provide their value later in time.

Priority E does not apply to site management. Most Priority E areas are adjacent to other areas with higher priorities, and management within the Priority E areas may augment or increase the effectiveness of actions within these neighboring, higher-priority areas.

## A3.2. California Spotted Owl

Within the California spotted owl range, the strategy used a 3-level prioritization system (A to C), applied individually for the two populations, Sierra Nevada and southern California. These range from actions that should be implemented as soon as possible to prevent successful invasion of the California spotted owl range in areas of highest risk to those that are not urgent but that could still assist in limiting the barred owl invasion.

**Priority A:** Actions that should be implemented as soon as possible to prevent barred owls from establishing populations where they are not yet established or building on existing populations, particularly in areas where the risk of population establishment is high. The focus of this priority is on elements and actions that need to be implemented in the very near future to prevent barred owls from establishing reproductive populations that could further feed barred owl population establishment in the California spotted owl range. This would generally be focused on areas at highest risk for the establishment of barred owl populations.

**Priority B:** Actions that should be implemented in the near future to prevent barred owl populations from expanding and establishing populations where they do not currently exist. The focus of this priority is on elements and actions that should be implemented in the near future to better ensure we prevent barred owls from developing populations and increasing. These may represent areas more removed from the risk of the establishment of barred owl populations.

**Priority C:** Actions that may be implemented over time and that would help to prevent barred owl populations from expanding and establishing populations. The focus is on securing the remaining areas, often more remote from the source of barred owls, or added monitoring/inventory that may further efforts to ensure barred owls do not manage to develop reproductive populations.

# Appendix 4. Barred Owl Management Strategy by Province or Area

This appendix describes the details on the Barred Owl Management Strategy (Strategy) by physiographic province for the northern spotted owl and by population for the California spotted owl. It contains information on northern spotted owl site management, including recommendations and prioritization for implementation. For management areas, it describes the reasons for selecting each area, the recommendations for management, and suggested priorities for implementation. For General Management Areas (GMAs), we discuss recommendations for the size and factors to consider in placing Focal Management Areas (FMAs). For special designated areas, we describe recommended management approaches.

We recommend that anyone wishing to implement actions under this Strategy use the information in these appendices to assist in the design of barred owl management.

## A4.1 Olympic Peninsula Province

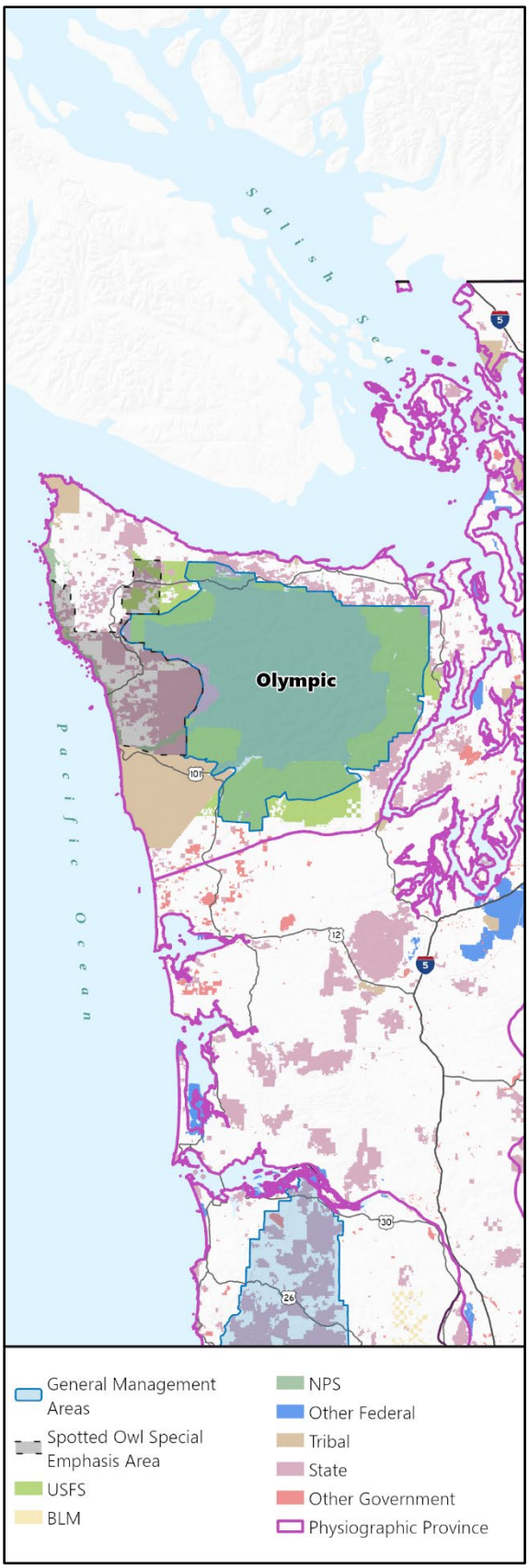
### A4.1.A Background

The Olympic Peninsula Province includes a large portion of National Park lands, with some Forest Service lands. The province includes 49 percent of the forest lands in Federal management, 15 percent in State management, 9 percent on Tribal lands, and the remainder generally in private ownership.

The Olympic Peninsula Province is characterized by high rainfall and cool to moderate temperatures at low to mid elevations. High elevations and cold temperatures occur in the interior portions of the Olympic Peninsula. Topographic variation in elevation between valley bottoms and ridges is high in the Olympic range, with many high-elevation areas supporting permanent snowfields and glaciers. Root diseases and wind-throw are important natural disturbance mechanisms that form gaps in forested areas.

#### A4.1.A.1 Spotted Owl Condition in the Olympic Peninsula Province

Federal lands in the province include approximately 723,935 acres of spotted owl nesting and roosting habitat (Davis et al. 2024a). Spotted owls here are limited to the elevations below 2,952 feet. The topographic variation creates conditions favorable for development of non-contiguous, fjord-like tracts of habitat at the higher end of this elevation range, with more contiguous forests at lower elevations. Douglas-fir (*Pseudotsuga menziezsii*) and western hemlock (*Tsuga heterophylla*) dominate forests used by spotted owls in this province. Because Douglas-fir dwarf mistletoe (*Arceuthobium douglasii*) is unusual in this region, spotted owl nesting habitat consists of stands providing very large trees with cavities or deformities. A few nests are associated with western hemlock dwarf mistletoe. Flying squirrels (*Glaucomys* spp.) are the dominant prey, with




snowshoe hares (*Lepus americanus*) and bushy-tailed woodrats (*Neotoma cinerea*) also representing important items in the spotted owl's diet (Forsman et al. 2001, p. 145).

The spotted owl population in the Olympic Peninsula Province is isolated from the rest of the spotted owl range by marine areas, developed areas, and large expanses of mainly younger forest, which generally do not provide suitable conditions for spotted owl occupancy. The Olympic Peninsula Province includes the Olympic Demography Study Area, and this study area provides the best representation of the status of spotted owls in the province. The Olympic study area provides data on spotted owl populations since 1987. Monitoring efforts on the Olympic study area indicate that spotted owl occupancy at historical territories has declined substantially. This study area, along with the Cle Elum study area in the Eastern Washington Cascades, has shown the highest rate of spotted owl population decline, nearly 9 percent per year from 1995 through 2017 (Franklin et al. 2021, pp. 11-13). Spotted owl pair occupancy dropped from 77 percent in 1993 to 12 percent in 2018 (Davis et al. 2022, p. 37). Since then, spotted owl monitoring in the study area has been conducted only via passive acoustic monitoring. In 2022, spotted owls were detected at 27 percent of sample units (hexagons), an increase from the 16 percent of sample units where they were detected in 2018 (Lesmeister et al. 2023, p. 17). These percentages are not directly comparable to those reported for 2017, because they were obtained with different methods. The areas where spotted owls persist on the Olympic Peninsula are mostly in the areas with lowest barred owl density, in the relatively higher elevation areas, at the backs of fjord-like valleys of habitat, surrounded by high elevation ridges without habitat.

### A4.1.A.2 Barred Owl Condition in the Olympic Peninsula Province

Barred owls have been present at high densities in Washington for longer periods of time compared to areas farther south in the northern spotted owl range. In the Olympic Demography Study Area, barred owls occupied 94 percent of the of the sample units (hexagons) surveyed via passive acoustic monitoring in 2020 (Lesmeister et al. 2022a, p. 22). Barred owl populations are denser at lower elevation, more contiguous forests of the Olympic Peninsula Province, and are less dense at higher elevation, less contiguous forests, particularly in the backs of long, narrow, forested valleys separated by high elevation ridges without forests.

## A4.1.B Management Strategy

### A4.1.B.1 Spotted Owl Site Management in the Olympic Peninsula Province

*A4.1.B.1.a Background*

Given the limited spotted owl population in this province, it is crucial to protect the remaining spotted owls through barred owl management at spotted owl sites. Because many areas have not been surveyed consistently in recent years, we recommend that historically active sites, particularly those active regularly over the past 10 years, be surveyed for activity.

In some cases, managed sites may eventually be incorporated into block management areas. In other cases, site management of single sites or clusters of sites may be an appropriate long-term action, if larger blocks of habitat are not available for management due to topographic or ownership conditions.

- Managing barred owls in recently occupied spotted owl sites is intended to help reduce the rate of spotted owl population decline as quickly as possible and prevent extinction/extirpation of the spotted owl in the province.
- Managing barred owls in spotted owl sites that are, or become, reproductively active, may enable those sites to provide a source of young for colonization of nearby management blocks. These sites may provide demographic support for nearby management blocks.
- Where spotted owl site management occurs within a GMA, these spotted owl sites may serve as key points for the development of focal management areas, now and in the future. Site management may be expanded into block management over time.
- Managing barred owls in spotted owl sites distributed across the province, whether within block management areas or not, may reduce the risk of loss of spotted owls in the province from catastrophic events, such as wildfire, by maintaining site occupancy across the area. Managing spotted owl sites also provides the opportunity for maintaining spotted owls in areas where block management is not feasible or recommended. This approach applies across the entire province, whether or not the locations are within a GMA or other mapped designation.
- These managed spotted owl sites may provide a potential source of spotted owl individuals for direct augmentation of block management areas in the future, should such management action be necessary.
- These spotted owl sites may serve to increase connectivity between and within block management areas, and provide sites in the vicinity of block management areas that can interact at a demographic level with those management areas.
- Spotted owl site management, due to its smaller size when compared to block management, provides a wider range of options for landowner contribution to barred owl management, particularly for smaller landowners. The smaller size also makes site

management suitable for areas where there are not large amounts of spotted owl habitat due to terrain, or extensive loss of habitat from wildfires, harvest, or other disturbances.

*Selection of spotted owl sites for management in Olympic Peninsula Province*

The primary focus of spotted owl site management in this province is on currently or recently active sites, where spotted owls are more likely to be present or recolonization of sites after barred owl removal is more likely. This is reflected in the priorities for site management. However, because many areas have not been surveyed consistently in recent years, or at all, older data and habitat condition may also be considered in establishing site management areas. We recommend that any historically active sites, particularly those active regularly over the past 10 years, be surveyed for activity. In the Olympic Peninsula Province, the highest priority is to start with individual site management within and around known currently and recently active spotted owl sites to prevent local extirpation in the province and provide source population for the GMA.

*Spotted Owl Site Management Priorities*

| Priority | Spotted Owl Site Condition |
|---|---|
| A | Currently and recently active sites, including all areas with any spotted owl detections within the last 5 years |
| B | Historically occupied spotted owl sites (pair or single) with last detection between 5 and 10 years ago |
| C | Historically occupied spotted owl sites (pair or single) with last detection more than 10 years ago |
| D | Potential sites with adequate habitat but no known history of spotted owl occupancy, and without detections within the last 5 years |

*Other considerations for selection of spotted owl sites for management:*

We recommend consideration of the following factors when selecting among sites within a priority category.

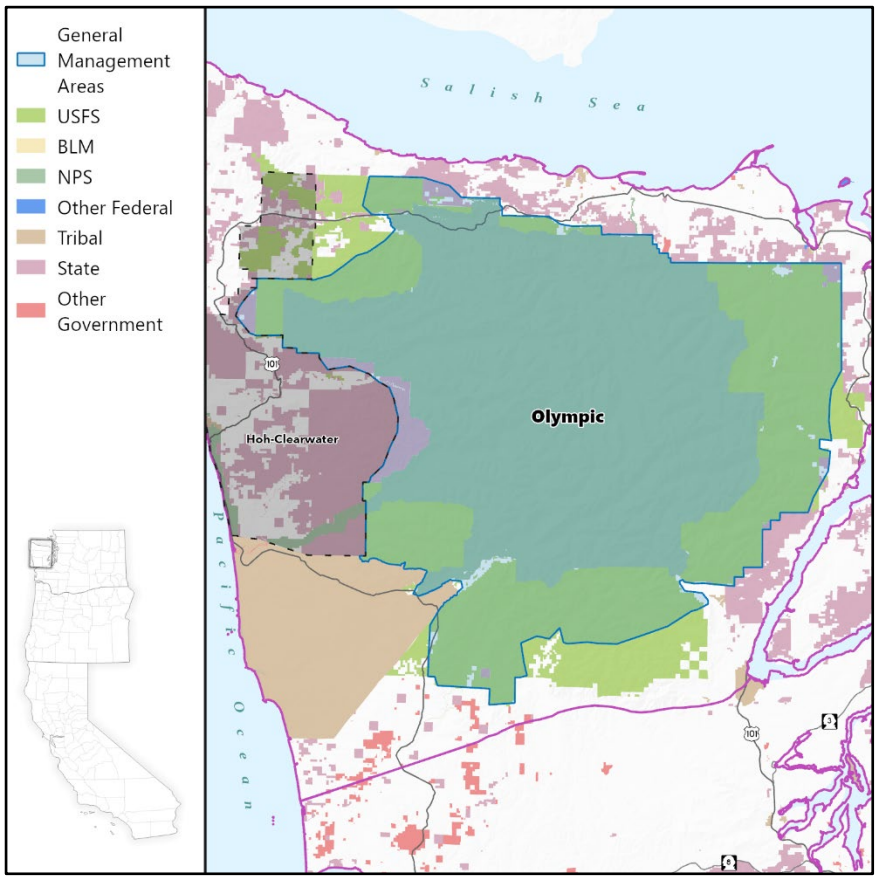
- Select sites with the most recent spotted owl occupancy, particularly if surveys have been conducted on these areas in recent years. Do not discount sites as unoccupied based on lack of recent surveys.
- Focus first on spotted owl sites with recent occupancy by pairs, then singles, then detections.
- Consider past reproductive history of the spotted owl site. Select sites with a history of reproduction on the site where surveys are available.
- Consider the condition of habitat in the area, particularly loss of habitat since the last surveys. All other things being equal, select sites with abundant high-quality habitat. Spotted owl that have lost substantial amounts of habitat to fire, harvest, insect damage, or other disturbances may be lower priority.

*A4.1.B.1.b Management Recommendations*

Within each individual spotted owl site, remove barred owls from an area between 14,657 and 26,058 acres. This represents the area in a circle of 1.5 and 2 home range radii (Table 2). This can be distributed in a circle around the activity center, or implementers can use local knowledge, topography, and habitat condition to design a non-circular area of the appropriate size that provides the best conditions for barred owl management. In areas where spotted owl sites are isolated, and particularly for sites in Priority A condition (see table above), we recommend a larger management area, up to 58,630 acres (3 home range radii). Where sites are not isolated, applying site management to clusters of two or more sites in close proximity is likely to provide more efficient management conditions and increased benefits for spotted owls present in those sites.

### A4.1.B.2 General Management Areas in the Olympic Peninsula Province

*A4.1.B.2.a Olympic GMA – Priority A*




The Olympic GMA lies on the Olympic Peninsula and includes most of the Olympic National Park (all except the coastal strip), and much of the Olympic National Forest, particularly where there has been more recent presence of spotted owls. The GMA includes a small amount of State forest in the Hoh-Clearwater Spotted Owl Special Emphasis area, adjacent to the Olympic National Forest, on the west side of the Olympic Peninsula. It includes approximately 1,398,653 acres in total, of which 1,206,151 acres (86 percent) are forest lands and 670,424 acres (48 percent) provide spotted owl nesting and roosting habitat. Very little private land is included in this GMA. Forest lands in this GMA are 96 percent Federal (Olympic National Park and Olympic National Forest), 3 percent State, and approximately 1 percent in private ownership.

This GMA was mapped for the following reasons:

- It contains the most current and recent known spotted owl pair activity in the Olympic Peninsula Province.

- It includes a large portion of the high-quality nesting and roosting habitat in the province.
- The GMA includes most of the Olympic Demography Study Area, with its historical and recent spotted owl data. The Northwest Forest Plan Effectiveness Monitoring program includes passive acoustic monitoring sampling 20 percent of the Olympic study area. This monitoring program will provide additional future data on both spotted and barred owls, and allow for efficiencies in monitoring barred owl removal and its effects on spotted owls. This portion of the GMA is well known and accessible, allowing for quicker implementation.

This GMA was assigned Priority A as the only GMA in the province. Additionally, the spotted owl population in the province has declined dramatically and is approaching extirpation. The well-studied landscape of the Olympic study area and knowledge of remaining active pair sites allow for rapid deployment of barred owl management to the locations where it can have the most immediate benefit to existing spotted owls. Therefore, this GMA is an area where barred owl management can and should be implemented immediately to prevent extirpation of spotted owls in the province, which is an area with very low spotted owl populations.

*Description of the elements considered in mapping:* In mapping the boundaries of the Olympic GMA we used information on the following elements.

*Spotted Owl Data:*

- We included historical spotted owl activity centers and recent spotted owl presence documented from the Olympic Demography Study Area and passive acoustic monitoring efforts in the southern portion of the Olympic Peninsula outside of the Olympic study area.
- We included areas with relatively large amounts of high-quality nesting and roosting habitat and activity centers from which to select FMAs large enough to support spotted owl populations. Models developed for the Northwest Forest Plan Effectiveness Monitoring program predict the presence of habitat that can support populations of spotted owls in this GMA. This GMA contains areas that have an estimated carrying capacity to support clusters of 20 or more spotted owl pairs, in the absence of barred owls.
- We did not try to exclude high elevation areas without spotted owl habitat. This can be considered during development of the FMA boundaries.
- We excluded the coastal strip from the GMA because it is not likely to support spotted owls currently due to isolation and fragmentation. This area has lower likelihood of successful barred owl management resulting in spotted owl recovery than the larger block of Federal lands in the center of the Olympic Peninsula. However, most of the coastal strip is included in the Hoh-Clearwater SOSEA (see below).
- We excluded the lowest elevation areas and coastal areas where there is much less habitat to support spotted owl residency and populations. Much of the low-elevation and coastal area on the west side of the Olympic Peninsula is included in the Hoh-Clearwater SOSEA (see below).
- We excluded most of the Hoh-Clearwater SOSEA. Although it is managed to provide dispersal habitat and demographic support at the province level, the Hoh-Clearwater SOSEA does not currently have a large amount of spotted owl nesting and roosting habitat. Under this Strategy, barred owls may still be removed from areas within the

SOSEA that are not included in this GMA under site management recommendations (see above) or management recommendations specific to SOSEAs (see below).

*Conditions:*

- We considered the availability of access via roads and trails in most of this area. The diversity of topography and fjord-like habitat within the area presents more access challenges, as compared with gentler, better-roaded terrain, but selected areas are accessible via trails and some roads.
- We considered the presence of SOSEAs with spotted owl habitat and activity centers. Including these areas allows for incentives for management. Additionally, State lands within the included portion of the SOSEA have better road access than adjacent Federal lands, though spotted owl habitat density is lower on the State lands.

*Other Considerations:*

- In some areas, the GMA boundaries follow ownership boundaries. The GMA includes all of the non-coastal area of Olympic National Park, which largely consists of spotted owl habitat except at higher elevations. It also includes most of the Olympic National Forest. It includes a small amount of State Forest, mainly areas in the Hoh-Clearwater SOSEA with relatively high concentrations of spotted owl habitat adjacent to high-quality habitat on Olympic National Park and Olympic National Forest.
- As discussed above, this GMA includes most of the Olympic study area. This allows for efficiencies in monitoring and opportunities for research. Although the GMA boundaries do not closely follow study area boundaries, the GMA includes the bulk of the study area.

*Focal Management Areas (FMAs)*

In this GMA, we recommend developing FMAs large enough to support as may spotted owl pair sites as possible, up to 50 pair sites per FMA. Generally, larger blocky areas provide a smaller edge-to-area ratio, and this may help reduce the influx of barred owls from outside the FMA in the future. However, where the landscape or forest conditions do not allow this, smaller or more sinuous areas may be appropriate. For example, in higher elevation areas where habitat is confined to valley bottoms, large blocky FMAs may not be reasonable or effective, and smaller FMAs, still encompassing multiple pair areas, may be a practical option. These may be more sinuous in nature due to the habitat limitations. If smaller FMAs are developed due to funding limitations, rather than habitat configuration, design them such that they could be expanded in the future if additional funding becomes available.

When possible, include multiple FMAs, generally spaced no farther than 12 to 15 miles apart. Where smaller areas are developed due to topography, forest condition, access, funding limitations, or other reasons, we recommend these be closer together and multiple areas be designed with the intent of encouraging exchange of spotted owls between these smaller areas.

Including recently occupied sites in FMAs provides the starting point for development of spotted owl populations as barred owl populations are reduced. In areas where habitat connectivity is limited, site management may help to provide connectivity between smaller FMAs. Coordinate

FMA locations with the spotted owl site management described above, and with any management within the Hoh-Clearwater SOSEA Special Designated Area, described below.

*Priorities:* The following are our recommended priorities for defining and selecting FMAs within the Olympic GMA. The following are in general priority order; however, local expertise will be important in applying these to specific FMA boundary designs.

1. Build FMAs around current and recent spotted owl sites (sites with presence or occupancy of spotted owls within the last five years). This provides a nucleus of spotted owls for the potential recolonization of sites within the FMA as barred owl numbers are reduced.

2. Place blocks allowing for the maximum number of spotted owls to be supported. Focus on areas with the potential for at least 20 spotted owl pairs, though 50 pair sized areas are the target where possible.

3. Include areas with high-quality historical spotted owl sites (sites with no confirmed occupancy in the last five years or more). Indicators may include, for example, especially good habitat amount, quality, and configuration; a history of good past demographic performance; or a history of long-term occupancy. These are areas that have been shown by past use to be attractive to spotted owls and therefore more likely to be reoccupied, especially as spotted owl populations increase.

4. Focus on areas with reasonable access, in terms of trail and road networks. Trail networks are available in most of the spotted owl habitat in the Olympic GMA. The Olympic GMA does not have as much road access as other GMAs, so access will rely mostly on trails, with roads being used to a lesser extent. Closed roads may be used like a trail system if they can be safely walked. Open roads are generally preferred where they exist to maximize operational efficiency. The highest priority for FMAs locations in the Olympic GMA is to include sites that are currently or recently occupied by spotted owls. Most of these occupied sites are now in relatively higher elevation areas, at the backs of valleys, only accessible by trail or helicopter. The priority would be to start at these occupied sites that are accessible by trail and expand management out, down the valleys to areas with greater accessibility.

5. Include lands of interested and willing landowners or land managers. A focus on areas where landowners have expressed interest in barred owl management and have the ability to assist with operations will speed the implementation of actual barred owl management and encourage involvement.

6. Consider the presence of areas already designated for spotted owl habitat management or compatible conservation purposes, such as Late Successional Reserves, Congressionally reserved areas, SOSEAs, designated critical habitat, and areas identified as high priorities in the Northern Spotted Owl Recovery Plan. Including these areas provides support for spotted owls and limits impacts on other resources. Because many of these have been managed for older forest over the last decades, these are the likely locations of some of the best habitat conditions.

7. Consider isolation from other spotted owls when selecting areas to include in FMAs, with the goal of reducing isolation of spotted owls through barred owl management. Due to the topography of the Olympic Peninsula, with fjord-like corridors of habitat being separated by long, high elevation ridges and highest densities of barred owl in the lower elevations, currently occupied spotted owl sites are likely isolated from other occupied sites. Consider including areas that will connect managed areas to reduce isolation of spotted owls.

8. Much of the habitat for spotted owls with current or recent presence exist in fjord-like valleys separated by high elevation ridges, which form natural edges to the habitat and are barriers to spotted owl and barred owl movement. Consider taking advantage of these natural edges that would prevent or reduce barred owl incursion into focal management areas. The highest priorities for FMAs in the Olympic GMA are spotted owl sites that are currently or recently occupied by spotted owls, which are now mostly in relatively higher elevation areas, at the backs of valleys, defined by unforested edges formed by ridges. Consider starting management in these occupied spotted owl sites that are often defined on two to three sides by natural edges and expand management from areas with relatively more spotted owls, and lower density of barred owls, working out and down the valleys into areas with higher barred owl densities in lower elevation areas. In this way, natural edges can be used as a management tool to reduce incursion of barred owls into focal management areas.

9. Consider including areas where there would be more efficient use of funding (such as targeting more accessible areas or including areas that already have past, ongoing, and future monitoring funded). Including accessible areas can be used to maximize management efficacy at scale, and more efficiently reduce the impact of barred owls on spotted owls. Including areas that are already have long term baseline demographic and population monitoring conducted, and have it planned and funded for the future will improve efficiencies in monitoring success of strategy implementation. Given the availability of recent and ongoing data collection for the Olympic Demography Study Area, and areas monitored with acoustic recording units in the southern Olympic Mountains, the operational advantage of leveraging prior and future data is likely an important consideration in this GMA.

### A4.1.B.3 Special Designated Areas

*A4.1.B.3.a Spotted Owl Special Emphasis Areas – Priority E*

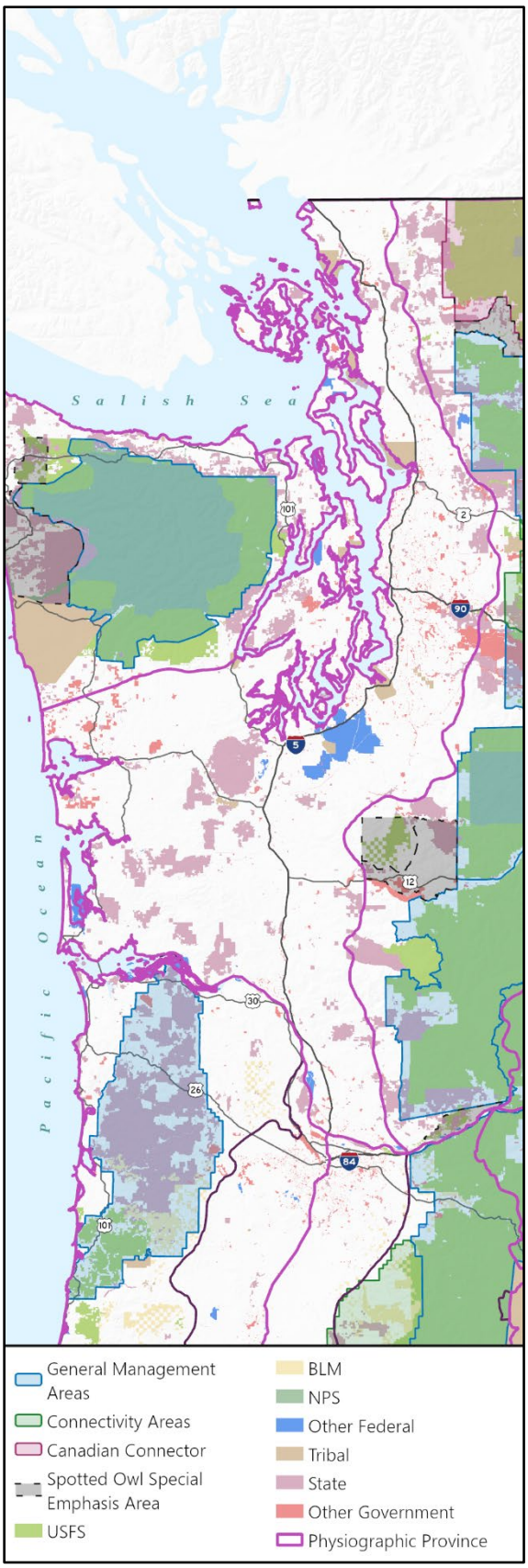
The State of Washington identified 10 key landscapes, referred to as Spotted Owl Special Emphasis Areas (SOSEAs), where northern spotted owl conservation in the form of demographic and/or dispersal support was important on non-Federal lands. In mapping the Strategy, portions of some SOSEAs were included in mapped GMAs. Barred owl management recommendations for GMAs apply to the portions of SOSEAs lying within those GMAs. Where SOSEA lands fell outside of these designations, we mapped the areas as SOSEA Special Designated Areas.

There is one SOSEA Special Designated Area in the Olympic Peninsula Province (see Olympic Peninsula Province map on page 100).

| SOSEA | Forest Acres on Federal lands | Forest Acres on State Lands | Forest Acres on Private Lands | Maximum Forest Acres Under Management |
|---|---|---|---|---|
| Hoh-Clearwater SOSEA | 49,359 | 182,776 | 121,791 | 89,852 |

In the original designation by Washington, each SOSEA was described in terms of one or more conservation functions -- demographic support, dispersal support, and combination support. Demographic support meant that adequate amounts and arrangements of suitable nesting, roosting, and foraging habitat are maintained to support reproductive spotted owl pairs. Dispersal support is provided by a landscape that includes dispersal habitat at the stand level interspersed with areas of higher quality habitat. Combination support was defined as either maintaining suitable spotted owl habitat to protect the viability of the owls at a spotted owl site center or providing a variety of habitat conditions which in total are more than dispersal support and less than demographic support. The Hoh-Clearwater SOSEA contains areas designated for all three of these conservation functions.

For the Strategy, barred owl management in the form of removal could be occur at any scale in a SOSEA. We recommend spotted owl site-based management as described in Section 8.4.1.2. of the Strategy and Section 4.1.B.1 above. Removal of barred owls around spotted owl sites can be applied anywhere within the province and is an appropriate small scale management effort in SOSEAs. Removing barred owls within and around occupied spotted owl sites retains the existing population, increases the potential for recruitment of young, and provides a source of young for recolonization of areas where barred owl management occurs. Spotted owl site management can provide connectivity between larger block areas. Where feasible, clustering spotted owl site management into small blocks increases the functionality of this management.




# A4.2 Western Washington Lowlands Province

## A4.2.A Background

The Western Washington Lowlands Province includes the highly developed Interstate 5 corridor to the west of the Cascades, and large expanses of private industrial timberland south of the Olympic Peninsula. Federal lands make up a small proportion of this province, and include Department of Defense (Joint Base Lewis-McChord), National Park Service (San Juan Island National Historical Park), and Fish and Wildlife Service (Willapa National Wildlife Refuge, Billy Frank Junior Nisqually National Wildlife Refuge). Numerous Tribes manage land in this province, mainly but not exclusively along the shores of Puget Sound and the Rosario Strait. State lands are important in this province, as are local public lands in some areas. Forest lands in this province are mostly private, with approximately 2 percent in Federal management, 12 percent in State management, 3 percent in other public management, 1 percent on Tribal lands, and the remainder in private ownership.

The Western Washington Lowlands Province is characterized by high rainfall and cool to moderate temperatures. Topography is generally gentle, though there are areas of low but rugged hills, including the Black Hills just southwest of the southern end of Puget Sound, and the Willapa Hills in the southwestern part of the province. Root diseases and wind-throw are important natural disturbance mechanisms that form gaps in forested areas. Many areas that were originally forested now consist of urban and suburban developments, especially in the northern portion of the province.

### A4.2.A.1 Spotted Owl Condition in the Western Washington Lowlands Province

Federal lands in the province include only approximately 10,035 acres of spotted owl nesting and roosting habitat. State lands are important in this province and include approximately 42,238 acres of spotted owl nesting and roosting habitat. This habitat is widely scattered, with small concentrations mostly on State lands. Most forest in this province is younger and does not provide suitable conditions for spotted owls. Where spotted owl habitat is present it is generally within Douglas-fir and western hemlock forests.

We expect that spotted owls are extremely rare in this province. By 1990, when northern spotted owls were added to the Endangered Species List, spotted owl habitat in this province had already been greatly reduced, and the remaining spotted owl population was extremely small (Thomas et al. 1990, pp. 13, 60; USFWS 1992, p. 105). Most of the already small number of known historical sites were vacant by 2006, though a few spotted owls, including two pairs, remained on or near State lands in the southwestern portion of the province (WDNR 2007, pp. 6, 8). Although we expect that functional spotted owl populations are not currently present in this province, it is possible that individual spotted owls may be present, for example, dispersers from surrounding provinces.

### A4.2.A.2 Barred Owl Condition in the Western Washington Lowlands Province

Barred owls have been present at high densities in Washington for longer periods of time compared to areas farther south in the northern spotted owl range. On Bainbridge Island, within this province, barred owl densities dramatically increased between 1993 and 2008, and did not appear to be leveling off during that period (Acker 2012, pp. 134-136). Barred owls were present in all surveyed historical spotted owl home ranges on State lands in the southwestern portion of the province in 2005 and 2006 (WDNR 2007, pp. 11-15, 18-22). We expect that barred owls are present at high densities throughout forest lands in this province.

## A4.2.B Management Strategy

### A4.2.B.1 Spotted Owl Site Management in the Western Washington Lowlands Province

*A4.2.B.1.a Background*

Spotted owl site management is the only barred owl management recommended for the Western Washington Lowlands Province. If spotted owls are detected in this province, protection of these individuals via site management will be important to preserve options for these individuals to best contribute to the conservation of the subspecies.

- Managing barred owls in recently occupied spotted owl sites is intended to increase the survival rate of spotted owls that are present.
- These managed spotted owl sites may provide a source of individuals for direct augmentation of populations in block management areas, in other provinces, or for a captive breeding population, if decisions are made to pursue either of these translocation strategies in the future.
- Spotted owl site management, due to its smaller size when compared to block management, provides a wider range of options for landowner contribution to barred owl

management, particularly for smaller landowners. The smaller size also makes site management suitable for areas where there are not large amounts of spotted owl habitat due to terrain, or extensive loss of habitat from wildfires, harvest, or other disturbances.

*Selection of spotted owl sites for management in Western Washington Lowlands Province*

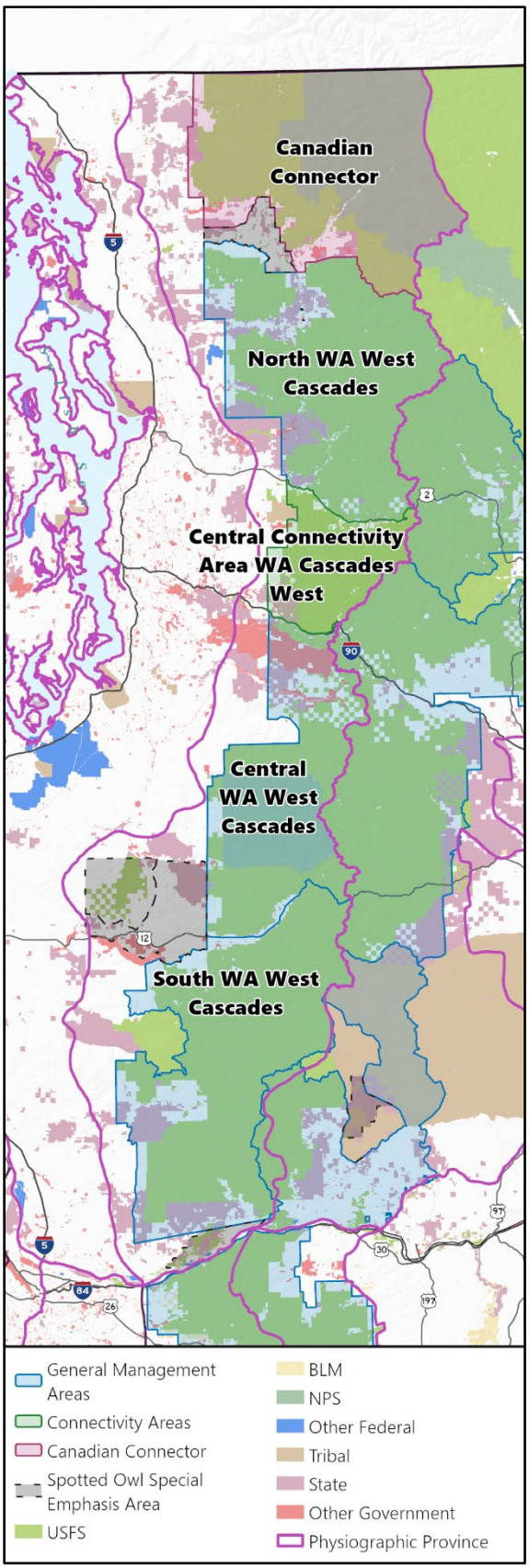
The primary focus of spotted owl site management in this province is on currently or recently active sites, where spotted owls are more likely to be present. This is reflected in the priorities for site management.

*Spotted Owl Site Management Priorities*

| Priority | Spotted Owl Site Condition |
|---|---|
| A | Currently and recently active sites, including all areas with any spotted owl detections within the last 5 years |
| D | Historically occupied spotted owl sites (pair or single) with last detection more than 5 years ago, and potential sites with adequate habitat but no known history of spotted owl occupancy and no detections within the last 5 years |

*A4.2.B.1.b Management Recommendations*

Within each individual spotted owl site, remove barred owls from an area of at least 14,657, but preferably 58,630 acres. These figures represent the area in a circle of 1.5 and 3 home range radii, respectively (Table 2). This can be distributed in a circle around the activity center, or implementers can use local knowledge, topography, and habitat condition to design a non-circular area of the appropriate size that provides the best conditions for barred owl management. Our recommendation to use 3 home range radii reflect our assumption that sites to be managed in this province will very likely be isolated.




# A4.3 Western Washington Cascades Province

## A4.3.A Background

The Western Washington Cascades Province is one of four physiographic provinces in Washington. The province includes a large portion of Forest Service lands, which include 50 percent of the forest lands in the province. Additionally, 8 percent of forest lands are managed by the National Park Service, 12 percent by State agencies, and 2 percent by local public agencies, and the remainder are in private ownership.

The Western Washington Cascades Province extends from the U.S. - Canadian border south to the Columbia River in southern Washington. Its eastern edge is the Cascade Crest, and to the west are the Washington Western Lowlands, which are highly developed in some areas. The northern portion of this province (north of Snoqualmie pass and Interstate 90) is characterized by high mountainous terrain with extensive areas of glaciers and snowfields at higher elevations. The mild marine climate brings high precipitation year-round, though higher in the winter in most areas, but is modified by high elevations and low temperatures over much of the area. The resulting distribution of forest vegetation is dominated by subalpine species, mountain hemlock (*Tsuga mertensiana*) and silver fir (*Abies alba*), with western hemlock and Douglas-fir forests mainly limited to lower elevations and river valleys, grading into the Western Washington Lowlands to the west. South from Snoqualmie Pass to the Columbia River, conditions differ from the northern portion with milder temperatures, lower elevations, a greater proportion of western hemlock and Douglas-fir forest, and occurrence of noble fir (*Abies procera*). Root pathogens like laminated root rot (*Phellinus weirii*) are important forest gap formers in Western Washington Cascades.

### A4.3.A.1 Spotted owl Condition in the Western Washington Cascades Province

Federal lands in the province include approximately 1,343,130 acres of spotted owl nesting and roosting habitat (Davis et al. 2024a). The distribution of this habitat reflects the distribution of western hemlock and Douglas-fir forests, generally limited to lower elevations and valley bottoms. As a result, spotted owls are rarely found at elevations greater than 4,200 feet in this region. Because Douglas-fir dwarf mistletoe occurs rarely in Western Washington Cascades, spotted owl nests sites are limited to defects in large trees, and occasionally nests of other raptors. Flying squirrels are the most important prey species in this province, with snowshoe hares and bushy-tailed woodrats also making up a substantial portion of the diet (Forsman et al. 2001, p. 145; Hamer et al. 2001, pp. 224-226). Diets of spotted owls in the northern part of Western Washington Cascades contain higher proportions of red-backed voles (*Clethrionomys* spp.) and deer mice (*Peromyscus* spp.) than in southern portion of Western Washington Cascades, where flying squirrels are dominant (USFWS 2011, p. C-10).

Spotted owl habitat in the northern half of the Western Washington Cascades is very fjord-like in many areas, similar to the Olympic Peninsula Province. Although terrain is less rugged in the southern portion of the province, it is still mountainous and includes steep slopes and high elevations. These features have been associated with greater spotted owl persistence at sites in the Western Washington Cascades (Mangan et al. 2019, pp. 10-11; Pearson and Livezey 2003, pp. 270-271), akin to the greater persistence of spotted owls on the Olympic Peninsula in the higher elevations at the backs of fjord-like valleys of habitat, surrounded by high elevation ridges without habitat. Although we have little information on the distribution of remaining spotted owls in the Western Washington Cascades Province, they may be concentrated in steeper, higher elevation areas, as they are on the Olympic Peninsula.

The Western Washington Cascades Province includes the Rainier Demography Study Area, so we use this study area to represent the status of spotted owls in the province. The Rainier study area provides data on spotted owls since 1993. Monitoring efforts on the Rainier study area indicate that spotted owl occupancy at historical territories has declined substantially. The spotted owl population in this study area declined nearly 6 percent per year from 1995 through 2017 (Franklin et al. 2021, pp. 11-13). Spotted owl pair occupancy dropped from 85 percent in 1993 to 11 percent in 2018 (Davis et al. 2022, p. 37). Comprehensive surveys in 2021 detected one single male and one single female on the Rainier Demography Study Area (Rossi et al. 2021, p. 5), though these results cannot be compared directly with the 2018 results because they have not been corrected to account for imperfect detection. On the Rainier study area spotted owl pairs have declined by 100 percent since 1992 with no known remaining pairs.

Outside of the Rainier DSA, recent survey data are largely unavailable, though some 2022 passive acoustic monitoring results have been reported from the Gifford Pinchot National Forest, both from Northwest Forest Plan Effectiveness Monitoring sampling two percent of this National Forest's landscape, and from a survey conducted prior to a forest management project. No spotted owls were detected in these surveys (Lesmeister et al. 2023, p. 14; J. Conner England pers. comm. 2023).

### A4.3.A.2 Barred Owl Condition in the Western Washington Cascades Province

Barred owls have been at high densities in Washington for longer periods of time compared to areas farther south in the northern spotted owl range. On the Rainier Demography Study Area, barred owls were detected at 56 percent of surveyed spotted owl sites in 2021 (Rossi et al. 2021, p. 5). Barred owls tend to be at higher densities in low valleys with more contiguous large blocks of high-quality habitat and tend to be at lower densities farther up slopes and in more marginal, less contiguous habitat.

## A4.3.B Management Strategy

### A4.3.B.1 Spotted Owl Site Management in the Western Washington Cascades Province

*A4.3.B.1.a Background*

Given the limited number of spotted owls in this province, it is crucial to protect the remaining spotted owls through barred owl management at spotted owl sites. This province has very low recent survey effort outside of the Rainier Demography Study Area. Therefore, we recommend surveys throughout the province to identify areas where spotted owls are currently active. Surveys are particularly important at historical sites that have been active regularly over the past 10 years, as this may indicate a higher likelihood of current spotted owl presence.

In some cases, managed sites may eventually be incorporated into block management areas. In other cases, site management of single sites or clusters of sites may be an appropriate long-term action, if larger blocks of habitat are not available for management due to topographic or ownership conditions.

- Managing barred owls in recently occupied spotted owl sites is intended to help reduce the rate of spotted owl population decline as quickly as possible and prevent extinction/extirpation of the spotted owl in the province.
- Managing barred owls in spotted owl sites that are, or become, reproductively active, may enable those sites to provide a source of young for colonization of nearby management blocks. These sites may provide demographic support for nearby management blocks.
- Where spotted owl site management occurs within a GMA, these spotted owl sites may serve as key points for the development of focal management areas, now and in the future. Spotted owl site management may be expanded into block management over time.
- Managing barred owls in spotted owl sites distributed across the province, whether within block management areas or not, may reduce the risk of loss of spotted owls in the province from catastrophic events, such as wildfire, by maintaining site occupancy across the area. Managing spotted owl sites also provides the opportunity for maintaining spotted owls in areas where block management is not feasible or recommended. This approach applies across the entire province, whether or not the locations are within a GMA or other mapped designation.
- These managed spotted owl sites may provide a potential source of spotted owl individuals for direct augmentation of block management areas in the future, should such management action be necessary.
- These spotted owl sites may serve to increase connectivity between and within block management areas, and provide sites in the vicinity of block management areas that can interact at a demographic level with those management areas.

- Spotted owl site management, due to its smaller size when compared to block management, provides a wider range of options for landowner contribution to barred owl management, particularly for smaller landowners. The smaller size also makes site management suitable for areas where there are not large amounts of spotted owl habitat due to terrain, or extensive loss of habitat from wildfires, harvest, or other disturbances.
- Spotted owl site management may help to prevent genetic bottlenecks or reduction in genetic diversity, by conserving remaining spotted owls, and the genetic diversity they represent, across the province.
- These managed spotted owl sites may provide a source of individuals for captive rearing in the future should such management action be necessary. This could include young produced by reproductive pairs to be taken into captivity for short periods to increase survival rates, particularly over the winter after fledging when survival rates are low, or it could include individuals for future captive breeding programs (either young produced by reproductive pairs or adults).

*Selection of spotted owl sites for management in Western Washington Cascades Province*

The number of spotted owl sites known to be currently active is extremely limited in this province. Based on the occupancy rates of the Rainier Demography Study Area, spotted owl site occupancy in the province is extremely low, but due to very low to no survey effort for most areas outside of the Demography Study Area, other areas in the province with current or recent spotted owl presence are unknown. The primary focus of spotted owl site management in this province is on sites that have been occupied by, or had detections of, spotted owls in the last five years. These areas are more likely to have spotted owls present, or be recolonized by spotted owls after barred owl removal. Because many areas have not been surveyed consistently in recent years, or at all, older data and habitat condition are also considerations. Any historically active spotted owl sites, particularly those active regularly over the past 10 years, are recommended to be surveyed for activity. This is reflected in the priorities for site management.

*Spotted Owl Site Management Priorities*

| Priority | Spotted Owl Site Condition |
|---|---|
| A | Currently and recently active sites, including all areas with any spotted owl detections within the last 5 years |
| B | Historically occupied spotted owl sites (pair or single) with last detection between 5 and 10 years ago |
| C | Historically occupied spotted owl sites (pair or single) with last detection more than 10 years ago |
| D | Potential sites with adequate habitat but no known history of spotted owl occupancy, and without detections within the last 5 years |

*Other considerations for selection of spotted owl sites for management:*

- We recommend consideration of the following factors when selecting among sites within a priority category. Select sites with the most recent spotted owl occupancy, particularly

if surveys have been conducted on these areas in recent years. Do not discount sites as unoccupied based on lack of recent surveys.

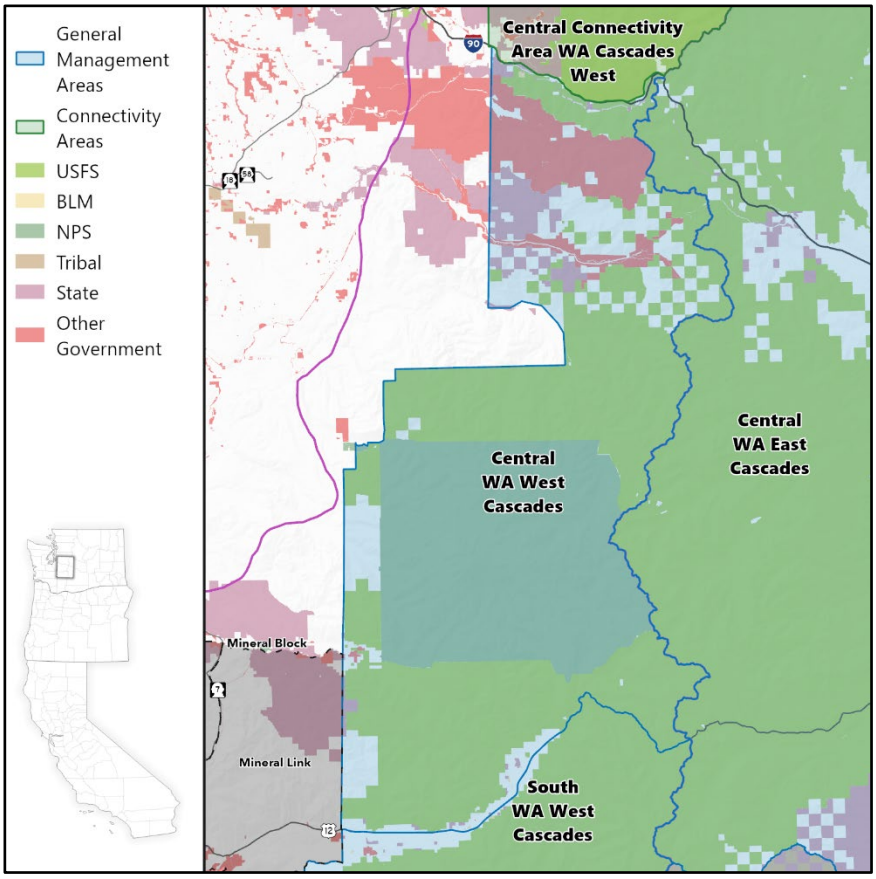
- Focus first on spotted owl sites with recent occupancy by pairs, then singles, then detections.
- Consider past reproductive history of the spotted owl site. Select sites with a history of reproduction on the site where surveys are available.
- Consider the condition of habitat in the area, particularly loss of habitat since the last surveys. All other things being equal, select sites with abundant high-quality habitat. Spotted owl sites that have lost substantial amounts of habitat to fire, harvest, insect damage, or other disturbances may be lower priority.

*A4.3.B.1.b Management Recommendations*

Within each individual spotted owl site, remove barred owls from an area between 14,657 and 26,058 acres. This represents the area in a circle of 1.5 and 2 home range radii (Table 2). This can be distributed in a circle around the activity center, or implementers can use local knowledge, topography, and habitat condition to design a non-circular area of the appropriate size that provides the best conditions for barred owl management. In areas where spotted owl sites are isolated, and particularly for sites in Priority A condition (see table above), we recommend a larger management area, up to 58,630 acres (3 home range radii). Where sites are not isolated, applying site management to clusters of two or more sites in close proximity is likely to provide more efficient management conditions and increased benefits for spotted owls present in those sites.

## A4.3.B.2 General Management Areas in the Western Washington Cascades Province

*A4.3.B.2.a Central Washington West Cascades GMA – Priority A*




The Central Washington West Cascades GMA lies west of the Cascade Crest, south of Interstate 90 and extends south to Highway 12. It includes approximately 767,542 acres in total, of which 654,931 acres (85 percent) are forest lands and 236,564 acres (31 percent) provide spotted owl nesting and roosting habitat. The GMA includes Mount Rainier National Park, parts of the Snoqualmie District of the Mount Baker-Snoqualmie National Forest, and parts of the Cowlitz Ranger District of the Gifford Pinchot National Forest. It also includes the I90-West SOSEA, which encompasses State, local, and private lands, and a portion of the Mineral Link SOSEA encompassing State and private lands. Forest lands in this GMA are 74 percent Federal lands (Forest Service and National Park Service), 4 percent State lands, 8 percent other public lands, and the remainder primarily in private ownership.

This GMA was mapped for the following reasons:

- It contains current, recent, and historical spotted owl sites, including the only currently occupied spotted owl sites for which information is available in the Western Washington Cascades Province.
- The GMA includes the Rainier Demography Study Area, with its historical and recent spotted owl data. The Northwest Forest Plan Effectiveness Monitoring program includes passive acoustic monitoring sampling 20 percent of the Federal lands within the Rainier study area. This monitoring program will provide additional future data on both spotted and barred owls and allow for efficiencies in monitoring barred owl removal and its effects on spotted owls. This portion of the GMA is well known and accessible, allowing for quicker implementation.
- The GMA is centrally located, allowing for connectivity to GMAs to the north, south and east.

This GMA was assigned Priority A. Spotted owls are at high risk of extirpation throughout the Western Washington Cascades Province. This GMA includes the portion of the province where barred owl management could be implemented the most quickly and effectively, due to the presence of known currently occupied spotted owl sites and the well-known landscape of the Rainier study area. Therefore, this GMA is an area where barred owl management can and should be implemented immediately to prevent extirpation of spotted owls in the province.

*Description of the elements considered in mapping:* In mapping the boundaries of the Central Washington West Cascades GMA we used information on the following elements.

*Spotted Owl Data:*

- We included historical spotted owl activity centers, and recent spotted owl presence documented on the Rainier Demography Study Area.
- We included areas with relatively large amounts of high-quality nesting and roosting habitat and activity centers from which to select FMAs large enough to support spotted owl populations. Models developed for the Northwest Forest Plan Effectiveness Monitoring program predict the presence of habitat that can support populations of spotted owls in this GMA. This GMA contains areas that have an estimated carrying capacity to support clusters of 20 or more spotted owl pairs, in the absence of barred owls.
- We did not try to exclude high elevation areas without habitat, or areas where habitat has been lost to wildfire. This can be considered during development of the Focal Management Area boundaries.
- The GMA boundary includes a long segment along the Cascades Crest, which makes up the province boundary with the Eastern Washington Cascades Province. In some areas, habitat is present along both sides of the Crest. All of the area to the east of this GMA is within the Central Washington East Cascades GMA. This allows for good connectivity between the provinces.
- Areas to the west were excluded due to the presence of smaller amounts and lower quality of habitat and no known recent spotted owl occupancy in these areas.

*Conditions:*

- We considered the availability of access via roads and trails in most of this area.
- We considered the presence of SOSEAs with spotted owl habitat and activity centers. Including these areas allows for incentives for management.

*Other Considerations:*

- The GMA boundaries generally follow the Cascade Crest, major roads, and land management boundaries. In a few areas, GMA boundaries deviate from these features in order to reduce the edge-to-area ratio of the GMA, making it possible to create FMAs with low edge-to-area ratios (see below).
- As discussed above, this GMA includes the Rainier study area. This allows for efficiencies in monitoring opportunities for research.

*Focal Management Areas (FMAs)*

In this GMA, we recommend developing FMAs large enough to support as many spotted owl sites as possible, up to 50 pair sites per FMA. Generally, larger blocky areas provide a smaller edge-to-area ratio, and this may help reduce the influx of barred owls from outside the FMA in the future. However, where the landscape or forest conditions do not allow this, smaller or more sinuous areas may be appropriate. For example, in higher elevation areas where spotted owl habitat is confined to valley bottoms, large blocky FMAs may not be reasonable or effective, and smaller FMAs, still encompassing multiple pair areas, may be a practical option. These may be more sinuous in nature due to the habitat limitations. If smaller FMAs are developed due to funding limitations, rather than habitat configuration, design them such that they could be expanded in the future if additional funding becomes available.

When possible, include multiple FMAs, generally spaced no farther than 12 to 15 miles apart. Where smaller areas are developed due to topography, forest condition, access, funding limitations, or other reasons, we recommend these be closer together and multiple areas be designed with the intent of encouraging exchange of spotted owls between these smaller areas.

Coordinate FMA locations with the spotted owl site management described above. Including recently occupied sites in FMAs provides the starting point for development of spotted owl populations as barred owl populations are reduced. In this GMA and throughout the province, there is very little information regarding recent spotted owl occupancy or presence outside of the Rainier Demography Study Area. We recommend conducting surveys so that areas of current spotted owl activity can be included in FMAs. Additionally, coordinate FMA locations with barred owl management activity in neighboring GMAs, the Central Connectivity Area, and the Mineral Link SOSEA Special Designated Area.

*Priorities:* The following are our recommended priorities for defining and selecting FMAs within the Central Washington West Cascades GMA. The following are in general priority order; however, local expertise will be important in applying these to specific FMA boundary designs.

1. Build FMAs around current and recent spotted owl sites (sites with presence or occupancy of spotted owls within the last five years). This provides a nucleus of spotted owls for the potential recolonization of sites within the FMA as barred owl numbers are reduced.

2. Include areas with high-quality historical spotted owl sites (sites with no confirmed occupancy in the last five years or more). Indicators may include, for example, especially good habitat amount, quality, and configuration; a history of good past demographic performance; or a history of long-term occupancy. These are areas that have been shown by past use to be attractive to spotted owls and therefore more likely to be reoccupied, especially as spotted owl populations increase.

3. Select areas with the greatest acreage or density of spotted owl habitat. These are likely to be areas with the highest carrying capacity for spotted owls, which can be measured using a habitat-based calculation of the estimated maximum population of territorial spotted owls without barred owl presence.

4. Place blocks allowing for the maximum number of spotted owls to be supported. Focus on areas with the potential for at least 20 spotted owl pairs, though 50 pair sized areas are the target where possible.

5. Include areas with the most high-quality spotted owl habitat in large areas where possible. This high-quality habitat may be in historical spotted owl sites, or it may connect sites.

6. Consider the presence of areas already designated for spotted owl habitat management or compatible conservation purposes, such as Late Successional Reserves, Congressionally reserved areas, SOSEAs, designated critical habitat, and areas identified as high priorities in the Northern Spotted Owl Recovery Plan. Including these areas provides support for spotted owls and limits impacts on other resources. Because many of these have been managed for older forest over the last decades, these are the likely locations of some of the best habitat conditions.

7. Focus on areas with reasonable access, in terms of road networks, which are available in most of the spotted owl habitat in this GMA. Closed roads may be used like a trail system if they can be safely walked. Trail systems can be used where roads do not exist, but roads are generally preferred to maximize operational efficiency.

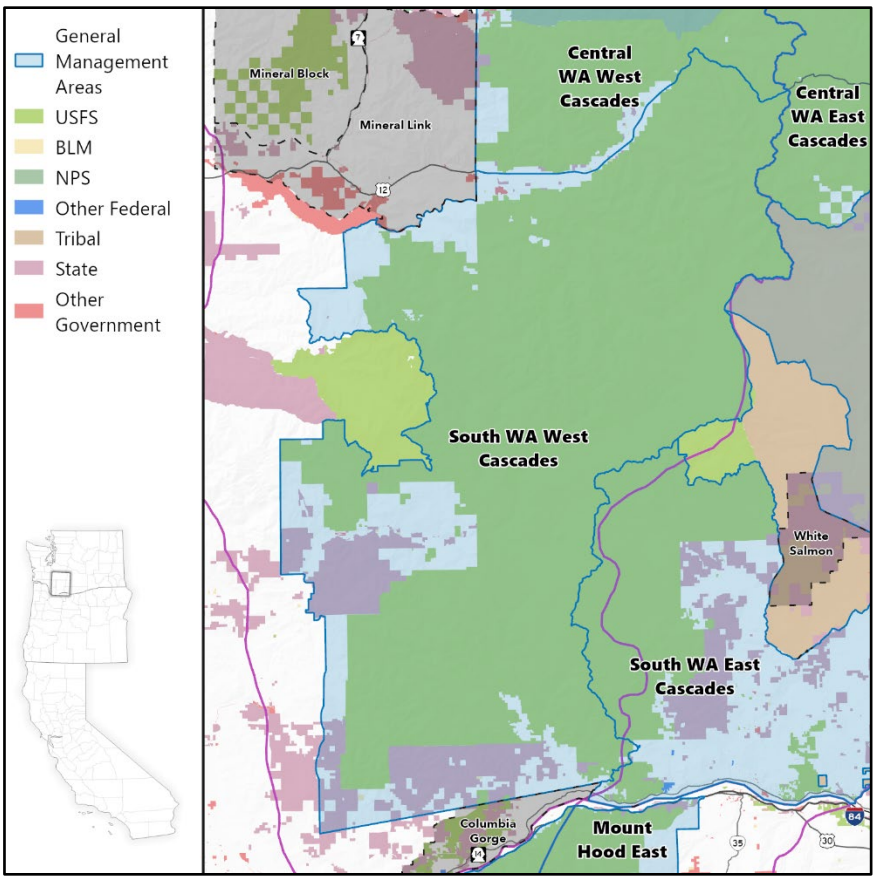
8. Include lands of interested and willing landowners or land managers. A focus on areas where landowners have expressed interest in barred owl management and may have the ability to assist with operations will speed the implementation of actual barred owl management and encourage involvement.

9. Prioritize areas with lower barred owl densities before expanding management to areas with higher barred owl densities. Outside of the Rainier study area, pre-management barred owl surveys may be needed to determine barred owl densities. Barred owl densities are often higher in unfragmented, lower elevation, high-quality spotted owl habitat and lower in marginal, fragmented habitat, particularly in drier habitats, at higher elevations, on steeper slopes, or at the backs of fjord-like valleys. These features associated with lower barred owl densities have also been associated with greater spotted owl persistence in the presence of barred owls.

10. Consider the potential for connection to other FMAs in the GMA and to neighboring management areas, with special attention to any FMAs or site management areas on the east side of the Cascade Crest with recent spotted owl presence. Placement of FMAs in close proximity to other managed areas, particularly where there is forest that may provide connectivity to the Eastern Washington Cascades through low passes, can connect populations in these areas.

11. Consider including areas where more efficient use of funding (such as targeting more accessible areas or areas where surveys are already funded and planned) can be used to maximize management efficacy at scale, and more efficiently reduce the impact of barred owls on spotted owls.

*A4.3.B.2.b South Washington West Cascades GMA – Priority B*




The South Washington West Cascades GMA lies west of the Cascade Crest, south of Highway 12 and stretches south almost to the Columbia River. It includes approximately 1,163,366 acres in total, of which 1,101,665 acres (95 percent) are forest lands and 460,819 acres (40 percent) provide suitable spotted owl habitat. The GMA includes the Mount Adams Ranger district and parts of the Cowlitz Ranger district on the Gifford Pinchot National Forest, and parts of the Mount Saint Helens National Volcanic Monument and the Columbia Gorge National Scenic Area. It also includes State and private lands within the Siouxon SOSEA and parts of the Mineral Link and Columbia Gorge SOSEAs, as well as some State and private lands outside of SOSEAs. Forest lands in this GMA are 78 percent Federal lands (Forest Service), 9 percent State lands, and the remainder primarily in private ownership.

This GMA was mapped for the following reasons:

- It contains historical spotted owl sites, although recent spotted owl occupancy and presence are unknown due to very low survey effort in recent years.
- This GMA has a high amount and density of habitat that could support spotted owl populations in the absence of barred owls.
- This GMA has connectivity to other areas with high densities of spotted owl habitat and recent spotted owl presence in the Central Washington West Cascades GMA to the north, and to GMAs to the east, including occupied habitat on the Yakama Nation Reservation.

This GMA is assigned Priority B. Spotted owls are at high risk of extirpation throughout the Western Washington Cascades Province. Due to low survey effort in recent years, the locations of currently or recently occupied spotted owl sites are unknown in this GMA. Block management in this GMA is intended to slow population declines and prevent extirpation, but in order to effectively accomplish this, FMAs must include current spotted owl sites. Therefore, immediate initiation of block management in this GMA may not be possible because surveys will be needed first. If spotted owls are located during surveys, site management to protect areas

where spotted owls are currently present (or have been detected within the previous five years) will be a Priority A action, but additional management outside of these sites is likely to increase the effectiveness of management. Although there is an urgent need for barred owl management in this FMA to protect any remaining spotted owls here, it cannot be initiated as swiftly as it can in the Central Washington West Cascades GMA, and therefore, block management in this area meets the definition of a Priority B action.

*Description of the elements considered in mapping:* In mapping the boundaries of the South Washington West Cascades GMA we used information on the following elements.

*Spotted Owl Data:*

- The GMA includes historical spotted owl activity centers.
- We included areas with relatively large amounts of high-quality habitat and activity centers from which to select FMAs large enough to support spotted owl populations. Models developed for the Northwest Forest Plan Effectiveness Monitoring program predict the presence of habitat that can support populations of spotted owls in this GMA. This GMA contains areas that have an estimated carrying capacity to support clusters of 20 or more spotted owl pairs, in the absence of barred owls.
- We did not try to exclude high elevation areas without habitat or areas where habitat has been lost to wildfire. This can be considered during development of the Focal Management Area boundaries.
- The GMA boundary includes a long segment along the Cascades Crest, which approximates the province boundary between the Western and Eastern Washington Cascades Provinces. In some areas, habitat is present along both sides of the Crest. This allows for good connectivity between the provinces. The areas to the east of this GMA include portions of the Central Washington East Cascades GMA and the South Washington East Cascades GMA, which includes Yakama Nation Reservation lands.
- We excluded areas to the west due to the presence of a smaller amount and lower quality of habitat in these areas, and no known recent spotted owl occupancy.
- We excluded areas with very little habitat on the Mount Saint Helens National Monument, as well as large tracts of private land with very little habitat and few activity centers.

*Conditions:*

- We considered the availability of access via roads and trails in most of this area. This GMA includes some areas where access may be difficult, such as wilderness and roadless areas. This can be considered during development of the Focal Management Area boundaries.
- We considered the presence of SOSEAs with habitat and activity centers. Including these areas allows for incentives for management.

*Other Considerations:*

- This GMA includes some areas of private and State lands with relatively low densities of spotted owl habitat. These areas were included in order to reduce the edge-to-area ratio of the GMA, making it possible to create FMAs with low edge-to-area ratios (see below).

These areas also buffer the areas of spotted owl habitat, providing for the possibility of removing barred owls that would otherwise move into areas of spotted owl habitat where barred owls have been removed.

*Focal Management Areas (FMAs)*
In this GMA, we recommend developing FMAs large enough to support as many spotted owl pair sites as possible, up to 50 pair sites per FMA. Generally, larger blocky areas provide a smaller edge-to-area ratio, and this may help reduce the influx of barred owls from outside the FMA in the future. However, where the landscape or forest conditions do not allow this, smaller or more sinuous FMAs, still encompassing multiple pair areas, may be appropriate. If smaller FMAs are developed due to funding limitations, design them such that they could be expanded in the future if additional funding becomes available.

When possible, include multiple FMAs, generally spaced no farther than 12 to 15 miles apart. Where smaller areas are developed due to topography, forest condition, access, funding limitations, or other reasons, we recommend these be closer together and multiple areas be designed with the intent of encouraging exchange of spotted owls between these smaller areas.

Coordinate FMA locations with the spotted owl site management described above. Including recently occupied sites in FMAs provides the starting point for development of spotted owl populations as barred owl populations are reduced. In this GMA and throughout the province, there is very little information regarding recent spotted owl occupancy or presence. We recommend conducting surveys so that areas of current spotted owl activity can be included in FMAs. Additionally, coordinate FMA locations with barred owl management activity in neighboring GMAs and the Mineral Link and Columbia Gorge SOSEA Special Designated Areas.

*Priorities:* The following are our recommended priorities for defining and selecting FMAs within the South Washington West Cascades GMA. The following are in general priority order; however, local expertise will be important in applying these to specific FMA boundary designs.

1. Build FMAs around current and recent spotted owl sites (sites with presence or occupancy of spotted owls within the last five years). This provides a nucleus of spotted owls for the potential recolonization of sites within the FMA as barred owl numbers are reduced.

2. Include areas with high-quality historical spotted owl sites (sites with no confirmed occupancy in the last five years or more). Indicators may include, for example, especially good habitat amount, quality, and configuration; a history of good past demographic performance; or a history of long-term occupancy. These are areas that have been shown by past use to be attractive to spotted owls and therefore more likely to be reoccupied, especially as spotted owl populations increase.

3. Select areas with the greatest acreage or density of spotted owl habitat. These are likely to be areas with the highest carrying capacity for spotted owls, which can be measured using a habitat-based calculation of the estimated maximum population of territorial spotted owls without barred owl presence.

4. Place blocks allowing for the maximum number of spotted owls to be supported. Focus on areas with the potential for at least 20 spotted owl pairs, though 50 pair sized areas are the target where possible.

5. Include areas with the most high-quality spotted owl habitat in large areas where possible. This high-quality habitat may be in historical spotted owl sites, or it may connect sites.

6. Consider the presence of areas already designated for spotted owl habitat management or compatible conservation purposes, such as Late Successional Reserves, Congressionally reserved areas, SOSEAs, designated critical habitat, and areas identified as high priorities in the Northern Spotted Owl Recovery Plan. Including these areas provides support for spotted owls and limits impacts on other resources. Because many of these have been managed for older forest over the last decades, these are the likely locations of some of the best habitat conditions.

7. Focus on areas with reasonable access, in terms of road networks, which are available in most of the spotted owl habitat in these GMAs. Closed roads may be used like a trail system if they can be safely walked. Trail systems can be used where roads do not exist, but roads are generally preferred to maximize operational efficiency.

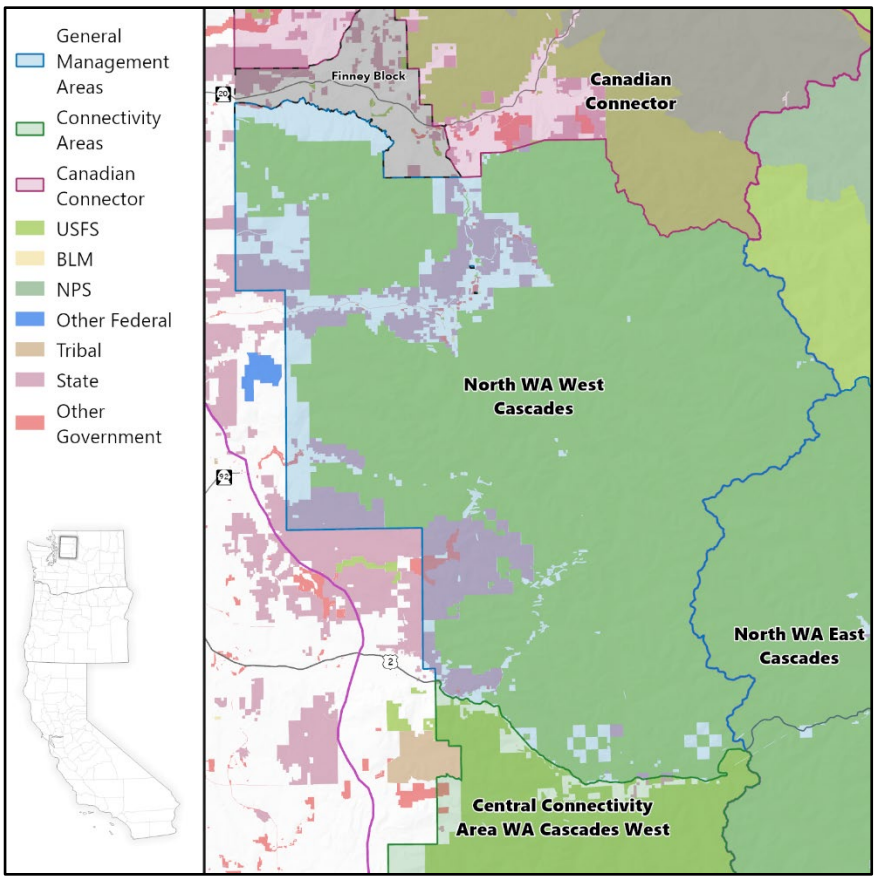
8. Include lands of interested and willing landowners or land managers. A focus on areas where landowners have expressed interest in barred owl management and may have the ability to assist with operations will speed the implementation of actual barred owl management and encourage involvement.

9. Prioritize areas with lower barred owl densities before expanding management to areas with higher barred owl densities. Though research on barred owl habitat use was previously conducted in parts of this GMA, pre-management barred owl surveys may be needed to determine current barred owl densities. Barred owl densities are often higher in unfragmented, lower elevation, high-quality spotted owl habitat and lower in marginal, fragmented habitat, particularly in drier habitats, at higher elevations, on steeper slopes, or at the backs of fjord-like valleys. These features associated with lower barred owl densities have also been associated with greater spotted owl persistence in the presence of barred owls.

10. Consider the potential for connection to other FMAs in the GMA, and to neighboring management areas, with special attention n to any FMAs or site management areas on the east side of the Cascade Crest with recent spotted owl presence. Placement of FMAs in close proximity to other managed areas, particularly where there is forest that may provide connectivity to the Eastern Washington Cascades through low passes, can connect populations in these areas.

11. Consider including areas where more efficient use of funding (such as targeting more accessible areas or areas where surveys are already funded and planned) can be used to maximize management efficacy at scale, and more efficiently reduce the impact of barred owls on spotted owls.

*A4.3.B.2.c North Washington West Cascades GMA – Priority C*




The North Washington West Cascades GMA lies south of Highway 20 and west of the Cascade Crest. It includes approximately 1,059,912 acres in total, of which 903,600 acres (85 percent) are forest lands and 350,764 acres (33 percent) provide suitable spotted owl habitat. The GMA includes parts of the Mount Baker-Snoqualmie National Forest (including most of the Darrington Ranger district, and southern parts of the Mount Baker Ranger District) as well a portion of the Finney Block SOSEA, and State and private lands both inside and outside of the SOSEA. Forest lands in this GMA are 79 percent Federal lands (Forest Service), 11 percent State lands, and the remainder primarily in private ownership.

This GMA was mapped for the following reasons:

- It contains historical activity centers, although recent spotted owl presence is unknown due to low survey effort in recent years.
- This GMA has a large amount of high-quality habitat that could support spotted owl populations in the absence of barred owls.
- This GMA has connectivity to areas with high densities of spotted owl habitat, and is adjacent to Special Designated Areas to the north and south, and to habitat and GMAs in the Eastern Washington Cascades province.

This GMA is assigned Priority C. Spotted owls are at high risk of extirpation throughout the Western Washington Cascades Province. Due to low survey effort in recent years, it is unknown whether spotted owls are currently present within this GMA, and if so, their locations are unknown. We expect that spotted owls are likely fewer in number in this GMA, relative to areas farther south, due to the longer time since the initial barred owl invasion. If spotted owls are detected during surveys, site management around these detections (and any other locations with detections in the last five years) will be a Priority A action, and site management to protect sites with known occupancy during the last ten years remains a Priority B action. Additional management within this GMA beyond site management is likely to increase the effectiveness of

management and provide opportunities for recolonization. However, because the habitat here is lower in density than in the other GMAs, we expect that recolonization may be slower here. Therefore, the definition of a Priority C action fits our expectations of FMA management in this GMA.

*Description of the elements considered in mapping:* In mapping the boundaries of the North Washington West Cascades GMA we used information on the following elements.

*Spotted Owl Data:*

- We included historical spotted owl activity centers. In some cases, the location of historical activity centers influenced the location of the GMA boundary.
- We included areas with relatively large amounts of high-quality habitat and historical activity centers from which to select FMAs large enough to support spotted owl populations. Models developed for the Northwest Forest Plan Effectiveness Monitoring program predict the presence of habitat that can support populations of spotted owls in this GMA. This GMA contains areas that have an estimated carrying capacity to support clusters of 20 or more pairs of spotted owls, in the absence of barred owls.
- The GMA boundary includes a long segment along the Cascades Crest, which makes up the province boundary with the Eastern Washington Cascades Province. In some areas, habitat is present along both sides of the Crest. Much of the area to the east of this GMA is within the North Washington East Cascades GMA. This allows for good connectivity between the provinces.
- We did not try to exclude high elevation areas without habitat, or areas where habitat has been lost to wildfire. This can be considered during development of the FMA boundaries.
- Areas to the west were excluded due to the presence of smaller amounts and lower quality of habitat in these areas, no known recent spotted owl occupancy, and very little to no historical occupancy.

*Conditions:*

- We considered the availability of access via roads and trails in most of this area. This GMA includes some areas where access may be difficult, such as wilderness and roadless areas. This can be considered during development of the Focal Management Area boundaries.
- We considered the presence of SOSEAs with habitat and activity centers. Including these areas allows for incentives for management.

*Other Considerations:*

- This GMA includes some areas of private and State lands with relatively low densities of spotted owl habitat. These areas were included in order to reduce the edge-to-area ratio of the GMA, making it possible to create FMAs with low edge-to-area ratios (see below). These areas also buffer the areas of spotted owl habitat, providing for the possibility of removing barred owls that would otherwise move into areas of spotted owl habitat where barred owls have been removed.

*Focal Management Areas (FMAs)*

In the North Washington East Cascades GMA, we recommend developing FMAs large enough to support as many spotted owl pair sites as possible, up to 50 spotted owl pair sites per FMA. Generally, larger blocky areas provide a smaller edge-to-area ratio, and this may help reduce the influx of barred owls from outside the FMA in the future. However, where the landscape or forest conditions do not allow this, smaller or more sinuous areas may be appropriate. For example, in higher elevation areas where habitat is confined to valley bottoms, large blocky FMAs may not be reasonable or effective, and smaller FMAs, still encompassing multiple pair areas, may be a practical option. These may be more sinuous in nature due to the habitat limitations. If smaller FMAs are developed due to funding limitations, rather than habitat configuration, design them such that they could be expanded in the future if funding becomes available.

Where possible, include multiple FMAs, generally spaced no farther than 12 to 15 miles apart. Where smaller areas are developed due to topography, forest condition, access, funding limitations, or other reasons, we recommend these be closer together and multiple areas be designed with the intent of encouraging exchange of spotted owls between these smaller areas.

Coordinate FMA locations with the spotted owl site management described above. Including recently occupied sites in FMAs provides a starting point for development of spotted owl populations as barred owl populations are reduced. In this GMA and throughout the province, there is very little information regarding recent spotted owl occupancy or presence. We recommend conducting surveys so that areas of current spotted owl activity can be included in FMAs. Additionally, coordinate FMA locations with barred owl management activity in neighboring GMAs, the Central Connectivity Area, the Canadian Connector, and the Finney Block SOSEA Special Designated Area.

*Priorities:* The following are our recommended priorities for defining and selecting FMAs within the North Washington West Cascades GMA. The following are in general priority order; however, local expertise will be important in applying these to specific FMA boundary designs.

1. Build FMAs around current and recent spotted owl sites (sites with presence or occupancy of spotted owls within the last five years). This provides a nucleus of spotted owls for the potential recolonization of sites within the FMA as barred owl numbers are reduced.

2. Include areas with high-quality historical spotted owl sites (sites with no confirmed occupancy in the last five years or more). Indicators may include, for example, especially good habitat amount, quality, and configuration; a history of good past demographic performance; or a history of long-term occupancy. These are areas that have been shown by past use to be attractive to spotted owls and therefore more likely to be reoccupied, especially as spotted owl populations increase.

3. Select areas with the greatest acreage or density of spotted owl habitat. These are likely to be areas with the highest carrying capacity for spotted owls, which can be measured using a habitat-based calculation of the estimated maximum population of territorial spotted owls without barred owl presence.

4. Place blocks allowing for the maximum number of spotted owls to be supported. Focus on areas with the potential for at least 20 spotted owl pairs, though 50 pair sized areas are the target where possible.

5. Include areas with the most high-quality spotted owl habitat in large areas where possible. This high-quality habitat may be in historical spotted owl sites, or it may connect sites.

6. Consider the presence of areas already designated for spotted owl habitat management or compatible conservation purposes, such as Late Successional Reserves, Congressionally reserved areas, SOSEAs, designated critical habitat, and areas identified as high priorities in the Northern Spotted Owl Recovery Plan. Including these areas provides support for spotted owls and limits impacts on other resources. Because many of these have been managed for older forest over the last decades, these are the likely locations of some of the best habitat conditions.

7. Focus on areas with reasonable access, in terms of road networks, which are available in most of the spotted owl habitat in this GMA. Closed roads may be used like a trail system if they can be safely walked. Trail systems can be used where roads do not exist, but roads are generally preferred to maximize operational efficiency.

8. Include lands of interested and willing landowners or land managers. A focus on areas where landowners have expressed interest in barred owl management and may have the ability to assist with operations will speed the implementation of actual barred owl management and encourage involvement.

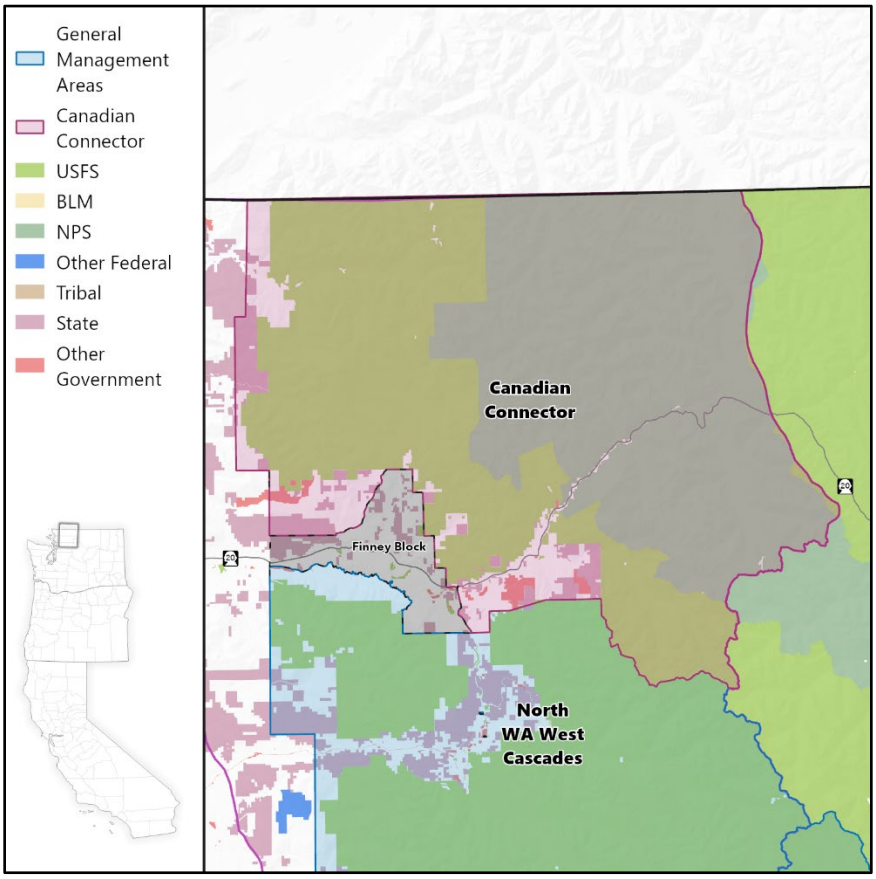
9. Prioritize areas with lower barred owl densities before expanding management to areas with higher barred owl densities. Pre-management barred owl surveys may be needed to determine barred owl densities. Barred owl densities are often higher in unfragmented, lower elevation, high-quality spotted owl habitat and lower in marginal, fragmented habitat, particularly in drier habitats, at higher elevations, on steeper slopes, or at the backs of fjord-like valleys. These features associated with lower barred owl densities have also been associated with greater spotted owl persistence in the presence of barred owls.

10. Consider the potential for connection to other FMAs in the GMA and to neighboring management areas, with special attention to any FMAs or site management areas on the east side of the Cascade Crest with recent spotted owl presence. Placement of FMAs in close proximity to other managed areas, particularly where there is forest that may provide connectivity to the Eastern Washington Cascades through low passes, can connect populations in these areas.

11. Consider including areas where more efficient use of funding (such as targeting more accessible areas or areas where surveys are already funded and planned) can be used to maximize management efficacy at scale, and more efficiently reduce the impact of barred owls on spotted owls.

### A4.3.B.3 Special Designated Areas

*A4.3.B.3.a. Canadian Connector – Priority D*




The Canadian Connector Special Designated Area lies north of Highway 20 and west of the Cascade Crest. It includes approximately 1,098,099 acres in total, of which 745,184 acres (68 percent) are forest lands and 302,310 acres (28 percent) provide suitable spotted owl habitat. The Canadian Connector includes parts of the Mount Baker-Snoqualmie National Forest and most of North Cascades National Park, and the Finney Block SOSEA. It includes State private lands both within and outside of the SOSEA. Forest lands in the Canadian Connector are 85 percent Federal lands (Forest Service and National Park Service), 5 percent State lands, 1 percent other public lands, and the remainder mainly in private ownership.

The Canadian Connector was mapped for the following reasons:

- The primary reason for mapping this area was to provide future opportunities to support the Canadian spotted owl reintroduction should that become possible. For example, if spotted owls are reintroduced near the border in Canada, barred owl removal nearby on the United States side of the border could increase the likelihood of reintroduction success. If reintroduced spotted owl populations become established in Canada, this area could allow for connectivity between those populations and populations in Washington.
- It contains historical activity centers, although recent spotted owl presence is unknown due to low survey effort in recent years.
- The Canadian Connector has a large amount of high-quality habitat that could support spotted owls in the absence of barred owls.
- This area includes large habitat areas mapped as fire and climate refugia.
- The Canadian Connector has connectivity to areas with high densities of spotted owl habitat and to habitat in Canada, and is adjacent to a GMA to the south and to habitat in the Eastern Washington Cascades Province with recent spotted owl presence.

The Canadian Connector is assigned Priority D. Due to low survey effort in recent years, it is unknown whether spotted owls are currently present within the Canadian Connector, and if so, their locations are unknown. We expect that spotted owls are likely fewer in number here, relative to areas farther south, due to the longer time since the initial barred owl invasion. If spotted owls are detected during surveys, site management around these detections (and any other locations with detections in the last five years) will be a Priority A action. Site management to protect sites with known occupancy during the last ten years remains a Priority B action, and site management to protect all other historical sites remains a Priority C action. Additional management within the Canadian Connector beyond site management would support Canadian spotted owl reintroduction efforts, and could also improve demographic connectivity between populations of spotted owls in larger management areas, both within Washington and between Washington or Canada. Given the low density of spotted owl habitat in this area, we expect that recolonization of this area would be slow, compared with areas to the south. Management within the Canadian Connector, beyond site management, would provide its greatest value at a later time, once Canadian reintroduction efforts are further along and/or populations of spotted owls in Washington begin to recover.

*Description of the elements considered in mapping:* In mapping the boundaries of the Canadian Connector we used information on the following elements.

*Spotted Owl Data:*

- This area includes historical spotted owl activity centers. In some cases the locations of these sites influenced the placement of the Canadian Connector boundaries.
- We included areas with relatively large amounts of high-quality habitat and historical activity centers from which to select management areas large enough to support spotted owl populations. Models developed for the Northwest Forest Plan Effectiveness Monitoring program predict fire refugia in this area, as well as habitat that can support populations of spotted owls in the Canadian Connector. The Canadian Connector contains areas that have an estimated carrying capacity to support clusters of 20 or more pairs of spotted owls, in the absence of barred owls.
- The Canadian Connector's boundary includes a long segment along the Cascades Crest, which makes up the province boundary with the Eastern Washington Cascades Province. In some areas, habitat is present along both sides of the Crest. Although the area to the east of the Canadian Connector is not within a mapped management area, it does include an area of habitat with known recent spotted owl occupancy, where site management is a Priority A action.
- We excluded areas to the west due to the presence of a smaller amount and lower quality of habitat in these areas, no known recent spotted owl occupancy, and very little to no historical occupancy.
- We did not try to exclude high elevation areas without habitat, or areas where habitat has been lost to wildfire. This can be considered during development of the FMA boundaries.

*Conditions:*

- We considered the availability of access via roads and trails in most of this area, mostly in fjord-like habitat. The Canadian Connector includes some areas where access may be

difficult, such as wilderness and roadless areas. This can be considered during development of the Focal Management Area boundaries.
- We considered the presence of SOSEAs with habitat and activity centers. Including these areas allows for incentives for management.

*Other Considerations:*

- Areas to the west were excluded due to the presence of less habitat in these areas, no recent spotted owl occupancy, and very little to no historical occupancy, and more marginal habitat in these areas.
- We did not try to exclude high elevation areas without habitat, or areas where habitat has been lost to wildfire. This can be considered during development of the FMA boundaries.
- We included some areas of private and State lands with relatively low densities of spotted owl habitat. These areas were included in order to reduce the edge-to-area ratio of the Canadian Connector, making it possible to create block management areas with low edge-to-area ratios (see below). These areas also buffer the areas of spotted owl habitat, providing for the possibility of removing barred owls that would otherwise move into areas of spotted owl habitat where barred owls have been removed.

*Management Recommendations for the Canadian Connector*

The primary function of the Canadian Connector is future opportunity to support spotted owl reintroduction in Canada. The management of blocks of habitat for spotted owl populations provides the best potential for such contributions.

The additional, short-term focus for management in this area is to identify remaining occupied spotted owl sites and conduct barred owl management to protect these remaining sites. Initially, we recommend conducting surveys of historical spotted owl sites, and areas with high-quality spotted owl habitat without historical spotted owl data. If occupied spotted owl sites are found, manage these sites using the site management described above, with at least 26,058 acres (2 home range radii), and preferably larger.

Longer term, focus on creating smaller blocks of habitat, each large enough to support multiple spotted owl sites, allowing for spotted owl populations to connect across this area. We recommend developing barred owl management areas around the occupied and historical spotted owl sites, with a focus on scattered small blocks across the entire area to provide for connectivity. In addition, general barred owl removal in this area, designed to reduce barred owl densities, may provide opportunities for successful dispersal of spotted owls. This is not anticipated to be as intense or continuous at that within management blocks.

Coordinate the locations of barred owl management within the Canadian Connector with any other barred owl management activity in surrounding areas. This may include neighboring site management areas, FMAs within the North Washington West Cascades GMA, and the Finney Block SOSEA Special Designated Area, as well as in Canadian spotted owl reintroduction areas.

*Priorities:* The following are our recommended priorities for defining and selecting management blocks within the Canadian Connector. The following are in general priority order; however, local expertise will be important in applying these to specific management block designs.

1. Place management blocks in areas that will best support Canadian spotted owl reintroduction efforts.

2. Manage around current and recent spotted owl sites (sites with presence or occupancy of spotted owls in the last five years). This is intended to maintain spotted owl distribution where it exists across the Canadian Connector. Where recent survey data are not available, manage around sites that have not undergone significant habitat modification since they were last known to be occupied.

3. Prioritize spotted owl site management, or place small management blocks, to include clusters of sites with good current demographic parameters (e.g., higher survival, occupancy, reproductive output, etc.) relative to others in the Canadian Connector.

4. Select management areas to facilitate connectivity, both within the Canadian Connector and with nearby GMAs and other management areas, via landscapes that can support dispersal. In particular, facilitate connectivity between close management areas, with management distributed across the Canadian Connector to make steppingstones for generational dispersal between the neighboring GMA, site management areas, and Canadian spotted owl populations that may develop.

5. Select clusters of spotted owl sites or place small blocks in areas with the highest acreage of high-quality spotted owl habitat, for example, as measured by relative habitat suitability. These are likely to be areas with the highest per-area carrying capacity for spotted owls, which can be measured using a habitat-based calculation of the estimated maximum population of territorial spotted owls without barred owl presence.

6. Build management blocks around current spotted owl sites with presence or occupancy of spotted owls. This provides a nucleus of spotted owls for the potential recolonization of sites within the management block as barred owl numbers are reduced. Additionally, include areas with high-quality historical spotted owl sites (sites with no confirmed occupancy in the last five years or more). Indicators may include, for example, especially good habitat amount, quality, and configuration; a history of good past demographic performance; or a history of long-term occupancy. These are areas that have been shown by past use to be attractive to spotted owls and therefore more likely to be reoccupied, especially as spotted owl populations increase.

7. Consider the presence of areas already designated for spotted owl management and compatible conservation purposes, such as Late Successional Reserves, Congressionally reserved areas, SOSEAs, designated critical habitat, and areas identified as high priorities in the Northern Spotted Owl Recovery Plan. Including these areas provides support for spotted owls and limits impacts on other resources. Because many of these have been managed for older forest over the last decades, these are the likely locations of some of the best habitat conditions.

8. Focus on areas with reasonable access, in terms of road networks, which are available in most of the spotted owl habitat in the Canadian Connector. Closed roads may be used like a

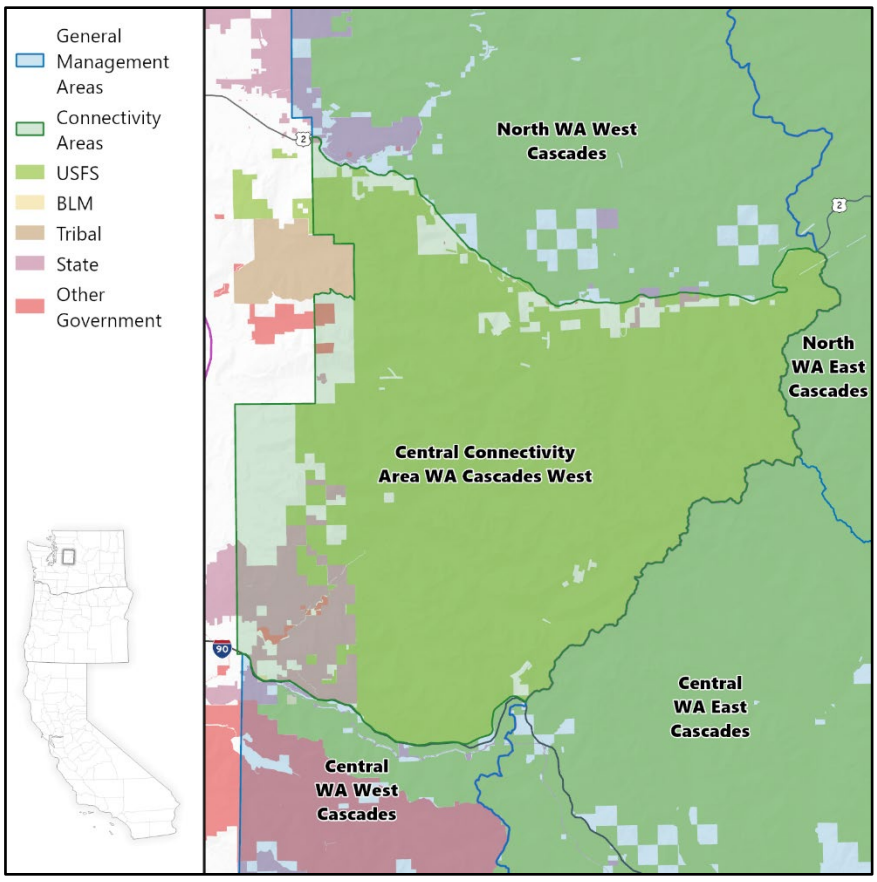
trail system if they can be safely walked. Trail systems can be used where roads do not exist, but roads are generally preferred to maximize operational efficiency.

9. Include lands of interested and willing landowners or land managers. A focus on areas where landowners have expressed interest in barred owl management and may have the ability to assist with operations will speed the implementation of actual barred owl management and encourage involvement.

10. Prioritize areas with lower barred owl densities before expanding management to areas with higher barred owl densities. Pre-management barred owl surveys may be needed to determine barred owl densities. Barred owl densities are often higher in unfragmented, lower elevation, high-quality spotted owl habitat and lower in marginal, fragmented habitat, particularly in drier habitats, at higher elevations, on steeper slopes, or at the backs of fjord-like valleys. These features associated with lower barred owl densities have also been associated with greater spotted owl persistence in the presence of barred owls.

11. Consider including areas where more efficient use of funding (such as targeting more accessible areas or areas where surveys are already funded and planned) can be used to maximize management efficacy at scale, and more efficiently reduce the impact of barred owls on spotted owls.

*A4.3.B.3.b Central Connectivity Area Washington Cascades West – Priority D*




The Central Connectivity Area Washington Cascades West lies north of Interstate 90, south of the North Washington West Cascades GMA, and west of the Cascade Crest. It includes approximately 323,206 acres in total, of which 265,754 acres (82 percent) are forest lands and 92,676 acres (29 percent) provide suitable spotted owl habitat. The Connectivity Area includes parts of the Mount Baker-Snoqualmie National Forest (including parts of the Darrington and Snoqualmie Ranger Districts), State lands (including part of the Middle Fork Snoqualmie Natural Resource Conservation Area), local lands, and some private lands. Forest lands in this Connectivity Area are 79 percent Federal lands (Forest Service), 7 percent State lands, and the remainder in primarily private ownership.

The Central Connectivity Area Washington Cascades West was mapped for the following reasons:

- It contains historical activity centers, although recent spotted owl presence is unknown due to low survey effort in recent years.
- The Central Connectivity Area Washington Cascades West includes high-quality habitat that could support spotted owls in the absence of barred owls.
- The Central Connectivity Area Washington Cascades West provides potential connectivity to areas with high densities of spotted owl habitat, is adjacent to four GMAs to the north, south and east, including habitat to the east and south with recent known spotted owl presence.

This Connectivity Area is assigned Priority D. Due to low survey effort in recent years, it is unknown whether spotted owls are currently present within this Connectivity Area, and if so, their locations are unknown. We expect that spotted owls are likely fewer in number in this area, relative to areas farther south, due to the longer time since the initial barred owl invasion. If spotted owls are detected during surveys, site management around these detections (and any other locations with detections in the last five years) will be a Priority A action. Site management

to protect sites with known occupancy during the last ten years remains a Priority B action, and site management to protect all other historical sites remains a Priority C action. Additional management within this Connectivity Area beyond site management could improve demographic connectivity between populations of spotted owls in larger management areas within Washington. Given the low density of spotted owl habitat in this area, we expect that recolonization of this area would be slow, compared with areas to the south. Management within this Connectivity Area, beyond site management, would provide its greatest value at a later time, once populations of spotted owls in Washington begin to recover.

*Description of the elements considered in mapping:* In mapping the boundaries of the Central Connectivity Area Washington Cascades West we used information on the following elements.e

*Spotted Owl Data:*

- This area includes historical spotted owl activity centers. In some cases the locations of these sites influenced the placement of the Connectivity Area boundaries.
- We included areas with relatively large amounts of high-quality habitat and historical activity centers from which to select management areas large enough to support spotted owl populations, movement and connectivity. Models developed for the Northwest Forest Plan Effectiveness Monitoring program predict habitat that can support populations of spotted owls in this Connectivity Area. This Connectivity Area contains areas that have an estimated carrying capacity to support clusters of 20 or more pairs.
- The Connectivity Area boundary includes a long segment along the Cascades Crest, which makes up the province boundary with the Eastern Washington Cascades Province. In some areas, habitat is present along both sides of the Crest. All of the area to the east of this Connectivity Area is within either the North Washington East Cascades GMA or the Central Washington East Cascades GMA. This allows for good connectivity between the provinces.
- In addition to the two GMAs in the Eastern Washington Cascades along the eastern boundary, the Connectivity Area is bounded to the north and south by the North Washington West Cascades GMA and the Central Washington West Cascades GMA, respectively. It is intended to facilitate connectivity among all of these areas.
- We excluded areas to the west due to the presence of smaller amounts and lower quality of habitat in these areas, no known recent spotted owl occupancy, and very little to no historical occupancy.
- We did not try to exclude high elevation areas without habitat, or areas where habitat has been lost to wildfire. This can be considered during development of the management area boundaries.

*Conditions:*

- We considered the availability of access via roads and trails in most of this area in fjord-like habitat. This Connectivity Area includes some areas where access may be difficult, such as wilderness, although most spotted owl habitat is in more accessible portions of the Connectivity Area. Accessibility can be considered during development of the management area boundaries.

*Other Considerations:*

- The Connectivity Area includes some areas of private and local public lands with relatively low densities of spotted owl habitat. These areas were included in order to reduce the edge-to-area ratio of the Connectivity Area, making it possible to create management areas with low edge-to-area ratios (see below). These areas also buffer the areas of spotted owl habitat, providing for the possibility of removing barred owls that would otherwise move into areas of spotted owl habitat where barred owls have been removed.

*Management Recommendations for the Connectivity Area*
In the Central Connectivity Area Western Washington Cascades, the short-term focus for management is to identify remaining occupied spotted owl sites and conduct barred owl management to protect these remaining sites. Longer term, focus on creating smaller blocks of habitat allowing for spotted owl populations to connect across this area and reducing overall barred owl population density to support spotted owl demographic connections across this area.

Initially, we recommend conducting surveys of historical spotted owl sites, and areas with high-quality spotted owl habitat without historical spotted owl data. If occupied sites are found, manage these sites using the site management described above, with at least 11,581 acres (2 home range radii), and preferably larger.

In the longer term, we recommend developing barred owl management areas around the occupied and historical spotted owl sites, with a focus on scattered small blocks across the entire Connectivity Area to provide for connectivity. In addition, general barred owl removal in this area, designed to reduce barred owl densities, may provide opportunities for successful dispersal of spotted owls. This is not anticipated to be as intense or continuous at that within management blocks.

Coordinate the locations of barred owl management within the Connectivity Area with any other barred owl management activity in surrounding areas. This may include FMAs within the four neighboring GMAs, as well any site management areas near the Connectivity Area.

*Priorities:* The following are our recommended priorities for defining and selecting management blocks within the Central Connectivity Area Washington West Cascades. The following are in general priority order; however, local expertise will be important in applying these to specific management block designs.

1. Manage around current and recent spotted owl sites (Sites with presence or occupancy of spotted owls within the last five years). This is intended to maintain distribution where it exists across the Connectivity Area. Where recent survey data are not available, manage around sites that have not undergone significant habitat modification since they were last known to be occupied.

2. Include areas with high-quality historical spotted owl sites (sites with no confirmed occupancy in the last five years or more). Indicators may include, for example, especially good habitat amount, quality, and configuration; a history of good past demographic

performance; or a history of long-term occupancy. These are areas that have been shown by past use to be attractive to spotted owls and therefore more likely to be reoccupied, especially as spotted owl populations increase.

3. Select management areas to facilitate connectivity, both within the Connectivity Area and with nearby GMAs and other management areas, via landscapes that can support dispersal. In particular, facilitate connectivity between close management areas, with management distributed across the Connectivity Area to make steppingstones for generational dispersal between neighboring GMAs.

4. Select clusters of spotted owl sites or place small blocks in areas with the highest acreage of high-quality spotted owl habitat, for example, as measured by relative habitat suitability. These are likely to be areas with the highest per-area carrying capacity for spotted owls, which can be measured using a habitat-based calculation of the estimated maximum population of territorial spotted owls without barred owl presence.

5. Include areas with the most high-quality spotted owl habitat in large areas where possible. This high-quality habitat may be in historical spotted owl sites or it may connect sites.

6. Consider the presence of areas already designated for spotted owl habitat management or compatible conservation purposes, such as Late Successional Reserves, Congressionally reserved areas, designated critical habitat, and areas identified as high priorities in the Northern Spotted Owl Recovery Plan. Including these areas provides support for spotted owls and limits impacts on other resources. Because many of these have been managed for older forest over the last decades, these are the likely locations of some of the best habitat conditions.

7. Focus on areas with reasonable access, in terms of road networks, which are available in most of the spotted owl habitat in this Connectivity Area. Closed roads may be used like a trail system if they can be safely walked. Trail systems can be used where roads do not exist, but roads are generally preferred to maximize operational efficiency.

8. Include lands of interested and willing landowners or land managers. A focus on areas where landowners have expressed interest in barred owl management and may have the ability to assist with operations will speed the implementation of actual barred owl management and encourage involvement.

9. Prioritize areas with lower barred owl densities before expanding management to areas with higher barred owl densities. Pre-management barred owl surveys may be needed to determine barred owl densities. Barred owl densities are often higher in unfragmented, lower elevation, high-quality spotted owl habitat and lower in marginal, fragmented habitat, particularly in drier habitats, at higher elevations, on steeper slopes, or at the backs of fjord-like valleys. These features associated with lower barred owl densities have also been associated with greater spotted owl persistence in the presence of barred owls.

10. Consider including areas where more efficient use of funding (such as targeting more accessible areas or areas where surveys are already funded and planned) can be used to

maximize management efficacy at scale, and more efficiently reduce the impact of barred owls on spotted owls.

*A4.3.B.3.c Spotted Owl Special Emphasis Areas – Priority E*

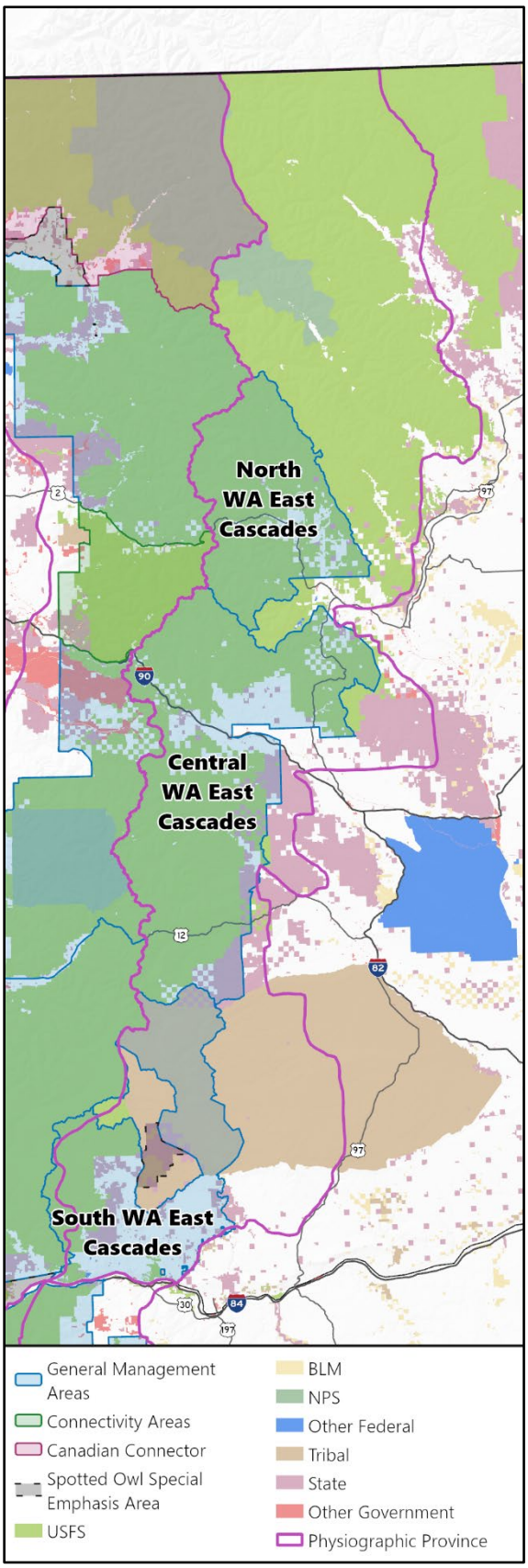
The State of Washington identified 10 key landscapes, referred to as Spotted Owl Special Emphasis Areas (SOSEAs), where northern spotted owl conservation in the form of demographic and/or dispersal support was important on non-Federal lands. In mapping the Strategy, portions of some SOSEAs were included in mapped GMAs and the Canadian Connector. Barred owl management recommendations for GMAs and the Canadian Connector apply to the portions of SOSEAs lying within those mapped areas. Where SOSEA lands fell outside of these designations, we mapped the areas as SOSEA Special Designated Areas.

There are four SOSEA Special Designated Areas in the Western Washington Cascades (see Western Washington Cascades Province map on page 112).

| SOSEA | Forest Acres on Federal lands | Forest Acres on State Lands | Forest Acres on Private Lands | Maximum Forest Acres Under Management |
|---|---|---|---|---|
| Finney Block SOSEA | 1,070 | 13,020 | 44,225 | 14,626 |
| Mineral Block SOSEA | 37,151 | 2,435 | 65,358 | 26,264 |
| Mineral Link SOSEA | 0 | 33,414 | 112,672 | 38,969 |
| Columbia Gorge SOSEA | 10,985 | 9,379 | 11,629 | 7,943 |

In the original designation by Washington, each SOSEA was described in terms of one or more conservation functions -- demographic support, dispersal support, and combination support. Demographic support meant that adequate amounts and arrangements of suitable nesting, roosting, and foraging habitat are maintained to support reproductive spotted owl pairs. Dispersal support is provided by a landscape that includes dispersal habitat at the stand level interspersed with areas of higher quality habitat. Combination support was defined as either maintaining suitable spotted owl habitat to protect the viability of the owls at a spotted owl site center or providing a variety of habitat conditions which in total are more than dispersal support and less than demographic support. The Finney Block SOSEA Special Designated Area is designated for dispersal support, as is the entire Mineral Link SOSEA. The Mineral Block and Columbia Gorge SOSEAs are designated for combination support.

For the Strategy, barred owl management in the form of removal could be occur at any scale in a SOSEA. We recommend spotted owl site-based management as described in Section 8.4.1.2. of the Strategy and Section B.1 above. Removal of barred owls around spotted owl sites can be applied anywhere within the province and is an appropriate small scale management effort in SOSEAs. Removing barred owls within and around occupied spotted owl sites retains the existing population, increases the potential for recruitment of young, and provides a source of young for recolonization of areas where barred owl management occurs. Spotted owl site management can provide connectivity between larger block areas. Where feasible, clustering spotted owl site management into small blocks increases the functionality of this management.




# A4.4 Eastern Washington Cascades Province

## A4.4.A Background

The Eastern Washington Cascades Province is one of four physiographic provinces in Washington. The majority of this province (61 percent of the total area) consists of Forest Service lands. Of the forest lands in this province, 63 percent are under Federal management (Forest Service and National Park Service), 15 percent on Tribal lands, 9 percent under State management, and the remainder primarily private land. The Eastern Washington Cascades are characterized by cold, snowy winters and dry summers with a high frequency of natural disturbance due to fires and outbreaks of forest insects and pathogens.

### A4.4.A.1 Spotted Owl Condition in the Eastern Washington Cascades

Federal lands in the province include approximately 543,829 acres of spotted owl nesting and roosting habitat, mostly in the central and southern portions of the province. Steep, rugged mountains in the northern portion of the province restrict habitat development to valley bottoms and other lower elevation areas, so habitat has historically been fragmented in this part of the province by topography. Habitat losses to fire and insect damage have also disproportionately reduced habitat amounts in the northern portion of the province.

Spotted owls within the Eastern Washington Cascades Province use a variety of forest types, including ponderosa pine (*Pinus ponderosa*)/Douglas-fir forests at lower elevations, mixed conifer forests, forests dominated by grand fir (*Abies grandis*), and higher elevation moist western hemlock forests. Spotted owls in the drier, lower-elevation forests have shown higher fecundity than those in wetter, higher-elevation conditions, but the lower, drier forests are also at higher risk of habitat loss due to fire and other

stressors (Irwin et al. 2004, pp. 15-16). Flying squirrels are the primary prey species, but depending on location, bushy-tailed woodrats, snowshoe hares, and pika (*Ochotona princeps*) may also be important (Bevis et al. 1997, p. 72; Forsman et al. 2001, p .145).

The Eastern Washington Cascades Province includes the Cle Elum Demography Study Area, so we use this area to represent the status of spotted owls in the province. The Cle Elum study area provides data on spotted owl populations since 1989. Monitoring efforts indicate that spotted owl occupancy at historical territories has declined substantially. This study area, along with the Olympic study area on the Olympic Peninsula, has shown the highest rate of spotted owl population decline, nearly 9 percent per year from 1995 through 2017 (Franklin et al. 2021, pp. 11-13). Spotted owl pair occupancy dropped from 65 percent in 1993 to 7 percent in in 2018 (Davis et al. 2022, p. 37). Comprehensive call playback surveys in 2021 detected spotted owls at 7 percent of the surveyed historical sites, including a pair at 1 percent of surveyed sites, but note that these results have not been corrected for imperfect detection (Lesmeister et al. 2022b, p. 12). Only one known spotted owl pair remains on the Cle Elum study area, and unless others are present but undetected, this represents a decline in pair occupancy by 98 percent since 1993. The other known spotted owls on the Cle Elum study area are all single males. Passive acoustic monitoring has also been conducted at the Cle Elum study area since 2020. Spotted owls were detected at 11 percent of sample units (hexagons) in 2022, a decrease from 19 percent in 2020 (Lesmeister et al. 2023, p. 17). Note that these results are not directly comparable to either the 2018 or the 2021 results reported above, because they were obtained using different methods.

#### A4.4.A.2 Barred Owl Condition in the Eastern Washington Cascades Province

Barred owls have been at high densities in Washington for longer periods of time compared to areas farther south in the northern spotted owl range, but their densities are lower in the drier forests east of the Cascade Crest than they are to the west. On the Cle Elum Study area in the Eastern Washington Cascades Province, barred owls occupied 70 percent of the of the sample units (hexagons) as detected by passive acoustic monitoring in 2021 (Lesmeister et al. 2022a, p. 23).

## A4.4.B. Management Strategy

### A4.4.B.1 Spotted Owl Site Management in the Eastern Washington Cascades Province

*A4.4.B.1.a Background*

Given the limited spotted owl population in this province, it is crucial to protect the remaining spotted owls through barred owl management at spotted owl sites. Because some areas have not been surveyed consistently in recent years, we recommend surveys of historically active sites, particularly those that have been active within the last 10 years and have not undergone major habitat loss since the last known spotted owl activity.

In some cases, managed sites may eventually be incorporated into block management areas. In other cases, site management of single sites or clusters of sites may be an appropriate long-term action, if larger blocks of habitat are not available for management due to topographic or ownership conditions.

- Managing barred owls in recently occupied spotted owl sites is intended to help reduce the rate of spotted owl population decline as quickly as possible and prevent extinction/extirpation of the spotted owl in the province.
- Managing barred owls in spotted owl sites that are, or become, reproductively active, may enable those sites to provide a source of young for colonization of nearby management blocks. These sites may provide demographic support for nearby management blocks.
- Where spotted owl site management occurs within a GMA, these spotted owl sites may serve as key points for the development of focal management areas, now and in the future. Site management may be expanded into block management over time.
- Managing barred owls in spotted owl sites distributed across the province, whether within block management areas or not, may reduce the risk of loss of spotted owls in the province from catastrophic events, such as wildfire, by maintaining spotted owl site occupancy across the area. Managing spotted owl sites also provides the opportunity for maintaining spotted owls in areas where block management is not feasible or recommended. This approach applies across the entire province, whether or not the locations are within a GMA or other mapped designation.
- These managed spotted owl sites may provide a source of spotted owl individuals for direct augmentation of block management areas in the future, should such management action be necessary.
- These spotted owl sites may serve to increase connectivity between and within block management areas, and provide sites in the vicinity of block management areas that can interact at a demographic level with those management areas.
- Spotted owl site management, due to its smaller size when compared to block management, provides a wider range of options for landowner contribution to barred owl management, particularly for smaller landowners. The smaller size also makes site management suitable for areas where there are not large amounts of spotted owl habitat due to terrain, or extensive loss of habitat from wildfires, harvest, or other disturbances.

*Selection of spotted owl sites for management in Eastern Washington Cascades Province*

The number of occupied spotted owl sites is extremely limited in this province. The primary focus of spotted owl site management in this province is on sites that have been occupied by, or had detections of, spotted owls in the last five years. These areas are more likely to have spotted owls present, or be recolonized by spotted owls after barred owl removal. This is reflected in the priorities for site management.

*Spotted Owl Site Management Priorities*

| Priority | Spotted Owl Site Condition |
|---|---|
| A | Currently and recently active sites, including all areas with any spotted owl detections within the last 5 years |
| B | Historically occupied spotted owl sites (pair or single) with last detection between 5 and 10 years ago |
| C | Historically occupied spotted owl sites (pair or single) with last detection more than 10 years ago |
| D | Potential sites with adequate habitat but no known history of spotted owl occupancy, and without detections within the last 5 years |

*Other considerations for selection of spotted owl sites for management:*

- We recommend consideration of the following factors when selecting among sites within a priority category. Select sites with the most recent spotted owl occupancy, particularly if surveys have been conducted on these areas in recent years. Do not discount sites as unoccupied based on lack of recent surveys.
- Focus first on sites with recent occupancy by pairs, then singles, then detections.
- Consider past reproductive history of the site. Select sites with a history of reproduction on the site where surveys are available.
- Consider the condition of habitat in the area, particularly loss of habitat since the last surveys. All other things being equal, select sites with abundant high-quality habitat. Spotted owl sites that have lost substantial amounts of habitat to fire, harvest, insect damage, or other disturbances may be lower priority.

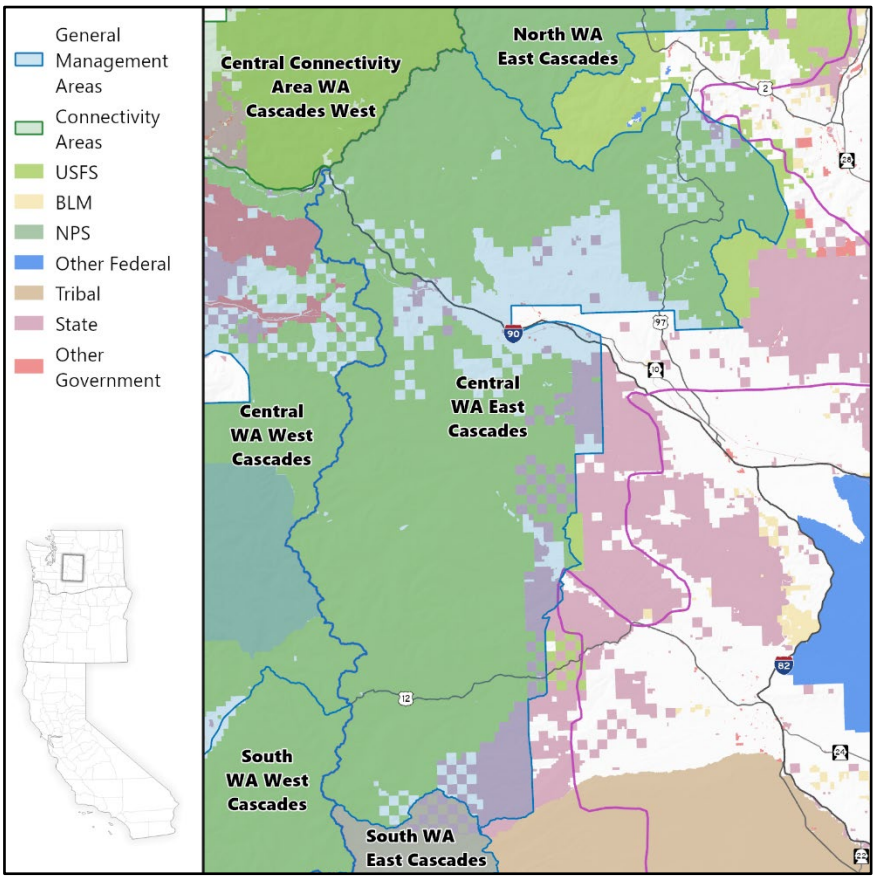
*A4.4.B.1.b Management Recommendations*

Within each individual site, remove barred owls from an area between 14,657 and 26,058 acres. This represents the area in a circle of 1.5 and 2 home range radii (Table 2). This can be distributed in a circle around the activity center, or implementers can use local knowledge, topography, and habitat condition to design a non-circular area of the appropriate size that provides the best conditions for barred owl management. In areas where spotted owl sites are isolated, and particularly for spotted owl sites in Priority A condition (see table above), we recommend a larger management area, up to 58,630 acres (3 home range radii). Where sites are not isolated, applying site management to clusters of two or more sites in close proximity is likely to provide more efficient management conditions and increased benefits for spotted owls present in those sites.

For example, in the northern portion of the province, a series of historical sites is present in a discrete patch of fjord-like habitat along the upper end of Lake Chelan, the Stehekin River, and Agnes Creek. This area is outside of mapped management areas, and even if it were included in a GMA or special designated area, the patch of habitat is too small to support large block management. In one of these sites, the most recent spotted owl detections were within the last five years. Therefore, this site would be assigned Priority A. If managed in isolation, we would recommend a site management area including up to 58,630 acres (3 home range radii), which could be arranged in an oblong along valley bottom and sides. The other historical sites in this area could also be managed via site management, and if site management at the current Priority A site enables reproduction and in turn recruitment to nearby sites, these neighboring sites may also move into Priority A status. Concurrent management of multiple historical sites in this area could result reduced barred owl densities throughout most of this patch of fjord-like habitat.

## A4.4.B.2 General Management Areas in the Eastern Washington Cascades Province

*A4.4.B.2.a Central Washington East Cascades GMA – Priority A*




The Central Washington East Cascades GMA lies east of the Cascade Crest and north of the Yakama Nation Reservation. It includes approximately 1,296,896 acres in total, of which 1,137,645 acres (88 percent) are forest lands and 277,111 acres (21 percent) provide spotted owl nesting and roosting habitat. The GMA includes the Naches Ranger District, the Cle Elum Ranger District, and parts of the Wenatchee River Ranger district on the Okanogan-Wenatchee National Forest. It encompasses the I90-East and North Blewett SOSEAs, which include State and private lands. It also includes State lands and some private lands outside of SOSEAs. Forest lands in this GMA are 76 percent Federal lands (Forest Service), 9 percent State lands, and the remainder primarily in private ownership.

This GMA was mapped for the following reasons:

- It contains the largest number of current and recent known spotted owl pair occupancy in the Eastern Washington Cascades Province. There are multiple spotted owl pairs present in this GMA.
- The GMA includes Cle Elum Demography Study Area, with its historical and recent spotted owl data. The Northwest Forest Plan Effectiveness Monitoring program includes passive acoustic monitoring sampling 20 percent of the Cle Elum study area. This monitoring program will provide additional future data on both spotted and barred owls, and allow for efficiencies in monitoring barred owl removal and its effects on spotted owls. This portion of the GMA is well known and accessible, allowing for quicker implementation.
- Barred owls were experimentally removed from a portion of the Cle Elum study area in 2015 through 2019. This work demonstrated benefits to spotted owls. Information collected during the experiment regarding barred and spotted owl use of the landscape would support quicker and more effective implementation.

- The GMA is centrally located, allowing for connectivity to GMAs to the north, south, and west.
- The GMA contains a diversity of habitat types, from relatively cool and moist to warmer and drier. This allows for management in the range of habitat types that spotted owls occupy in the Eastern Washington Cascades. Historically, some of the highest fecundity rates for spotted owls occurred in the Cle Elum demography study area, even in the warmer and drier portions of it, and some of the few remaining known pairs occur in the warmer and drier parts of this GMA. These forest types can be more vulnerable to loss from catastrophic wildfire. Therefore, by including a diversity of forest types in this GMA that connect warmer and drier forest types to relatively cooler and moister forest types that are predicted to function as fire refugia in the future, we build in connectivity to more resilient and diverse habitat types for a future spotted owl population in this GMA.

This GMA was assigned Priority A due to the demonstrated previous success here of barred owl management for spotted owl conservation and the rapid decline of spotted owls in this area. The well-studied landscape of the Cle Elum study area and practical knowledge gained during experimental removals allow for rapid deployment of barred owl management to the locations where it can have the most immediate benefit to existing spotted owls. Therefore, this GMA is an area where barred owl management can and should be implemented immediately to prevent extirpation of spotted owls in the province, which is an area with very low spotted owl populations and very high risk of extirpation in the near future.

*Description of the elements considered in mapping:* In mapping the boundaries of the Central Washington East Cascades GMA we used information on the following elements.

*Spotted Owl Data:*

- This GMA includes current, recent, and historical spotted owl activity centers. In some cases the locations of these sites influenced the placement of the GMA boundaries.
- We included areas with relatively large amounts of high-quality nesting and roosting habitat and activity centers from which to select FMAs large enough to support spotted owl populations. Models developed for the Northwest Forest Plan Effectiveness Monitoring program predict habitat that can support populations of spotted owls in this GMA. This GMA contains areas that have an estimated carrying capacity to support clusters of 20 or more pairs.
- We did not try to exclude high elevation areas without habitat, or areas where habitat has been lost to wildfire. This can be considered during development of the FMA boundaries.
- We included a diversity of habitat types within the GMA, ranging from relatively cool and moist to warmer and drier, as well as fjord-like habitat, allowing for management of all types of landscapes.
- The GMA boundary includes a long segment along the Cascades Crest, which makes up the province boundary with the Western Washington Cascades Province. In some areas, habitat is present along both sides of the Crest. This allows for good connectivity between the provinces. The areas to the west of this GMA include the Central Washington West Cascades GMA and portions of the South Washington West Cascades GMA and the Central Connectivity Area.

- In addition to the GMAs and Connectivity Area in the Western Washington Cascades along the western boundary, the GMA is bounded to the north and south, respectively, by the North Washington East Cascades GMA and the South Washington East Cascades GMA, including Yakama Nation Reservation lands, providing for connectivity within the province.
- Areas to the east were excluded due to the presence of smaller amounts and lower quality of habitat in these areas, and lack of recent spotted owl occupancy based on surveys in recent years.

*Conditions:*

- We considered the availability of access via roads and trails in most of this area. We excluded portions of some wilderness areas due to poor accessibility and lack of habitat, but the GMA includes other wilderness and roadless areas where access may be difficult. Accessibility can be considered during development of the FMA boundaries.
- We considered the presence of SOSEAs with spotted owl habitat and activity centers. Including these areas allows for incentives for management.

*Other Considerations:*

- As discussed above, this GMA includes the Cle Elum study area, which encompasses a former experimental removal area. This allows for efficiencies in monitoring and opportunities for research. Although portions of the study area are outside of the GMA, the GMA does include the vast majority of the study area.

*Focal Management Areas (FMAs)*

In this GMA, we recommend developing FMAs large enough to support as many spotted owl pair sites as possible, up to 50 pair sites per FMA. Generally, larger blocky areas provide a smaller edge-to-area ratio, and this may help reduce the influx of barred owls from outside the FMA in the future. However, where the landscape or forest conditions do not allow this, smaller or more sinuous areas may be appropriate. For example, in higher elevation areas where habitat is confined to valley bottoms, large blocky FMAs may not be reasonable or effective, and smaller FMAs, still encompassing multiple pair areas, may be a practical option. These may be more sinuous in nature due to the habitat limitations. If smaller FMAs are developed due to funding limitations, design them such that they could be expanded in the future if funding becomes available.

When possible, include multiple FMAs, generally spaced no farther than 12 to 15 miles apart. Where smaller areas are developed due to topography, forest condition, access, funding limitations, or other reasons, we recommend these be closer together and multiple areas be designed with the intent of encouraging exchange of spotted owls between these smaller areas.

Because of the history of barred owl research and experimental management in parts of this area, additional information may be available regarding areas with higher and lower barred owl influxes, and implementers should refer to this information in FMA development.

Including recently occupied sites in FMAs provides the starting point for development of spotted owl populations as barred owl populations are reduced. In areas where habitat connectivity is limited, site management may help to provide connectivity between smaller FMAs. Coordinate FMA locations with the site management described above, with FMA locations in adjacent GMAs, and with barred owl management in the Central Connectivity Area.

*Priorities:* The following are our recommended priorities for defining and selecting FMAs within the Central Washington East Cascades GMA. The following are in general priority order; however, local expertise will be important in applying these to specific FMA boundary designs.

1. Build FMAs around current and recent sites (sites with presence or occupancy of spotted owls within the last five years). This provides a nucleus of spotted owls for the potential recolonization of sites within the FMA as barred owl numbers are reduced.

2. Focus on areas with reasonable access, in terms of road networks, which are available in most of the spotted owl habitat in the GMA. Closed roads may be used like a trail system if they can be safely walked. Trail systems can be used where roads do not exist, but roads are generally preferred to maximize operational efficiency.

3. Consider fire risk in mapping the boundaries of the FMAs. Avoid concentrating FMAs solely in areas identified as having the highest risk of habitat loss to fire; however, some areas with high fire risk may still be important to include in FMAs, particularly where spotted owls are likely to be present (i.e., areas with recent detections). Providing connectivity in FMAs from higher risk spotted owl habitat to areas identified as fire refugia and other areas with relatively lower risk in the fire prone landscape of the Eastern Washington Cascades. Placement of multiple FMAs within the GMA and inclusion of areas with relatively high resistance to uncharacteristic fire could reduce the risk of complete loss.

4. Place blocks allowing for the maximum number of spotted owls to be supported. Focus on areas with the potential for at least 20 spotted owl pairs, though 50 pair sized areas are the target where possible.

5. Select areas with the greatest acreage or density of spotted owl habitat. These are likely to be areas with the highest carrying capacity for spotted owls, which can be measured using a habitat-based calculation of the estimated maximum population of territorial spotted owls without barred owl presence.

6. Include lands of interested and willing landowners or land managers. A focus on areas where landowners have expressed interest in barred owl management and have the ability to assist with operations will speed the implementation of actual barred owl management and encourage involvement.

7. Include areas with high-quality historical spotted owl sites (sites with no confirmed occupancy in the last five years or more). Indicators may include, for example, especially good habitat amount, quality, and configuration; a history of good past demographic performance; or a history of long-term occupancy. These are areas that have been shown by

past use to be attractive to spotted owls and therefore more likely to be reoccupied, especially as spotted owl populations increase.

8. Consider the potential for connection to other FMAs in the GMA, and to neighboring GMAs and the Central Connectivity Area. Placement of FMAs in close proximity to other management areas, particularly there is forest that may provide connectivity to the Western Washington Cascades through low passes, can connect populations in these areas.

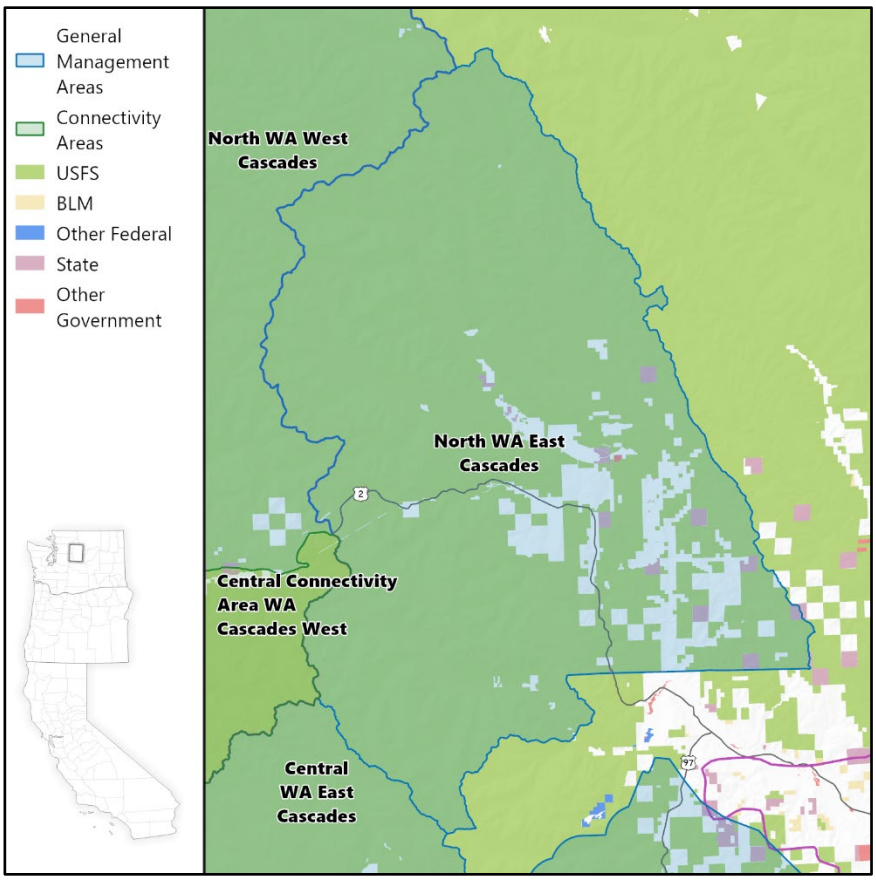
9. Consider the presence of areas already designated for spotted owl habitat management or compatible conservation purposes, such as Late Successional Reserves, Congressional reserves, SOSEAs, designated critical habitat and areas identified as high priorities in the Northern Spotted Owl Recovery Plan. Including these areas provides support for spotted owls and limits impactss on other resources. Because many of these have been managed for older forest over the last decades, these are the likely locations of some of the best habitat conditions.

10. Select areas with a diversity of spotted owl habitat types. Given the range of forest conditions spotted owls use in this GMA, selecting areas with a range of habitat types provides for a variety of conditions for future spotted owl population development. Historically, the Eastern Washington Cascades had some of the highest fecundity rates for spotted owls, even in warmer and drier areas with more fire risk. The relatively cool, moist areas of the landscape may have more long-term forest resiliency or act as fire refugia, but may not support the same high fecundity rates. Managing a variety of connected types of spotted owl habitat in this province could allow spotted owl to best withstand a dynamic future under climate change with increased risk of habitat loss from very large, high intensity fires and outbreaks of tree disease and insects that affect trees.

11. Consider climate change resilience in selecting areas. Other things being equal, include areas identified as having greater resilience. This may include areas identified as fire refugia or areas with sufficient spotted owl habitat that have been treated for improved resilience to threats associated with climate change such as increases in habitat loss from widespread insect or disease outbreak and/or catastrophic very large fires.

12. Consider including areas where more efficient use of funding (such as targeting more accessible areas) can be used to maximize management efficacy at scale, and more efficiently reduce the impact of barred owls on spotted owls.

*A4.4.B.2.b North Washington East Cascades GMA – Priority B*




The North Washington East Cascades GMA lies east of the Cascade Crest and north of the Cle Elum Ranger District on the Okanogan-Wenatchee National Forest. It includes approximately 592,394 acres in total, of which 452,374 acres (76 percent) are forest lands and 139,970 acres (24 percent) provide spotted owl nesting and roosting habitat. The GMA includes most of the Wenatchee River Ranger district on the Okanogan-Wenatchee National Forest, as well as the majority of the Entiat Ridge SOSEA. It includes State and private lands both within and outside of the SOSEA. It lies on both the north and south sides of the Highway 2 corridor and stretches north to Entiat Ridge and the southern boundary of the Entiat Ranger District. Forest lands in this GMA are 89 percent Federal lands (Forest Service), 1 percent State lands, and the remainder in primarily private ownership.

This GMA was mapped for the following reasons:

- It contains recent and current spotted owl presence and known pair activity, though there are fewer active spotted owl pair sites and fewer sites in all here than in the Central Washington East Cascades GMA just to the south.
- This GMA has a high amount and density of habitat that could support spotted owl populations in the absence of barred owls.
- This GMA has connectivity to the Central Washington East Cascades GMA with high densities of spotted owl habitat and areas with recent spotted owl presence to the south, and to GMAs and a Connectivity Area to the west.
  It contains a diversity of habitat types, from relatively cool and moist to warmer and drier. This allows for management in the range of habitat types that spotted owls occupy in the Eastern Washington Cascades. Warmer and drier forest types may support higher spotted owl fecundity, but also can be more vulnerable to loss from catastrophic wildfire. By including a diversity of forest types in this GMA that connect warmer and drier forest types to relatively cooler and moister forest types that are predicted to function as fire refugia in the future, we

build in connectivity to more resilient and diverse habitat types for a future spotted owl population in this GMA.

This GMA is assigned Priority B. Spotted owls are at high risk of extirpation throughout the Eastern Washington Cascades Province. The spotted owl population in this area is very small, and has been affected not only by barred owl effects but also by loss of habitat to fire and other forest disturbances. Barred owl removal, if implemented soon, would reduce further impacts from barred owl competition to spotted owls already stressed by habitat loss. This, in turn, could slow population declines and stabilize the population. Placing block management areas to encompass a range of vegetation communities used by spotted owls may be especially beneficial, in that it will connect high risk habitat that may provide short-term demographic benefits to lower risk areas that may provide habitat over a longer period of time. Site management around currently occupied sites within this GMA remains a Priority A action, but additional management outside of these sites is likely to increase the effectiveness of management. Portions of this landscape are relatively well-surveyed and accessible, allowing for relatively rapid implementation of barred owl management, but not as rapid as in the Central Washington East Cascades GMA, which includes a study area where experimental barred owl management has previously occurred.

*Description of the elements considered in mapping:* In mapping the boundaries of the North Washington East Cascades GMA we used information on the following elements.

*Spotted Owl Data:*

- This GMA includes current, recent, and historical spotted owl activity centers. In some cases the locations of these activity centers influenced the placement of the GMA boundaries.
- We included areas with relatively large amounts of high-quality nesting and roosting habitat and activity centers from which to select FMAs large enough to support spotted owl populations. Models developed for the Northwest Forest Plan Effectiveness Monitoring program predict habitat that can support populations of spotted owls in this GMA. This GMA contains areas that have an estimated carrying capacity to support clusters of 20 or more pairs.
- We included a diversity of habitat types within the GMA, ranging from relatively cool and moist to warmer and drier, as well as fjord-like habitat, allowing for management of all types of landscapes.
- The GMA boundary includes a long segment along the Cascades Crest, which makes up the province boundary with the Western Washington Cascades Province. In some areas, habitat is present along both sides of the Crest. This allows for good connectivity between the provinces. The areas to the west of this GMA include portions of the North Washington West Cascades GMA and the Central Connectivity Area.
- In addition to the management areas in the Western Washington Cascades along the western boundary, the GMA is bounded to the south by the Central Washington East Cascades GMA, providing for connectivity within the province.
- Areas to the east were excluded due to the presence of smaller amounts and lower quality of habitat in these areas and no known recent spotted owl occupancy in these driest areas.

- We excluded high elevation areas of the Stuart Range, which lack habitat, but did not try to exclude all high elevation areas without habitat, or areas where habitat has been lost to wildfire. This can be considered during development of the Focal Management Area boundaries.

*Conditions:*

- We considered the availability of access via roads and trails in most of this area. We excluded portions of some wilderness areas due to poor accessibility and lack of habitat, but the GMA includes other wilderness and roadless areas where access may be difficult. Accessibility can be considered during development of the management area boundaries.
- We considered the presence of SOSEAs with spotted owl habitat and activity centers. Including these areas allows for incentives for management.

*Other Considerations:*

- The GMA boundaries generally followed watershed boundaries or SOSEA boundaries.

*Focal Management Areas (FMAs)*

In this GMA, we recommend developing FMAs large enough to support as many spotted owl pair sites as possible, up to 50 pair sites per FMA. Generally, larger blocky areas provide a smaller edge-to-area ratio, and this may help reduce the influx of barred owls from outside the FMA in the future. However, where the landscape or forest conditions do not allow this, smaller or more sinuous areas may be appropriate. For example, in higher elevation areas where habitat is confined to valley bottoms, large blocky FMAs may not be reasonable or effective, and smaller FMAs, still encompassing multiple pair areas, may be a practical option. These may be more sinuous in nature due to the habitat limitations. If smaller FMAs are developed due to funding limitations, rather than habitat configuration, design them such that they could be expanded in the future if funding becomes available.

When possible, include multiple FMAs, generally spaced no farther than 12 to 15 miles apart. Where smaller areas are developed due to topography, forest condition, access, funding limitations, or other reasons, we recommend these be closer together and multiple areas be designed with the intent of encouraging exchange of spotted owls between these smaller areas.

Including recently occupied sites in FMAs provides the starting point for development of spotted owl populations as barred owl populations are reduced. In areas where habitat connectivity is limited, site management may help to provide connectivity between smaller FMAs. Coordinate FMA locations with the site management described above, with FMA locations in adjacent GMAs, and with barred owl management in the Central Connectivity Area.

*Priorities:* The following are our recommended priorities for defining and selecting FMAs within the North Washington East Cascades GMA. The following are in general priority order; however, local expertise will be important in applying these to specific FMA boundary designs.

1. Build FMAs around current and recent sites (sites with presence or occupancy of spotted owls within the last five years). This provides a nucleus of spotted owls for the potential recolonization of sites within the FMA as barred owl numbers are reduced.

2. Focus on areas with reasonable access, in terms of road networks, which are available in most of the spotted owl habitat in the GMA. Closed roads may be used like a trail system if they can be safely walked. Trail systems can be used where roads do not exist, but roads are generally preferred to maximize operational efficiency.

3. Consider fire risk in mapping the boundaries of the FMAs. Avoid concentrating FMAs solely in areas identified as having the highest risk of habitat loss to fire; however, some areas with high fire risk may still be important to include in FMAs, particularly where spotted owls are likely to be present (i.e., areas with recent detections). Providing connectivity in FMAs from higher risk spotted owl habitat to areas identified as fire refugia and other areas with relatively lower risk will be important in the fire prone landscape of the Eastern Washington Cascades. Placement of multiple FMAs within the GMA and inclusion of fire refugia or other areas with higher resistance to uncharacteristic fire could reduce the risk of complete loss.

4. Place blocks allowing for the maximum number of spotted owls to be supported. Focus on areas with the potential for at least 20 spotted owl pairs, though 50 pair sized areas are the target where possible.

5. Select areas with the greatest acreage or density of spotted owl habitat. These are likely to be areas with the highest carrying capacity for spotted owls, which can be measured using a habitat-based calculation of the estimated maximum population of territorial spotted owls without barred owl presence.

6. Include lands of interested and willing landowners or land managers. A focus on areas where landowners have expressed interest in barred owl management and have the ability to assist with operations will speed the implementation of actual barred owl management and encourage involvement.

7. Include areas with high-quality historical spotted owl sites (sites with no confirmed occupancy in the last five years or more). Indicators may include, for example, especially good habitat amount, quality, and configuration; a history of good past demographic performance; or a history of long-term occupancy. These are areas that have been shown by past use to be attractive to spotted owls and therefore more likely to be reoccupied, especially as spotted owl populations increase.

8. Consider the potential for connection to other FMAs in the GMA, and to neighboring GMAs, to the Central Connectivity Area, and to any site management areas to the north. Placement of FMAs in close proximity to other management areas, particularly where there is forest that may provide connectivity to the Western Washington Cascades through low passes, can connect populations in these areas.

9. Consider the presence of areas already designated for spotted owl habitat management or compatible conservation purposes, such as Late Successional Reserves, Congressionally

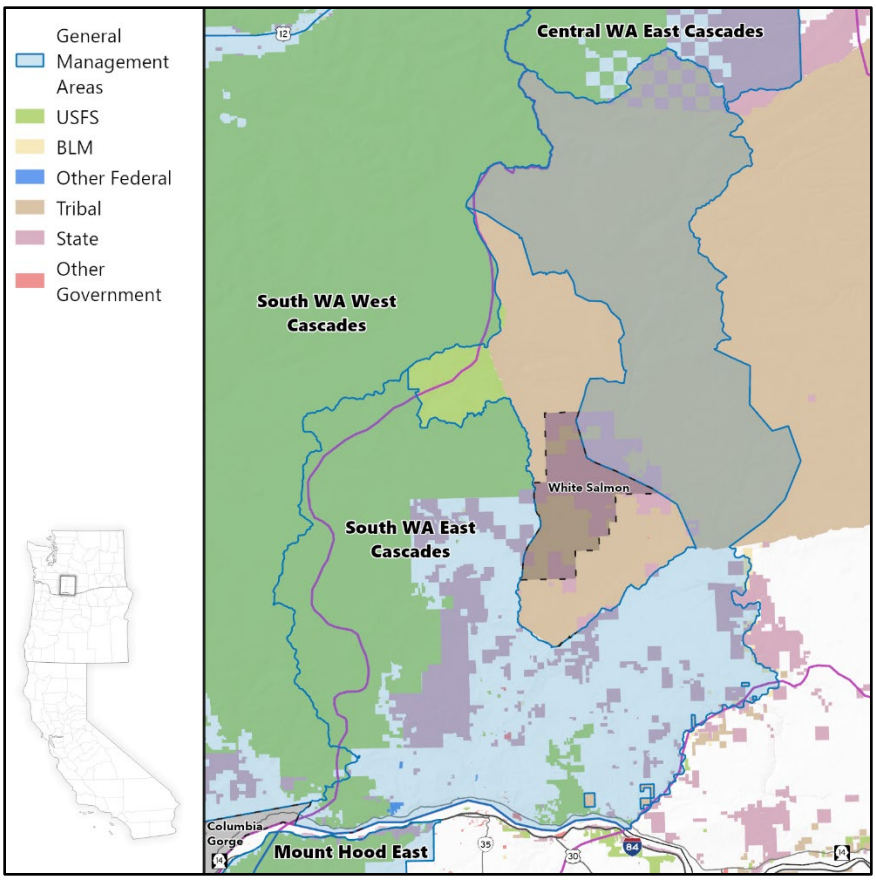
reserved areas, SOSEAs, designated critical habitat, and areas identified as high priorities in the Northern Spotted Owl Recovery Plan. Including these areas provides support for spotted owls and limits impacts on other resources. Because many of these have been managed for older forest over the last decades, these are the likely locations of some of the best habitat conditions.

10. Select areas with a diversity of spotted owl habitat types. Given the range of forest conditions spotted owls use in this GMA, selecting areas with a range of habitat types provides for a variety of conditions for future spotted owl population development. Historically, the Eastern Washington Cascades had some of the highest fecundity rates for spotted owls, even in warmer and drier areas with more fire risk. The relatively cool, moist areas of the landscape may have more long-term forest resiliency or act as fire refugia, but may not support the same high fecundity rates. Managing a variety of connected types of spotted owl habitat in this province could allow spotted owls to best withstand a dynamic future under climate change with increased risk of habitat loss from very large, high intensity fires and outbreaks of tree disease and insects that affect trees.

11. Consider climate change resilience in selecting areas. Other things being equal, include areas identified as having greater resilience. This may include areas identified as fire refugia or areas with sufficient spotted owl habitat that have been treated for improved resilience to threats associated with climate change such as increases in habitat loss from widespread insect or disease outbreak and/or catastrophic very large fires.

12. Consider including areas where more efficient use of funding (such as targeting more accessible areas) can be used to maximize management efficacy at scale, and more efficiently reduce the impact of barred owls on spotted owls.

*A4.4.B.2.c South Washington East Cascades GMA – Priority B*




The South Washington East Cascades GMA lies north of the Columbia River and east of the Cascade Crest. It includes approximately 717,252 acres in total, of which 662,301 acres (92 percent) are forest lands and 193,572 acres (27 percent) provide spotted owl nesting and roosting habitat. The GMA includes the southeastern part of the Gifford Pinchot National Forest (mostly on the Mount Adams Ranger district) as well as Yakama Nation lands, part of the White Salmon SOSEA, and some State and private lands both within and outside of the SOSEA. It stretches north through the Klickitat River drainage within the Yakama Nation Reservation and includes parts of the Columbia River Gorge National Scenic Area on its southern edge. Forest lands in this GMA are 38 percent Yakama Nation lands, 27 percent Federal lands (Forest Service), 12 percent State lands, and the remainder primarily in private ownership.

This GMA was mapped for the following reasons:

- It contains current and recent spotted owl activity centers, including occupied pair sites on the Yakama Nation Reservation, and other detections.
- This GMA has a large amount of habitat that could support spotted owl populations in the absence of barred owls, though habitat density is low in some areas.
- This GMA has connectivity to areas with high densities of spotted owl habitat, and connectivity to GMAs to the north and west. Although historical and current patterns of spotted owl dispersal across the Columbia River are not well understood, this GMA is likely in the best location for such dispersal events, due to concentrations of spotted owl habitat on both sides of the river, and places where the expanse of open water is narrower than in many other nearby portions of the river. It contains a diversity of habitat types (relatively cool and moist to warmer and drier). This allows for management in the range of habitat types that spotted owls occupy in the Eastern Washington Cascades. Warmer and drier forest types may support higher spotted owl fecundity, but also can be more vulnerable to loss from catastrophic wildfire. By including a diversity of forest types in this GMA that connect warmer and drier forest types to relatively cooler and moister forest types that are predicted

to function as fire refugia in the future, we build in connectivity to more resilient and diverse habitat types for a future spotted owl population in this GMA.

- We included an area on the east side of the GMA with smaller amounts and lower quality of habitat, where juvenile spotted owls from the Yakama Nation Reservation were known to disperse in the past. This area is mostly private timberland, but there are some areas of high-quality nesting and roosting habitat and historical productive spotted owl activity centers in this area.

This GMA is assigned Priority B. Spotted owls are at high risk of extirpation throughout the Eastern Washington Cascades Province. The spotted owl population in this area is very small, and has been affected not only by barred owl effects but also by loss of habitat to fire and other forest disturbances. Barred owl removal, if implemented soon, would reduce further impacts from barred owl competition to spotted owls already stressed by habitat loss. This, in turn, could slow population declines and stabilize the population. Placing block management areas to encompass a range of vegetation communities used by spotted owls may be especially beneficial, in that it will connect high risk habitat that may provide short-term demographic benefits to lower risk areas that may provide habitat over a longer period of time. Site management around currently occupied sites within this GMA remains a Priority A action, but additional management outside of these sites is likely to increase the effectiveness of management. Portions of this landscape are relatively well-surveyed and accessible, allowing for relatively rapid implementation of barred owl management, but not as rapid as in the Central Washington East Cascades GMA, which includes a study area where experimental barred owl management has previously occurred.

*Description of the elements considered in mapping:* In mapping the boundaries of the South Washington East Cascades GMA we used information on the following elements.

*Spotted Owl Data:*

- We included current, recent, and historical spotted owl activity centers, and known areas of juvenile dispersal, concentrated presence, and settlement.
- We included areas with relatively large amounts of high-quality nesting and roosting habitat and historical activity centers from which to select FMAs large enough to support spotted owl populations. Models developed for the Northwest Forest Plan Effectiveness Monitoring program predict habitat that can support populations of spotted owls in this GMA. This GMA contains areas that have an estimated carrying capacity to support clusters of 20 or more pairs.
- We included a diversity of habitat types within the GMA, ranging from relatively cool and moist to warmer and drier, allowing for management of all types of landscapes.
- The GMA boundary includes a long segment along the Cascades Crest, which approximates the province boundary between the Western and Eastern Washington Cascades Provinces. In many areas, habitat is present along both sides of the Crest. This allows for good connectivity between the provinces. The areas to the west of this GMA are within the South Washington West Cascades GMA.

- We excluded areas to the east due to the presence of smaller amounts and lower quality of habitat in these areas, no known recent spotted owl occupancy, and very little to no known historical occupancy in these driest areas.
- We excluded some high elevation or large lava flow areas without habitat, as well as areas where habitat was lost to the 2015 Cougar Creek Fire. We did not exclude all high elevation or burned areas that lack habitat, and this can be considered during development of the Focal Management Area boundaries.

*Conditions:*

- We considered the availability of access via roads and trails in most of this area. We excluded a portion of the Mount Adams Wilderness due to poor accessibility and smaller amounts of habitat, but the GMA includes other wilderness and roadless areas where access may be difficult. Accessibility can be considered during development of the management area boundaries.
- We considered the presence of SOSEAs with spotted owl habitat and activity centers. Including these areas allows for incentives for management.

*Other Considerations:*

- We excluded human population centers and prairie areas within Yakama Nation lands.

*Focal Management Areas (FMAs)*

In the South Washington East Cascades GMA, we recommend developing FMAs large enough to support as many spotted owl pair sites as possible, up to 50 pair sites per FMA. Generally, larger blocky areas provide a smaller edge-to-area ratio, and this may help reduce the influx of barred owls from outside the FMA in the future. However, where the landscape or forest conditions do not allow this, smaller or more sinuous FMAs, still encompassing multiple pair areas, may be appropriate. If smaller areas are developed due to funding limitations, rather than habitat limitations, design them such that they could be expanded in the future if funding becomes available.

When possible, include multiple FMAs, generally spaced no farther than 12 to 15 miles apart. Where smaller areas are developed due to topography, forest condition, access, funding limitations, or other reasons, we recommend these be closer together and multiple areas be designed with the intent of encouraging exchange of spotted owls between these smaller areas.

Including recently occupied sites in FMAs provides the starting point for development of spotted owl populations as barred owl populations are reduced. In areas where habitat connectivity is limited, site management may help to provide connectivity between smaller FMAs. Coordinate FMA locations with the site management described above, with FMA locations in adjacent GMAs, and with barred owl management in the White Salmon SOSEA Special Designated Area.

*Priorities:* The following are our recommended priorities for defining and selecting FMAs within the South Washington East Cascades GMA. The following are in general priority order; however, local expertise will be important in applying these to specific FMA boundary designs.

1. Build FMAs around current and recent sites (sites with presence or occupancy of spotted owls within the last five years). This provides a nucleus of spotted owls for the potential recolonization of sites within the FMA as barred owl numbers are reduced.

2. Focus on areas with reasonable access, in terms of road networks, which are available in most of the spotted owl habitat in this GMA. Closed roads may be used like a trail system if they can be safely walked. Trail systems can be used where roads do not exist, but roads are generally preferred to maximize operational efficiency.

3. Consider fire risk in mapping the boundaries of the FMAs. Avoid concentrating FMAs solely in areas identified as having the highest risk of habitat loss to fire; however, some areas with high fire risk may still be important to include in FMAs, particularly where spotted owls are likely to be present (i.e., areas with recent detections). Providing connectivity in FMAs from higher risk spotted owl habitat to areas identified as fire refugia and other areas with relatively lower risk will be important in the fire prone landscape of the Eastern Washington Cascades. Placement of multiple FMAs within the GMA and inclusion of fire refugia or other areas with higher resistance to uncharacteristic wildfire could reduce the risk of complete loss.

4. Place blocks allowing for the maximum number of spotted owls to be supported. Focus on areas with the potential for at least 20 spotted owl pairs, though 50 pair sized areas are the target where possible.

5. Select areas with the greatest acreage or density of spotted owl habitat. These are likely to be areas with the highest carrying capacity for spotted owls, which can be measured using a habitat-based calculation of the estimated maximum population of territorial spotted owls without barred owl presence.

6. Include lands of interested and willing landowners or land managers. A focus on areas where landowners have expressed interest in barred owl management and have the ability to assist with operations will speed the implementation of actual barred owl management and encourage involvement.

7. Include areas with high-quality historical spotted owl sites (sites with no confirmed occupancy in the last five years or more). Indicators may include, for example, especially good habitat amount, quality, and configuration; a history of good past demographic performance; or a history of long-term occupancy. These are areas that have been shown by past use to be attractive to spotted owls and therefore more likely to be reoccupied, especially as spotted owl populations increase.

8. Consider the potential for connection to other FMAs in the GMA, and to neighboring GMAs, with special attention to any FMAs or site management areas on the west side of the Cascades Crest with spotted owl presence that may become known. Placement of FMAs within close proximity to other GMAs, particularly where there is forest that may provide connectivity to the Western Washington Cascades through low passes, can connect populations in these areas.

9. Consider the presence of areas already designated for spotted owl habitat management or compatible conservation purposes, such as Late Successional Reserves, Congressionally reserved areas, SOSEAs, designated critical habitat, and areas identified as high priorities in the Northern Spotted Owl Recovery Plan. Including these areas provides support for spotted owls and limits impacts on other resources. Because many of these have been managed for older forest over the last decades, these are the likely locations of some of the best habitat conditions.

10. Select areas with a diversity of spotted owl habitat types. Given the range of forest conditions spotted owls use in this GMA, selecting areas with a range of habitat types provides for a variety of conditions for future spotted owl population development. Historically, the Eastern Washington Cascades had some of the highest fecundity rates for spotted owls, even in warmer and drier areas with more fire risk. The relatively cool, moist areas of the landscape may have more long-term forest resiliency or act as fire refugia, but may not support the same high fecundity rates. Managing a variety of connected types of spotted owl habitat in this province could allow spotted owls to best withstand a dynamic future under climate change with increased risk of habitat loss from very large, high intensity fires and outbreaks of tree disease and insects that affect trees.

11. Consider climate change resilience in selecting areas. Other things being equal, include areas identified as having greater resilience. This may include areas identified as fire refugia or areas with sufficient spotted owl habitat that have been treated for improved resilience to threats associated with climate change such as increases in habitat loss from widespread insect or disease outbreak and/or catastrophic very large fires.

12. Consider including areas where more efficient use of funding (such as targeting more accessible areas) can be used to maximize management efficacy at scale, and more efficiently reduce the impact of barred owls on spotted owls.

### A4.4.B.3 Special Designated Areas

*A4.4.B.3.a Spotted Owl Special Emphasis Areas – Priority E*

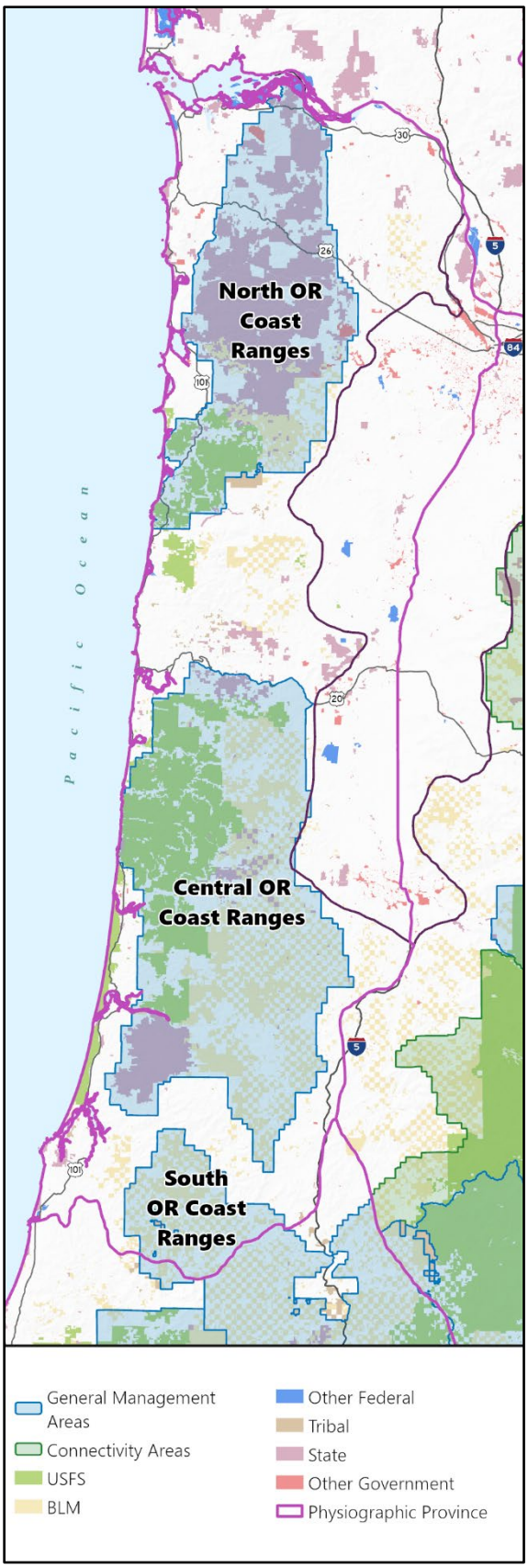
The State of Washington identified 10 key landscapes, referred to as Spotted Owl Special Emphasis Areas (SOSEAs), where northern spotted owl conservation in the form of demographic and/or dispersal support was important on non-Federal lands. In mapping the Strategy, portions of some SOSEAs were included in mapped GMAs. Barred owl management recommendations for GMAs apply to the portions of SOSEAs lying within those GMAs. Where SOSEA lands fell outside of these designations, we mapped the areas as SOSEA Special Designated Areas.

There is one SOSEA Special Designated Area in the Eastern Washington Cascades Province (see Eastern Washington Cascade map on page 143).

| SOSEA | Forest Acres on Federal lands | Forest Acres on State Lands | Forest Acres on Private Lands | Maximum Forest Acres Under Management |
|---|---|---|---|---|
| White Salmon SOSEA | 0 | 28,005 | 16,903 | 8,522 |

In the original designation by Washington, each SOSEA was described in terms of one or more conservation functions -- demographic support, dispersal support, and combination support. Demographic support meant that adequate amounts and arrangements of suitable nesting, roosting, and foraging habitat are maintained to support reproductive spotted owl pairs. Dispersal support is provided by a landscape that includes dispersal habitat at the stand level interspersed with areas of higher quality habitat. Combination support was defined as either maintaining suitable spotted owl habitat to protect the viability of the owls at a spotted owl site center or providing a variety of habitat conditions which in total are more than dispersal support and less than demographic support. The White Salmon SOSEA is designated for combination support.

For the Strategy, barred owl management in the form of removal could be occur at any scale in a SOSEA. We recommend spotted owl site-based management as described in Section 8.4.1.2. of the Strategy and Section 4.4.B.1 above. Removal of barred owls around spotted owl sites can be applied anywhere within the province and is an appropriate small scale management effort in SOSEAs. Removing barred owls within and around occupied spotted owl sites retains the existing population, increases the potential for recruitment of young, and provides a source of young for recolonization of areas where barred owl management occurs. Spotted owl site management can provide connectivity between larger block areas. Where feasible, clustering spotted owl site management into small blocks increases the functionality of this management.




# A4.5 Oregon Coast Ranges Province, Plus West Edge of Willamette Valley

## A4.5.A Background

The Oregon Coast Ranges Province is one of five physiographic provinces in Oregon. Management areas designated in this province also include small areas of forested lands within the portions of the Willamette Valley Province and the Oregon Klamath Province that are immediately adjacent to the Oregon Coast Ranges Province. The Oregon Coast Ranges Province, plus the western edge of the Willamette Valley Province, includes 25 percent of forest lands in Federal management (BLM and Forest Service), 13 percent in State management, 1 percent managed by local public agencies, and the remainder generally on private land.

The Oregon Coast Ranges are characterized by cool, dry summers and mild, wet winters. During the last 200 years, much of the area was either burned in large, severe fires, or heavily logged, or both. Therefore, many areas of this province lack significant quantities of well-connected older forest.

### A4.5.A.1 Spotted Owl Condition in the Oregon Coast Ranges Province

Due to the history of fire and harvest in this province, some areas, especially in the northern portion of the province, lack well-connected high-quality spotted owl nesting and roosting habitat, and some of the spotted owls in this province rely primarily on lower quality habitat. Federal lands in the province (not including those neighboring areas) include approximately 558,273 acres of spotted owl nesting and roosting habitat and 368,595 acres of marginal habitat. State lands are important in this province and include approximately 115,084 acres of spotted owl nesting and roosting habitat and 220,211 acres of marginal habitat. Flying squirrels are generally the

primary prey species, but woodrats (including both dusky-footed [*Neotoma fuscipes*] and bushy-tailed woodrats), leporids (including both snowshoe hares and brush rabbits [*Sylvilagus bachmani*]), red tree voles (*Arborimus longicaudus*), and deer mice are also important in some locations (Forsman et al. 1984, pp. 40-45; Forsman et al. 2004, p. 219; Wiens 2012, pp. 114-115).

Two spotted owl demography study areas occur within the Oregon Coast Ranges Province, the Oregon Coast Ranges Demography Study Area and the Tyee Demography Study Area. The Oregon Coast Ranges Study Area provides data on spotted owl populations since 1990, and the Tyee Study area provides similar information since 1985. Monitoring efforts indicate that spotted owl occupancy at historical territories has declined substantially in both study areas.

The spotted owl population within the Coast Ranges study area declined by more than 7 percent per year from 1995 through 2017 (Franklin et al. 2021, pp. 11-13). Spotted owl pair occupancy on sites within the Coast Ranges study area dropped from 72 percent in 1993 to 15 percent in 2018 (Davis et al. 2022, p. 37). Since then, spotted owls have been monitored via passive acoustic monitoring at this study area, and the proportion of sample units (hexagons) where spotted owls were detected declined from 18 percent in 2018 to 9 percent in 2022 (Lesmeister et al. 2023, p. 17), though we note that these data are not directly comparable to those for 2018 because they were obtained using different survey methods.

The spotted owl population within the Tyee study area declined by approximately 5 percent per year from 1995 through 2017 (Franklin et al. 2021, pp. 11-13). Spotted owl pair occupancy on sites within the Tyee study area dropped from 46 percent in 1993 to 17 percent in 2018, in spite of earlier increases between 1993 and the early 2000s (Davis et al. 2022, p. 37; Franklin et al. 2021, pp. 11-13). Comprehensive call-playback surveys in 2020 confirmed 14 unpaired adults or subadults and 5 pairs on the Tyee Demography Study Area, with occupancy at approximately 14 percent of the historical sites surveyed, and pair occupancy at 3 percent. These data are not directly comparable to those for 2018 because the 2018 results were corrected to include an estimate of spotted owls that were present, but not detected on surveys, and the 2020 results were not corrected. Additionally, spotted owls have been monitored via passive acoustic monitoring since 2021, with detections in 35 percent of sample units (hexagon) in 2021 and at 20 percent of sample units in 2022 (Lesmeister et al. 2023, p. 17). The passive acoustic monitoring data are not directly comparable to either the 2018 or the 2020 data because they were obtained using different survey methods.

In both of these study areas, previously territorial spotted owls now frequently move away from their territories, often repeating this dispersal behavior annually (Jenkins et al. 2021, pp. 8-9, 12). These kinds of movements have increased in frequency across the northern spotted owl range, but have become markedly more common in the Oregon Coast Ranges Province, possibly due to the high densities of barred owls present in this province (see below).

### A4.5.A.2. Barred Owl Condition in the Oregon Coast Ranges Province

Barred owls are present at very high densities in the Oregon Coast Ranges. Barred owls were experimentally removed in a portion of the Oregon Coast Ranges study area during 2015 through

2019 (Wiens et al. 2021, entire). Researchers detected between twice and four times as many barred owls in the Oregon Coast Ranges study area than in study areas in the Eastern Washington Cascades and Oregon Klamath Provinces. In 2018, barred owls were present in 94 percent of spotted owl home ranges in the Oregon Coast Ranges study area, outside of barred owl removal areas. In 2019, outside of the barred owl removal areas, barred owls were estimated to occupy 90 percent of potential barred owl home ranges. Between 2018 and 2020, barred owls were detected via passive acoustic monitoring at 99 to 100 percent of sample units (hexagons) each year (Lesmeister et al. 2022a, p. 23). Barred owl occupancy in the Tyee Demography Study Area may be slightly lower, but is still very high: in 2018, barred owls were present in 82 percent of spotted owl home ranges.

## A4.5.B Management Strategy

### A4.4.B.1 Spotted Owl Site Management in the Oregon Coast Ranges Plus Province

*A4.4.B.1.a Background*

Given the limited number of spotted owls in this province, and the high pressure from barred owls, it is crucial to protect the remaining spotted owls through barred owl management at spotted owl sites. Much, but not all, of the available habitat in this province has been surveyed in recent years. Where recent survey coverage is incomplete, we recommend surveys of areas that retain adequate habitat, especially historically active sites where the last spotted owl detections occurred between 5 and 10 years ago.

In some cases, managed sites may eventually be incorporated into block management areas. In other cases, site management of single sites or clusters of sites may be an appropriate long-term action, especially in areas that promote demographic connectivity between block management areas. Additionally, site management may be used to accomplish medium-term goals related to production of young for natural recolonization or potential future population augmentation actions.

- Managing barred owls in recently occupied spotted owl sites is intended to help reduce the rate of spotted owl population decline as quickly as possible and prevent extinction/extirpation of the spotted owl in the province.
- Where spotted owl site management occurs within a GMA, these spotted owl sites may serve as key points for the development of focal management areas, now and in the future. Site management may be expanded into block management over time.
- Barred owl management in spotted owl sites may serve to increase connectivity between and within block management areas. If so, this connectivity may prevent genetic bottlenecks or reductions in genetic diversity.
- Where sites are not currently occupied, site management will provide areas for recolonization by young produced in nearby management blocks, boosting population growth.
- Managing barred owls in spotted owl sites that are, or become, reproductively active, may enable those sites to provide a source of young for colonization of nearby management blocks. These sites may interact demographically with nearby management blocks.
- These managed spotted owl sites may provide a source of spotted owl individuals for direct augmentation of block management areas in the future, should such management action be necessary.

*Selection of spotted owl sites for management*

The number of currently occupied spotted owl sites is very limited in this province. The primary focus of spotted owl site management in this province is on sites that have been occupied by, or had detections of, spotted owls in the last five years. These areas are more likely to have spotted owls present, or be recolonized by spotted owls after barred owl removal. This is reflected in the priorities for site management.

*Spotted Owl Site Management Priorities*

| Priority | Spotted Owl Site Condition |
|---|---|
| A | Currently and recently active sites, including all areas with any spotted owl detections within the last 5 years |
| C | Historically occupied spotted owl sites (pair or single) with last detection more than 5 years ago |
| D | Potential sites with adequate habitat but no known history of spotted owl occupancy, and without detections within the last 5 years |

*Other considerations for selection of spotted owl sites for management:*

- We recommend consideration of the following factors when selecting among sites within a priority category. Select sites with the most recent spotted owl occupancy.
- Where relevant information is available, select sites with the best recent demographic performance (for example, select the sites where the largest numbers of young have fledged).
- Preferentially select sites with good accessibility, to maximize the efficiency of implementation.
- Consider the condition of habitat in the area, particularly loss of habitat since the last surveys. All other things being equal, select sites with abundant high-quality habitat. Spotted owl sites that have lost substantial amounts of habitat to harvest or other disturbances may be lower priority.
- Choose sites within GMAs, near GMAs, or creating steppingstone connectivity between GMAs.
- Consider the history of spotted owl use at the site. Where historical survey information is available, focus first on sites with a long history of pair occupancy, including reproduction.

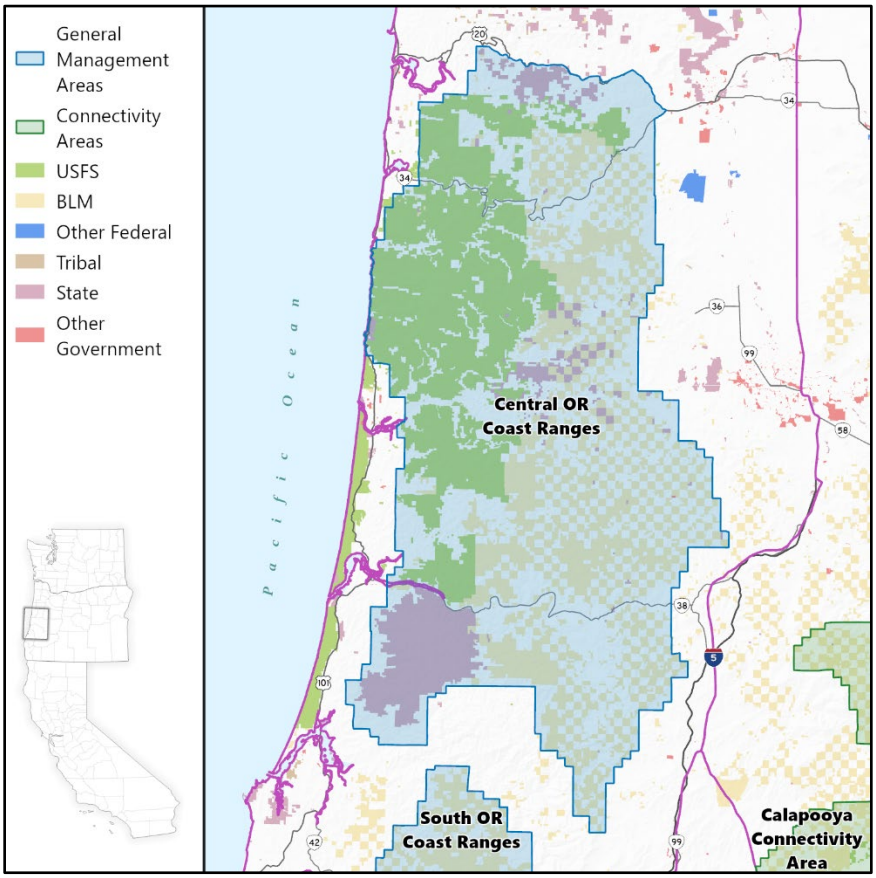
*A4.5.B.1.b Management Recommendations*

Within each individual site, remove barred owls from an area between 10,179 and 18,096 acres. This represents the area in a circle of 1.5 and 2 home range radii (Table 2). This can be distributed in a circle around the activity center, or implementers can use local knowledge, topography, and habitat condition to design a non-circular area of the appropriate size that provides the best conditions for barred owl management. In areas where spotted owl sites are

isolated, and particularly for sites in Priority A condition (see table above), we recommend a larger management area, up to 40,715 acres (3 home range radii). Where sites are not isolated, applying site management to clusters of two or more sites in close proximity is likely to provide more efficient management conditions and increased benefits for spotted owls present in those sites.

### A4.5.B.2 General Management Areas in the Oregon Coast Ranges Plus Province

*A4.5.B.2.a Central Oregon Coast Ranges GMA – Priority A*




The Central Oregon Coast Ranges GMA lies in the south-central portion of the Oregon Coast Ranges Province and spans the province from west to east, also including some adjacent areas within the forested foothills of the Willamette Valley Province. It includes approximately 1,789,726 acres in total, of which 1,724,821 acres (96 percent) are forest lands and 493,280 acres (28 percent) provide spotted owl nesting and roosting habitat. The GMA includes the Elliott State Research Forest, the largest contiguous portion of the Siuslaw National Forest, and adjacent and interspersed Bureau of Land Management (managed by the Northwest Oregon and Roseburg Districts), State, and private lands. Overall, Forest lands in the GMA are 52 percent Federal lands (BLM and Forest Service), 8 percent State lands, and the remainder primarily in private ownership.

This GMA was mapped for the following reasons:

- It includes the highest habitat density within the Oregon Coast Ranges Province.
- The GMA includes most of the Oregon Coast Ranges and Tyee Demography Study Areas, with their historical and recent spotted owl data. The Northwest Forest Plan Effectiveness Monitoring program includes passive acoustic monitoring sampling 20 percent of each study area. This program will provide additional future data on both spotted and barred owls, and allow for efficiencies in monitoring barred owl removal and its effects on spotted owls. These portions of the GMA are well known and accessible, allowing for quicker implementation.

- Barred owls were experimentally removed from a portion of the Oregon Coast Ranges study area in 2015 through 2019. This work demonstrated benefits to spotted owls in spite of very high barred owl densities and high reinvasion rates. Information collected during the experiment regarding barred and spotted owl use of the landscape would support quicker and more effective implementation.

This GMA was assigned Priority A due to the demonstrated previous success here of barred owl management for spotted owl conservation, and the rapid decline of spotted owls in this area. The well-studied landscape of the Oregon Coast Ranges and Tyee study areas and practical knowledge gained during experimental removals allow for rapid deployment of barred owl management to the locations where it can have the most immediate benefit to existing spotted owls. Therefore, this GMA is an area where barred owl management can and should be implemented immediately to prevent extirpation of spotted owls in the province, which is an area with very low spotted owl populations.

*Description of the elements considered in mapping:* In mapping the boundaries of the Central Oregon Coast Ranges GMA we used information on the following elements.

*Spotted Owl Data:*

- We included areas with a relatively large amount of high-quality nesting and roosting habitat. This portion of the Oregon Coast Ranges Province contains most of the concentrations of high-quality habitat in the province.
- This GMA includes current, recent, and historical spotted owl sites. We referred to information regarding the location of activity centers, where survey information was available and sites were located near a potential boundary. In some cases, this led to small portions of the Willamette Valley Province being included.
- We did not include the South Willamette-North Umpqua Area of Concern identified in the Northwest Forest Plan standards and guidelines (USDA and USDI 1994, p. C-42), which includes lands managed by the Eugene District of the Bureau of Land Management, even though this area likely presents the best possible opportunity for direct connectivity between the Western Oregon Cascades and Oregon Coast Ranges Provinces. We excluded it because public lands make up a minority of the lands in this area, and little spotted owl habitat remains on private lands. If, in the future, there are opportunities to develop spotted owl habitat on private lands in this area, this decision should be reconsidered.

*Conditions:*

- We considered the availability of access via roads and trails in most of this area.

*Other Considerations:*

- As discussed above, this GMA includes portions of two study areas, one of which encompasses a former experimental barred owl removal area. This allows for efficiencies in monitoring and opportunities for research. Although the GMA boundaries do not closely follow study area boundaries, the GMA includes the bulk of each study area.

- The GMA includes State lands where two separate Habitat Conservation Plans (HCPs) are in development, and barred owl management could potentially be used to mitigate unavoidable impacts of land management activities.

*Focal Management Areas (FMAs)*

In this GMA, we recommend developing FMAs large enough to potentially support as many spotted owl pair sites as possible, up to 50 pair sites per FMA. Generally, larger blocky areas provide a smaller edge-to-area ratio, and this may help reduce the influx of barred owls from outside the FMA in the future. However, where the landscape or forest conditions do not allow this, smaller or more sinuous FMAs, still encompassing multiple pair areas, may be appropriate. If smaller FMAs are developed due to funding limitations, design them such that they could be expanded in the future if funding becomes available.

When possible, include multiple FMAs, generally spaced no farther than 12 to 15 miles apart. If smaller areas are developed due to forest condition, access, funding limitations, or other reasons, we recommend these be closer together and multiple areas be designed with the intent of encouraging exchange of spotted owls between these smaller areas.

Because of the history of barred owl research and experimental management in parts of this area, additional information may be available regarding areas with higher and lower barred owl influxes, and implementers should refer to this information in FMA development.

Including recently occupied sites in FMAs provides a starting point for development of spotted owl populations once barred owl populations are reduced. In areas where habitat connectivity is limited, site management may help to provide connectivity between smaller FMAs. Coordinate FMA locations with the site management described above.

*Priorities:* The following are our recommended priorities for defining and selecting FMAs within the Central Oregon Coast Ranges GMA. The following are in general priority order; however, local expertise will be important in applying these to specific FMA boundary designs.

1. Build FMAs around current and recent occupied spotted owl sites (sites with spotted owl detections in the last five years). This provides a nucleus of spotted owls for the potential recolonization of sites within the FMA as barred owl numbers are reduced.

2. Select areas with the best spotted owl habitat in terms of acreage or density. These are likely to be areas with the highest carrying capacity for spotted owls, which can be measured using a habitat-based calculation of the estimated maximum population of territorial spotted owls without barred owl presence.

3. Include lands of interested and willing landowners or land managers. A focus on areas where landowners have expressed interest in barred owl management will speed the implementation of actual barred owl management and encourage involvement.

4. Place blocks to include spotted owl populations, or clusters of sites, with good current demographic parameters (e.g., higher survival, occupancy, reproductive output, etc.) relative to others in the GMA.

5. Include known sites with indicators of high site quality, as determined during evaluations of current and historical sites. These indicators may include, for example, especially good habitat amount, quality, and configuration; a history of good past demographic performance; or a history of long-term occupancy. These are areas that have been shown by past use to be attractive to spotted owls and therefore more likely to be reoccupied, especially as spotted owl populations increase.

6. Place FMAs in areas with good connectivity within the local environment, including habitat connectivity within an FMA, between neighboring FMAs, and/or between an FMA and nearby managed spotted owl sites. Consider placing an FMA to facilitate connectivity with the South Oregon Coast Ranges GMA. Opportunities for connectivity to the North Oregon Coast Ranges GMA are tenuous, so trying to achieve connectivity with that GMA is not a high priority.

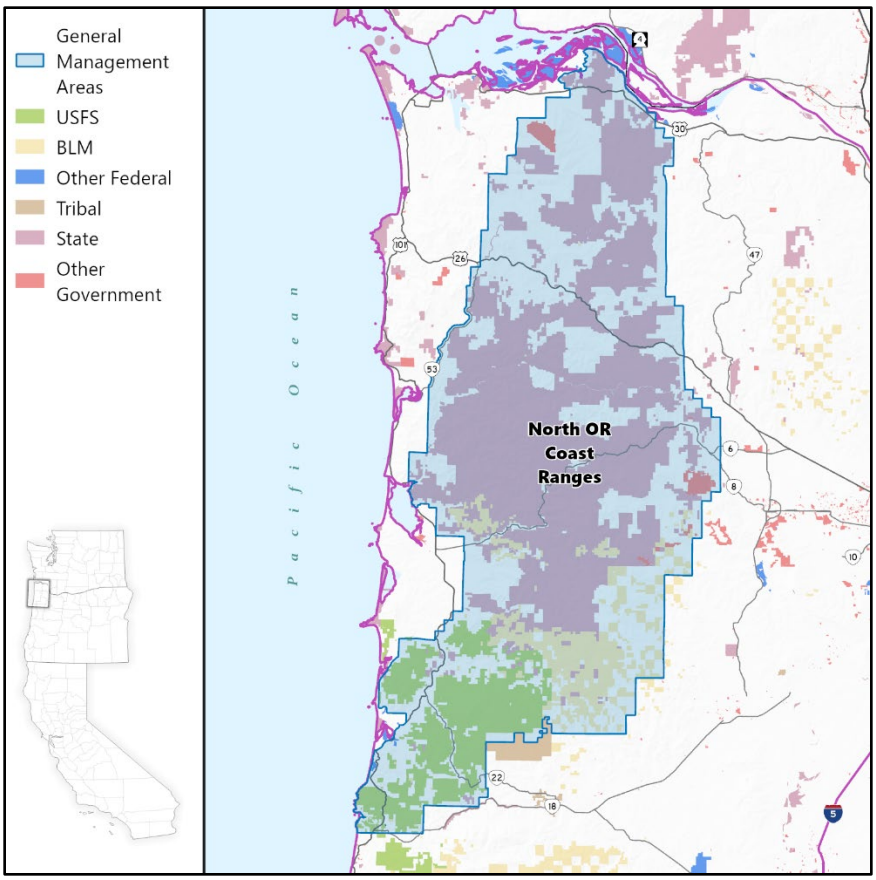
7. Place FMAs to minimize the cost of management. For example, select areas where existing monitoring will meet some of the monitoring needs associated with barred owl management.

8. Select areas with good networks of accessible, drivable roads.

9. Choose areas where funding is available for management.

10. Consider the presence of areas already designated for spotted owl habitat management or compatible conservation purposes, such as Late Successional Reserves, Congressionally reserved areas, proposed Habitat Conservation Areas or Conservation Research Watersheds, designated critical habitat, and areas identified as high priorities in the Northern Spotted Owl Recovery Plan. Including these areas provides support for spotted owls and limits impacts on other resources. Because many of these have been managed for older forest over the last decades, these are likely locations of some of the best habitat conditions.

*A4.5.B.2.b North Oregon Coast Ranges GMA – Priority B*




The North Oregon Coast Ranges GMA lies in the northern portion of the Oregon Coast Ranges Province and spans the province from west to east. It includes approximately 1,148,688 acres in total, of which 1,113,267 acres (97 percent) are forest lands and 131,060 acres (11 percent) provide spotted owl nesting and roosting habitat. Another 282,770 acres (25 percent) provide marginal spotted owl habitat. The GMA includes most of the Clatsop and Tillamook State Forests, adjacent BLM lands managed by the Northwest Oregon District, and the northernmost portion of the Siuslaw National Forest. Saddle Mountain State Natural Area and the municipal watershed for the city of Astoria are also within the GMA. This GMA also contains substantial amounts of adjacent and interspersed private lands, where the density and quality of spotted owl habitat is low, but which may provide habitat for barred owls. Overall, forest lands in the GMA are 17 percent Federal lands (Forest Service and BLM), 45 percent State lands, 1 percent other public lands, and the remainder primarily in private ownership.

This GMA was mapped for the following reasons:

- In spite of high densities of barred owls and relatively low-quality spotted owl habitat, spotted owls persist on this landscape.
- Where habitat is conserved, for example, in reserved or constrained land allocations, spotted owl habitat quantity and quality are likely to increase over time as the landscape recovers from historical fire and harvest.
- Oregon Department of Forestry (ODF) has expressed interest in barred owl management on their lands and has drafted an HCP that includes barred owl management as a conservation measure.
- A relatively detailed survey history is available for most of the area within the GMA.
- Should the HCP be finalized and implemented on the ODF lands, monitoring will occur as part of HCP implementation, creating efficiencies for the monitoring required for barred owl management. The GMA also includes the northernmost area of the Oregon Coast Ranges Demography Study Area. The Northwest Forest Plan Effectiveness Monitoring program

includes passive acoustic monitoring sampling 20 percent of the Oregon Coast Ranges study area. This program will provide additional future data on both spotted and barred owls and allow for efficiencies in monitoring barred owl removal and its effects on spotted owls.
- This GMA includes the northernmost population of spotted owls within Oregon.
- Federal lands in the southern portion of the GMA contain some concentrations of higher quality nesting and roosting habitat.

This GMA was assigned Priority B because, if implemented soon, barred owl removal in this GMA would help to slow spotted owl population declines and prevent extirpation from the northern half of the Oregon Coast Ranges Province. The spotted owl population in this area is small and aging, and barred owl densities are high, leading to an elevated likelihood of extirpation. Site management around currently and recently occupied sites within this GMA remains a Priority A action, but additional management outside of these sites is likely to increase the effectiveness of management and offer opportunities for spotted owls to recolonize better-quality habitat that barred owls currently prevent them from accessing. The landscape is relatively well-surveyed and accessible, which allows for relatively rapid implementation of barred owl management, but likely not as immediately as in landscapes where experimental barred owl removals previously occurred (e.g., the Central Oregon Coast Ranges GMA).

*Description of the elements considered in mapping:* In mapping the boundaries of the North Oregon Coast Ranges GMA we used information on the following elements.

*Spotted Owl Data:*

- This GMA includes current, recent, and historical spotted owl sites. We referred to information regarding the location of activity centers, where survey information was available and sites were located near a potential boundary.
- We included areas at the southern end of the GMA with somewhat larger amounts of high-quality nesting and roosting habitat than are available elsewhere in the northern portion of the Oregon Coast Ranges.

*Conditions:*

- This area has a relatively high road density.

*Other Considerations:*

- This GMA includes all of the larger Habitat Conservation Areas proposed for the northern portion of the province within ODF's draft HCP.
- This area includes a relatively large amount of private land with relatively low density of spotted owl habitat. These areas were included in order to reduce the edge-to-area ratio of the GMA, making it possible to create FMAs with low edge-to-area (see below). These areas also buffer the areas of spotted owl habitat, providing for the possibility of removing barred owls that would otherwise move into areas of spotted owl habitat where barred owls have been removed.

*Focal Management Areas (FMAs)*
In this GMA, we recommend developing FMAs large enough to support as many spotted owl pair sites as possible, up to 50 pair sites per FMA. Generally, larger blocky areas provide a smaller edge-to-area ratio, and this may help reduce the influx of barred owls from outside the FMA in the future. However, where the landscape or forest conditions do not allow this, smaller or more sinuous FMAs, still encompassing multiple pair areas, may be appropriate. If smaller FMAs are developed due to funding limitations, design them such that they could be expanded in the future if funding becomes available.

When possible, include multiple FMAs, generally spaced no farther than 12 to 15 miles apart. Where smaller areas are developed due to topography, forest condition, access, funding limitations, or other reasons, we recommend these be closer together and multiple areas be designed with the intent of encouraging exchange of spotted owls between these smaller areas.

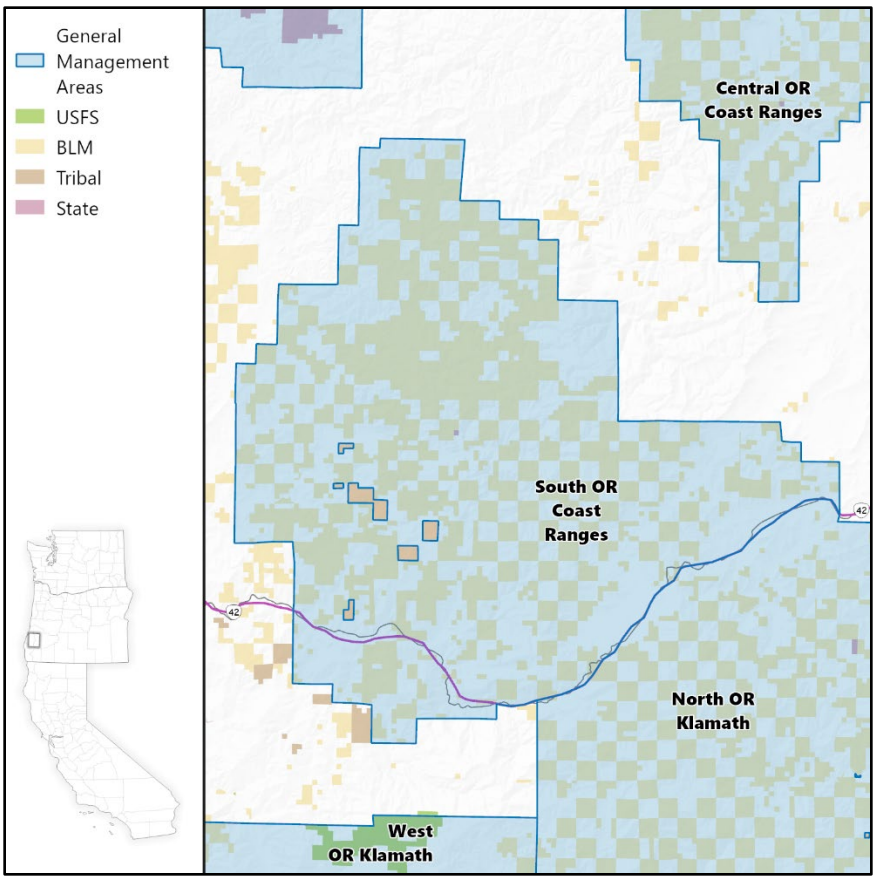
Including recently occupied sites in FMAs provides a starting point for development of spotted owl populations once barred owl populations are reduced. In areas where habitat connectivity is limited, site management may help to provide connectivity between smaller FMAs. Coordinate FMA locations with the site management described above.

*Priorities:* The following are our recommended priorities for defining and selecting FMAs within the North Oregon Coast Ranges GMA. The following are in general priority order; however, local expertise will be important in applying these to specific FMA boundary designs.

1. Build FMAs around current occupied spotted owl sites (sites with detections in the last five years). This provides a nucleus of spotted owls for the potential recolonization of sites within the FMA as barred owl numbers are reduced.
2. Select areas with the best spotted owl habitat in terms of acreage or density. These are likely to be areas with the highest carrying capacity for spotted owls, which can be measured using a habitat-based calculation of the estimated maximum population of territorial spotted owls without barred owl presence.
3. Include lands of interested and willing landowners or land managers. A focus on areas where landowners have expressed interest in barred owl management will speed the implementation of actual barred owl management and encourage involvement.
4. Place blocks to include spotted owl populations, or clusters of sites, with good current demographic parameters (e.g., higher survival, occupancy, reproductive output, etc.) relative to others in the GMA.
5. Include known sites with indicators of high site quality, as determined during evaluations of current and historical sites. These indicators may include, for example, especially good habitat amount, quality, and configuration; a history of good past demographic performance; or a history of long-term occupancy. These are areas that have been shown by past use to be attractive to spotted owls and therefore more likely to be reoccupied, especially as spotted owl populations increase.

6. Place FMAs in areas with good connectivity within the local environment, including habitat connectivity within an FMA, between neighboring FMAs, and/or between an FMA and nearby managed spotted owl sites.
7. Place FMAs to minimize the cost of management. For example, select areas where existing monitoring will meet some of the monitoring needs associated with barred owl management.
8. Choose areas where funding is available for management.
9. When selecting FMAs, consider the contribution of the potential FMA toward maintaining the historical range of the spotted owl within this province. In other words, select FMAs to maintain spotted owl presence from north to south within the GMA.
10. Consider the presence of areas already designated for spotted owl habitat management or compatible conservation purposes, such as Late Successional Reserves, Congressionally reserved areas, proposed Habitat Conservation Areas, designated critical habitat, and areas identified as high priorities in the Northern Spotted Owl Recovery Plan. Including these areas provides support for spotted owls and limits impacts on other resources. Because many of these have been managed for older forest over the last decades, these are likely locations of some of the best habitat conditions.

*A4.5.B.2.c South Oregon Coast Ranges GMA – Priority C*




The South Oregon Coast Ranges GMA lies in the southernmost portion of the Oregon Coast Ranges Province and includes small areas of the Oregon Klamath Province to the south. It includes approximately 314,282 acres in total, of which 298,931 acres (95 percent) are forest lands and 68,245 acres (22 percent) provide spotted owl nesting and roosting habitat. The GMA consists of BLM checkerboard lands managed by the Coos Bay and Roseburg Districts, with private lands interspersed. Overall, forest lands in the GMA are 47 percent Federal lands (BLM) with the remainder primarily in private ownership.

This GMA was mapped for the following reasons:

- It includes the southernmost area of spotted owl habitat and public land in the province.
- It allows for connectivity to the North Oregon Klamath GMA immediately to the southeast, which in turn allows for connectivity to other Oregon Klamath GMAs and to management areas in the Western Oregon Cascades Province.
- If healthy spotted owl populations can be supported here, they could provide for natural recolonization to neighboring areas in multiple provinces.

This GMA is assigned Priority C. This is a relatively small area of the province, but provides opportunities for connectivity with somewhat more robust spotted owl populations to the south. Site management remains a Priority A action for currently and recently active sites within the GMA, but additional management outside of currently and recently active sites could provide opportunities for population stabilization and recolonization.

*Description of the elements considered in mapping:* In mapping the boundaries of the South Oregon Coast Ranges GMA we used information on the following elements.

*Spotted Owl Data:*

- This GMA includes current, recent, and historical spotted owl sites. We referred to information regarding the location of activity centers, where survey information was available and sites were located near a potential boundary.
- We included an area of relatively high habitat density in the neighboring portion of the Oregon Klamath Province, because this area lacks connectivity with other habitat within the Oregon Klamath Province but is contiguous with habitat already included in the GMA.

*Conditions:*

- This area has a relatively high road density.

*Other Considerations:*

- This GMA includes areas of private land with relatively low density of spotted owl habitat. These areas were included in order to reduce the edge-to-area ratio of the GMA, making it possible to create FMAs with low edge-to-area ratios (see below). These areas also buffer the areas of spotted owl habitat, providing for the possibility of removing barred owls that would otherwise move into areas of spotted owl habitat where barred owls have been removed.

*Focal Management Areas (FMAs)*

In this GMA, we recommend developing at least one FMA large enough to potentially support 50 spotted owl pair sites. Development of multiple FMAs large enough to support 50 spotted owl pair sites would require designation of at least one FMA that is shared between this GMA and the North Oregon Klamath GMA, or, similarly, developing a smaller FMA within this GMA and another, adjacent FMA within the North Oregon Klamath GMA, that would support 50 spotted owl pair sites between them.

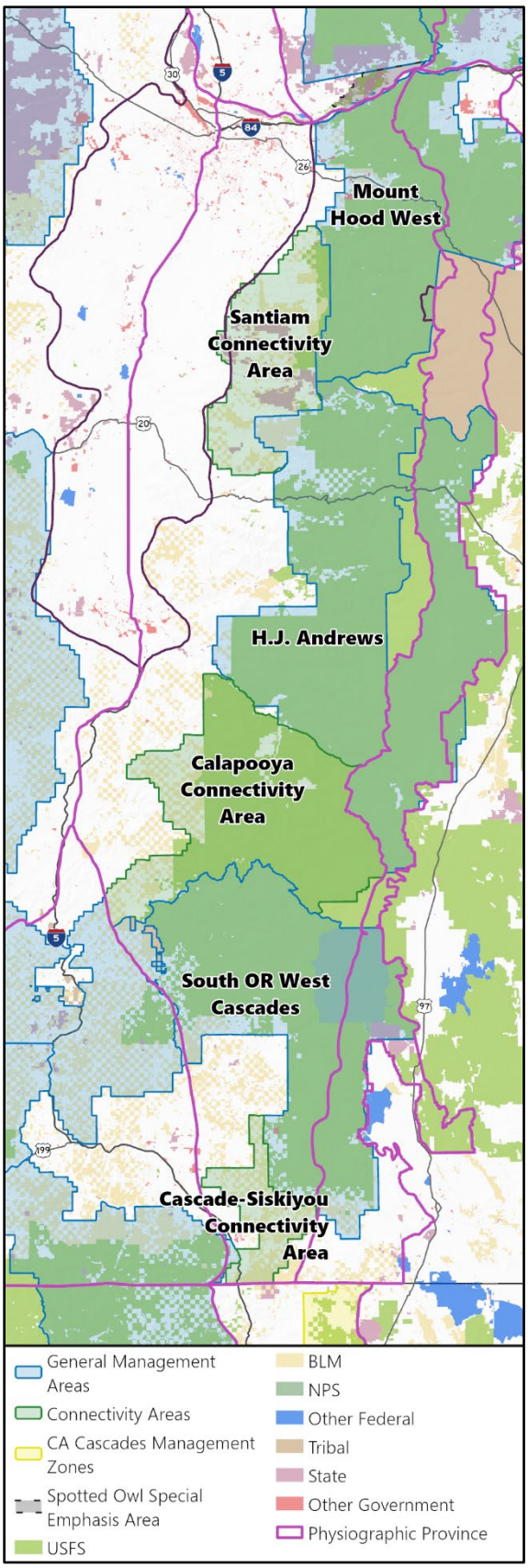
Generally, larger blocky areas provide a smaller edge-to-area ratio, and this may help reduce the influx of barred owls from outside the FMA in the future. However, where the landscape or forest conditions do not allow this, smaller or more sinuous FMAs, still encompassing multiple pair areas, may be appropriate. If smaller FMAs are developed due to funding limitations, design them such that they could be expanded in the future if funding becomes available.

If multiple FMAs are developed, these should generally be spaced no farther than 12 to 15 miles apart. Where smaller areas are developed due to topography, forest condition, access, funding limitations, or other reasons, we recommend these be closer together and multiple areas be designed with the intent of encouraging exchange of spotted owls between these smaller areas.

Including recently occupied sites in FMAs provides a starting point for development of spotted owl populations once barred owl populations are reduced. In areas where habitat connectivity is limited, site management may help to provide connectivity between smaller FMAs. Coordinate FMA locations with the site management described above, as well as with FMA development within the North Oregon Klamath GMA.

*Priorities:* The following are our recommended priorities for defining and selecting FMAs within the South Oregon Coast Ranges GMA. The following are in general priority order; however, local expertise will be important in applying these to specific FMA boundary designs.

1. Build FMAs around current occupied spotted owl sites (sites with detections in the last five years). This provides a nucleus of spotted owls for the potential recolonization of sites within the FMA as barred owl numbers are reduced.
2. Select areas with the best spotted owl habitat in terms of acreage or density. These are likely to be areas with the highest carrying capacity for spotted owls, which can be measured using a habitat-based calculation of the estimated maximum population of territorial spotted owls without barred owl presence.
3. Include lands of interested and willing landowners or land managers. A focus on areas where landowners have expressed interest in barred owl management will speed the implementation of actual barred owl management and encourage involvement.
4. Place blocks to include spotted owl populations, or clusters of sites, with good current demographic parameters (e.g., higher survival, occupancy, reproductive output, etc.) relative to others in the GMA.
5. Include known sites with indicators of high site quality, as determined during evaluations of current and historical sites. These indicators may include, for example, especially good habitat amount, quality, and configuration; a history of good past demographic performance; or a history of long-term occupancy. These are areas that have been shown by past use to be attractive to spotted owls and therefore more likely to be reoccupied, especially as spotted owl populations increase.
6. Place FMAs to support connectivity with the North Oregon Klamath GMA. Place FMAs in areas with good connectivity within the local environment, including habitat connectivity within an FMA, between neighboring FMAs, and/or between an FMA and nearby managed spotted owl sites. Consider placing an FMA to facilitate connectivity with the Central Oregon Coast Ranges GMA.
7. Place FMAs to minimize the cost of management. For example, select areas where existing monitoring will meet some of the monitoring needs associated with barred owl management.
8. Choose areas where funding is available for management.
9. Consider the presence of areas already designated for spotted owl habitat management or compatible conservation purposes, such as Late Successional Reserves, Congressionally reserved areas, designated critical habitat, and areas identified as high priorities in the Northern Spotted Owl Recovery Plan. Including these areas provides support for spotted owls and limits impacts on other resources. Because many of these have been managed for older forest over the last decades, these are likely locations of some of the best habitat conditions.




# A4.6 Western Oregon Cascades Province, Plus East Edge of Willamette Valley

## A4.6.A Background

The Western Oregon Cascades Province is one of five physiographic provinces in Oregon. Forest lands in this province, plus the eastern edge of the Willamette Valley Province, are 67 percent Federal lands (Forest Service and BLM), 1 percent State lands, and the remainder primarily in private ownership. Some management areas designated in this province also include small areas of forested lands within the portions of the Willamette Valley Province and the Oregon Klamath Province that are immediately adjacent to the Western Oregon Cascades Province.

The Western Oregon Cascades are characterized by dry summers and wet winters, with mild temperatures and precipitation falling as rain at lower elevations, and colder temperatures with precipitation falling as snow at higher elevations.

### A4.6.A.1 Spotted Owl Condition in the Western Oregon Cascades Province

Federal lands in the province include approximately 2,018,776 acres of spotted owl nesting and roosting habitat. Spotted owl habitat is abundant in this province, with large concentrations of habitat available throughout most of the middle elevation areas of the province. In some areas, spotted owl habitat is present up to the Cascade Crest, but in other areas, high elevation conditions preclude the development of spotted owl habitat. At the lowest elevations, spotted owl habitat is sparser due to heavier human use of the landscape, including human population centers and timberlands that have been heavily harvested. The distribution of spotted owl habitat has also been affected by wildfires, and in particular, north-south connectivity was affected by large, severe fires in 2020 that burned along the

Santiam River and up through the Santiam Pass. Flying squirrels are the primary prey species consumed by spotted owls in most of the Western Oregon Cascades, with woodrats taking on more importance in the southern portion of the province. Leporids (snowshoe hares and brush rabbits), pocket gophers (*Thomomys* spp.), and red-backed voles are also important locally or seasonally (Forsman et al. 1984, pp. 40-45; Forsman et al. 2004, p. 219; Rosenberg et al. 2003, . 1717).

The Western Oregon Cascades Province includes the H.J. Andrews Demography Study Area, as well as the majority of the South Cascades Demography Study Area, so we use these study areas to represent the status of spotted owls in the province. In the central portion of the province, the H.J. Andrews study area provides data on spotted owl populations since 1987. At the south end of the province, the South Cascades study area provides data on spotted owl populations since 1991. In both study areas, monitoring efforts indicate that spotted owl occupancy at historical territories has declined substantially.

The spotted owl population within the H.J. Andrews study area declined by 4.5 percent per year from 1995 through 2017 (Franklin et al. 2021, pp. 11-13). Spotted owl pair occupancy on sites within the H.J. Andrews study area dropped from 91 percent in 1993 to 27 percent in 2018 (Davis et al. 2022, p. 37). Call-playback surveys of the study area in 2022 detected spotted owls at 16 percent of the surveyed historical sites, including pairs at 8 percent of surveyed sites (Dugger et al. 2022, p. 6). The 2022 results are concerning, because they may indicate a precipitous decline over a period of a few years, but the 2022 results represent raw data, whereas the 2018 results are corrected for imperfect detection, and therefore are not directly comparable. Spotted owls were detected via passive acoustic monitoring at 46 percent of sample units (hexagons) in 2021 and at 39 percent in 2022 (Lesmeister et al. 2023, p. 17), but these results are not comparable to the 2018 pair occupancy results or the 2022 call-playback results, because they were obtained using different methods.

The spotted owl population within the South Cascades study area declined by nearly 5 percent per year from 1995 through 2017 (Franklin et al. 2021, p. 11-13). Spotted owl pair occupancy on sites within the South Cascades study area dropped from 70 percent in 1993 to 23 percent in 2018 (Davis et al. 2022, p. 37). Comprehensive call-playback surveys in 2022 detected spotted owls at 17 percent of historical sites, including pairs at 11 percent of historical sites (Dugger et al. 2023, p. 5). The 2022 data are not comparable to the 2018 data because they have not been corrected for imperfect detection. Spotted owls were detected via passive acoustic monitoring at 34 percent of sample units (hexagons) in 2021 and at 27 percent in 2022 (Lesmeister et al. 2023, p. 17), but these results are not comparable to the 2018 pair occupancy results or the 2022 call-playback results, because they were obtained using different methods.

Information from surveys conducted outside of the two study areas appears to indicate a smaller, less well-known population in the northern portion of the province and a larger, better surveyed remaining population, undergoing a slower decline, in the southern portion of the province.

### A4.6.A.2 Barred Owl Condition in the Western Oregon Cascades Province:

We expect that barred owl densities likely vary throughout this province, with higher densities in the north, and lower densities in the south, due to the longer time since the initial invasion in the north, as well as drier conditions in the southern portion of the province. This assumption is consistent with information from the study areas. At the H.J. Andrews study area in 2022, barred owls were detected in 64 percent of spotted owl home ranges (Dugger et al. 2022, p. 8). In the South Cascades Demography Study Area in 2022, barred owls were detected in 42 percent of spotted owl home ranges (Dugger et al. 2023, p. 7), the second lowest proportion found at any study area throughout the northern spotted owl range.

## A4.6.B Management Strategy

### A4.6.B.1 Spotted Owl Site Management in the Western Oregon Cascades Plus Province

*A4.6.B.1.a Background*

Although the number of spotted owls remaining in this province is larger than in some other provinces, spotted owl populations continue to decline, and therefore it is crucial to protect the remaining spotted owl sites, especially in the northern portions of the province where the barred owl influence is likely to be strongest and local extirpations may be more imminent. Because many areas have not been surveyed consistently in recent years, especially in the northern portion of the province, we recommend that historically active sites be surveyed for activity, with emphasis on those with known spotted owl activity within the last ten years.

In some cases, managed sites may eventually be incorporated into block management areas. In other cases, site management of single sites or clusters of sites may be an appropriate long-term action, if larger blocks of habitat are not available for management due to landscape or ownership conditions, or in areas where site management promotes connectivity between block management areas. Additionally, site management may be used to accomplish medium-term goals related to production of young for natural recolonization or potential future population augmentation actions.

- Where spotted owl site management occurs within a GMA, these spotted owl sites may serve as key points for the development of focal management areas, now and in the future. Site management may be expanded into block management over time.
- Managing barred owls in recently occupied spotted owl sites is intended to help reduce the rate of spotted owl population decline as quickly as possible and prevent extinction/extirpation of the spotted owl in the province. At present, the prevention of local extirpation is especially important in the northern portions of the province, but reducing the rate of population decline is important throughout.
- Managing barred owls in spotted owl sites that are, or become, reproductively active, may enable those sites to provide a source of young for colonization of nearby management blocks. These sites may interact demographically with nearby management blocks.
- Barred owl management in spotted owl sites may serve to increase connectivity between and within block management areas. If so, this connectivity may prevent genetic bottlenecks or reductions in genetic diversity.

- Spotted owl site management, due to its smaller size when compared to block management, provides a wider range of options for landowner contribution to barred owl management, particularly for smaller landowners. The smaller size also makes site management suitable for areas where there are not large amounts of spotted owl habitat due to terrain, or extensive loss of habitat from wildfires, harvest, or other disturbances.
- These managed spotted owl sites may provide a source of individuals for direct augmentation of populations in block management areas, either within this province or in other provinces, or for a captive breeding population, if decisions are made to pursue either of these translocation strategies in the future.
- Managing barred owls in spotted owl sites distributed across the province, whether within block management areas or not, may reduce the risk of loss of spotted owls in the province from catastrophic events, such as wildfire, by maintaining spotted owl site occupancy across the area. Managing spotted owl sites also provides the opportunity for maintaining spotted owls in areas where block management is not feasible or recommended. This approach applies across the entire province, whether or not the locations are within a GMA or other mapped designation.

*Selection of spotted owl sites for management*

The number of occupied spotted owl sites is somewhat limited in this province. The primary focus of spotted owl site management in this province is on sites that have been occupied by, or had detections of, spotted owls in the last five years. These areas are more likely to have spotted owls present, or be recolonized by spotted owls after barred owl removal. This is reflected in the priorities for site management. In well-surveyed landscapes within the southern portion of the province, where spotted owls remain present at higher numbers than in the north, the primary focus is specifically on sites that have been occupied by, or had detections of, spotted owls in the last year, though recently occupied sites are also a high priority.

*Spotted Owl Site Management Priorities*

| Priority | Spotted Owl Site Condition |
|---|---|
| A | Currently active sites, including all areas with any spotted owl detections within the last year; and recently active sites, including areas with any spotted owl detections within the 5 years, in portions of the province where spotted owl populations are smaller and/or less well-surveyed |
| B | Recently active sites, including areas where the most recent spotted owl detection was between 1 and 5 years ago, in portions of the province that are well-surveyed and where evidence indicates that spotted owl populations are declining more slowly |
| C | Historically occupied spotted owl sites (pair or single) with last detection between 5 and 10 years ago |
| D | Historically occupied spotted owl sites (pair or single) with last detection more than 10 years ago; and potential sites with adequate habitat but no known history of spotted owl occupancy, and without detections within the last 5 years |

*Other considerations for selection of spotted owl sites for management:*

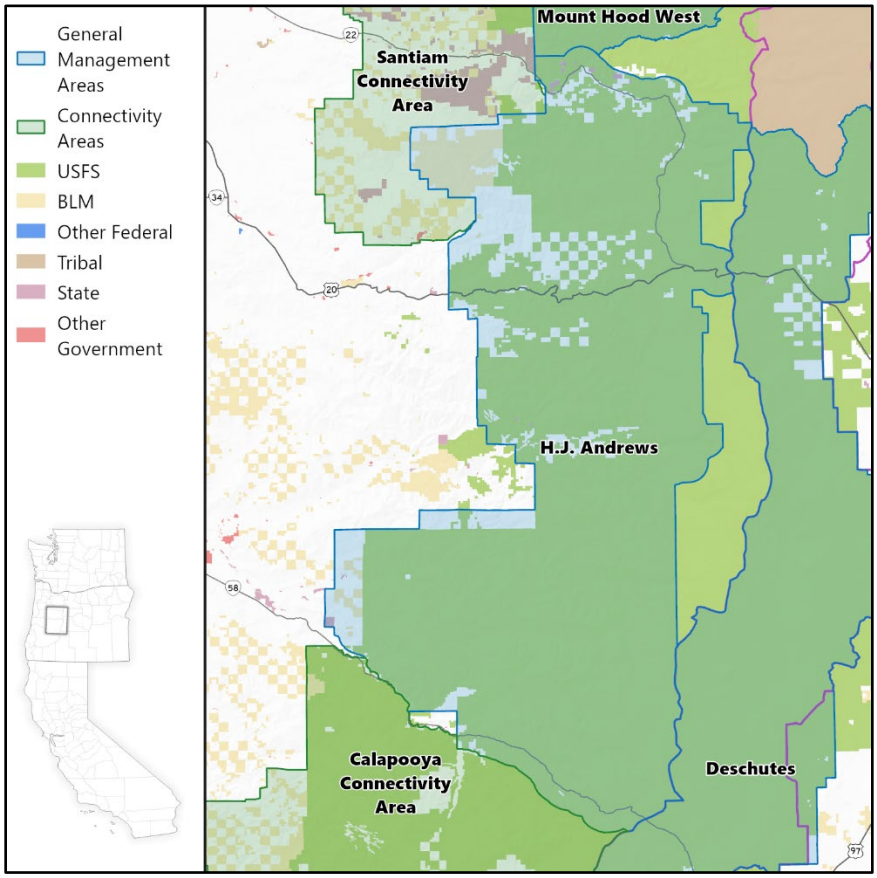
- We recommend consideration of the following factors when selecting among sites within a priority category. Select sites with the most recent spotted owl occupancy.
- Focus first on sites with recent occupancy by pairs, then singles, then detections.
- Where relevant information is available, select sites with the best recent demographic performance (for example, select the sites where the largest numbers of young have fledged).
- Preferentially select sites with good accessibility, to maximize the efficiency of implementation.
- Consider the condition of habitat in the area, particularly loss of habitat since the last surveys. All other things being equal, select sites with abundant high-quality habitat. Spotted owl sites that have lost substantial amounts of habitat to harvest, fire, insect damage, or other disturbances may be lower priority.
- Choose sites within GMAs, near GMAs, or creating steppingstone connectivity between GMAs.
- Consider the history of spotted owl use at the site. Where historical survey information is available, focus first on sites with a long history of pair occupancy, including reproduction.

*A4.6.B.1.b Management Recommendations*

Within each individual site, remove barred owls from an area between 6,514 and 11,581 acres. This represents the area in a circle of 1.5 and 2 home range radii (Table 2). This can be distributed in a circle around the activity center, or implementers can use local knowledge, topography, and habitat condition to design a non-circular area of the appropriate size that provides the best conditions for barred owl management. In areas where spotted owl sites are isolated, and particularly for sites in Priority A condition (see table above), we recommend a larger management area, up to 26,058 acres (3 home range radii). Where sites are not isolated, applying site management to clusters of two or more sites in close proximity is likely to provide more efficient management conditions and increased benefits for spotted owls present in those sites.

### A4.6.B.2 General Management Areas in the Western Oregon Cascades Plus Province

*A4.6.B.2.a H.J. Andrews GMA – Priority A*




The H.J. Andrews GMA is located in the central portion of the Western Oregon Cascades Province, and generally includes all of the mid-elevation areas centered on the H.J. Andrews Experimental Forest, with additional areas to the north and south. It includes approximately 1,304,025 acres in total, of which 1,273,146 acres (98 percent) are forest lands and 594,667 acres (46 percent) provide spotted owl nesting and roosting habitat. The GMA includes a large portion of the Willamette National Forest, as well as some lower elevation areas managed by the BLM Northwest Oregon District, a few small parcels of State lands, and adjacent and interspersed private lands. Overall, forest lands in the GMA are 90 percent Federal lands (Forest Service and BLM), with the remainder primarily in private ownership.

This GMA was mapped for the following reasons:

- It encompasses the central portion of the spotted owl range within this province.
- Habitat density is very high here.
- The GMA includes the H.J. Andrews Demography Study Area, with its historical and recent spotted owl data. The Northwest Forest Plan Effectiveness Monitoring program includes passive acoustic monitoring sampling 20 percent of the H.J. Andrews study area. This monitoring program will provide additional future data on both spotted and barred owls, and allow for efficiencies in monitoring barred owl removal and its effects on spotted owls. This portion of the GMA is well known and accessible, allowing for quicker implementation.
- Demographic information from the study area indicates that spotted owls there maintained better demographic rates more characteristic of areas farther south, in spite of having higher barred owl occupancy rates more characteristic of areas farther north. This may be due to the high quantity and quality of available spotted owl habitat. We interpret this as an indication that the potential for population recovery is high here, once the pressure from barred owls is reduced.

- Recent information indicating the possibility of rapid declines in spotted owl numbers in this area highlights the urgency of management here.
- Taken together, these factors indicate that rapid implementation of FMA management in this area may have the greatest impact on both the short-term likelihood of extirpation and the long-term likelihood of recovery in this province.

This GMA was assigned Priority A. This area retains the potential to serve as a source population if barred owl populations can be reduced, but appears to be undergoing rapid population decline at present. The well-studied landscape of the H.J. Andrews study area will allow for immediate implementation of barred owl management to the locations where it can have the most immediate benefit to existing spotted owls. Actions here are intended to prevent extirpation and to create refugia to secure and improve spotted owl populations here, which may eventually serve as source populations for the rest of the province and the Eastern Oregon Cascades.

*Description of the elements considered in mapping:* In mapping the boundaries of the H.J. Andrews GMA we used information on the following elements.

*Spotted Owl Data:*

- We included areas of especially high habitat density and excluded most areas with smaller amounts or lower quality of habitat.
- We included some areas of lower quality habitat where it appeared that the habitat might support dispersal between this GMA and the Deschutes GMA in the Eastern Oregon Cascades, due to the presence of habitat (even if lower quality) on either side of the Cascade Crest, and concentrations of enough higher quality habitat to support a spotted owl pair within a few miles of the crest on either side.
- This GMA includes current, recent, and historical spotted owl sites.

*Conditions:*

- We generally excluded portions of inventoried roadless areas or wilderness areas that were located more than two miles from the nearest road. Some of the included areas may remain difficult to access, and this should be considered during development of FMA boundaries.

*Other Considerations:*

- We included most of the H.J. Andrews Demography Study Area, except where it coincides with the Mount Hagen Inventoried Roadless Area, where spotted owl habitat is present but at lower density than in other portions of the study area. As noted above, inclusion of the study area allows efficiencies in monitoring and opportunities for research.
- In several areas, we used a road to guide the drawing of the GMA boundary, but also included a buffer area on the other side of the road to avoid situations in which an individual barred owl may be easily accessible from the road, but cannot be removed due to a boundary line along the road.

*Focal Management Areas (FMAs)*

In this GMA, we recommend developing FMAs large enough to support as many spotted owl pair sites as possible, up to 50 pair sites per FMA. Generally, larger blocky areas provide a smaller edge-to-area ratio, and this may help reduce the influx of barred owls from outside the FMA in the future. If smaller FMAs are developed due to funding limitations, design them such that they could be expanded in the future if funding becomes available.

When possible, include multiple FMAs, generally spaced no farther than 12 to 15 miles apart. Where smaller areas are developed due to topography, forest condition, access, funding limitations, or other reasons, we recommend these be closer together and multiple areas be designed with the intent of encouraging exchange of spotted owls between these smaller areas.

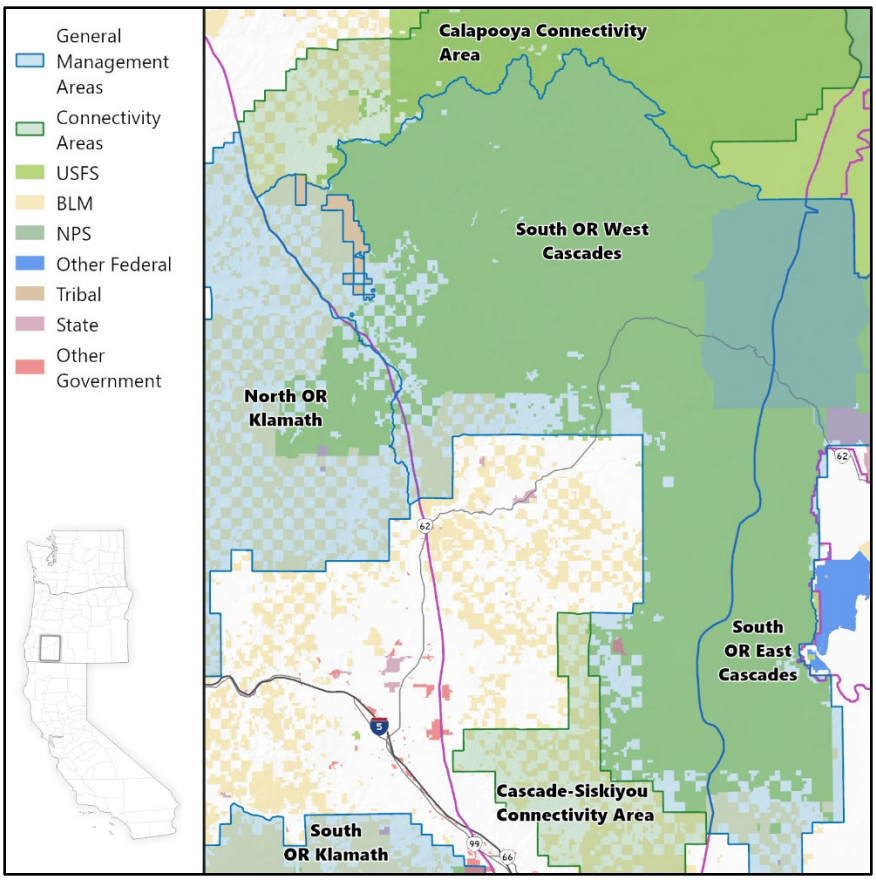
Including recently occupied sites in FMAs provides a starting point for development of spotted owl populations once barred owl populations are reduced. Coordinate FMA locations with the site management described above, with FMA locations in adjacent GMAs, and with barred owl management in the adjacent Connectivity Areas.

*Priorities:* The following are our recommended priorities for defining and selecting FMAs within the H.J. Andrews GMA. The following are in general priority order; however, local expertise will be important in applying these to specific FMA boundary designs.

1. Build FMAs around current and recent occupied spotted owl sites (sites with presence or occupancy of spotted owls in the last five years). This provides a nucleus of spotted owls for the potential recolonization of sites within the FMA as barred owl numbers are reduced.
2. Place blocks to include spotted owl populations, or clusters of sites, with good current demographic parameters (e.g., higher survival, occupancy, reproductive output, etc.) relative to others in the GMA.
3. Select areas with the highest acreage of high-quality spotted owl habitat, for example, as measured by relative habitat suitability. These are likely to be areas with the highest carrying capacity for spotted owls, which can be measured using a habitat-based calculation of the estimated maximum population of territorial spotted owls without barred owl presence.
4. Place FMAs to minimize the cost of management. Select areas where drivable roads are available and accessible (including access rights and weather conditions) during the period when management is needed. Where roads are not available, trails may be used, but avoid areas lacking in roads and trails. Select areas where existing monitoring will meet some of the monitoring needs associated with barred owl management.
5. Place FMAs in areas allowing for connectivity within the local environment, including habitat connectivity within an FMA, between neighboring FMAs, and between an FMA and nearby managed spotted owl sites. Place FMAs to facilitate connectivity between management areas, including the neighboring Connectivity Areas, the Mount Hood West GMA, and the Deschutes GMA in the Eastern Oregon Cascades Province. Consider the capability of the landscape to support dispersal.

6. Include known sites with indicators of high site quality, as determined during evaluations of current and historical sites. These indicators may include, for example, especially good habitat amount, quality, and configuration; a history of good past demographic performance; or a history of long-term occupancy. These are areas that have been shown by past use to be attractive to spotted owls and therefore more likely to be reoccupied, especially as spotted owl populations increase.
7. Include lands of interested and willing landowners or land managers. A focus on areas where landowners have expressed interest in barred owl management will speed the implementation of actual barred owl management and encourage involvement. Focus first on areas where funding is available.
8. Other factors being equal, preferentially select FMAs to include areas where spotted owl habitat has higher projected climate change resilience. This may include indications of higher microclimate stability, lower fire risk, lower risk of tree mortality due to drought, lower likelihood of vegetation shifts away from forest types supporting spotted owl habitat conditions, or other factors.
9. Choose areas that may serve as source populations in the future. These will be areas in which the spotted owl population is large enough, with good enough demographic parameters (e.g., survival, site occupancy, and fecundity) to produce enough young that they disperse to other areas. Such areas may not exist now, but habitat and historical information might be informative as to where such spotted owl populations may become possible, with a reduction in barred owl densities.
10. Consider the presence of areas already designated for spotted owl habitat management or compatible conservation purposes, such as Late Successional Reserves, Congressionally reserved areas, designated critical habitat, and areas identified as high priorities in the Northern Spotted Owl Recovery Plan and final Critical Habitat rule. Including these areas provides support for spotted owls and limits impacts on other resources. Because many of these have been managed for older forest over the last decades, these are the likely locations of some of the best habitat conditions.

*A4.6.B.2.b South Oregon West Cascades GMA – Priority B*




The South Oregon West Cascades GMA is located in the southern portion of the Western Oregon Cascades Province, spans the province from west to east, and includes a small neighboring area of the Oregon Klamath Province. It includes approximately 1,060,627 acres in total, of which 1,030,595 acres (97 percent) are forest lands and 463,596 acres (44 percent) provide spotted owl nesting and roosting habitat. The GMA is primarily made up of Federal lands, including portions of Umpqua and Rogue River-Siskiyou National Forests, Crater Lake National Park, and BLM lands associated with the Medford and Roseburg Districts. It also includes adjacent and interspersed private lands, and one county park surrounded by Forest Service lands. Overall, forest lands in the GMA are 90 percent Federal lands (Forest Service, National Park Service, and BLM), with the remainder primarily in private ownership.

This GMA was mapped for the following reasons:

- This area allows for connectivity to both the Eastern Oregon Cascades and Oregon Klamath Provinces, and from there to the Oregon Coast Ranges Province and to provinces in California.
- It includes the largest concentrations of spotted owl habitat in the southern portion of the province.
- The GMA overlaps a portion of the South Cascades Demography Study Area, with its historical and recent spotted owl data. The Northwest Forest Plan Effectiveness Monitoring program includes passive acoustic monitoring sampling 20 percent of the South Cascades study area. This monitoring program will provide additional future data on both spotted and barred owls, and allow for efficiencies in monitoring barred owl removal and its effects on spotted owls. This portion of the GMA is well known and accessible, allowing for quicker implementation.
- Demographic data from the South Cascades study area indicates that spotted owls here have a potential for high fecundity if the negative influence of barred owls can be reduced.

This GMA was assigned Priority B. Spotted owl subpopulations in this GMA are declining, but not as rapidly as they are in the northern and central portions of the province. Barred owl management in this GMA would help to slow these declines. Site management around currently occupied sites within this GMA remains a Priority A action, but additional management outside of these sites is likely to increase the effectiveness of management and offer opportunities for spotted owls to recolonize currently unoccupied areas. Portions of the landscape are relatively well-surveyed and accessible, which allows for relatively rapid implementation of barred owl management. Barred owl management should be implemented as soon as possible, but block management here is not among the highest urgency actions in the province, and therefore fits the definition of a Priority B action.

*Description of the elements considered in mapping:* In mapping the boundaries of the South Oregon West Cascades GMA we used information on the following elements.

*Spotted Owl Data:*

- We focused on concentrations of spotted owl habitat in the southern portion of the province, moving north from the southern end of the South Cascades study area.
- The GMA includes several areas of potential connectivity to the South Oregon East Cascades GMA, where habitat to support spotted owl dispersal is present up to the Cascades Crest on both the east and west sides.
- The GMA boundary includes a long segment along the province boundary with the Oregon Klamath Province, allowing for good connectivity with the North Oregon Klamath GMA. Spotted owl habitat is abundant on both sides of the boundary.
- North of State Highway 62, between the towns of Trail and Prospect, the GMA includes two peninsulas with higher concentrations of spotted owl habitat in an area where habitat is somewhat sparser than in other portions of the GMA. This is due to information indicating spotted owl presence in these locations.
- This GMA includes current, recent, and historical spotted owl sites.

*Conditions:*

- We did not exclude inventoried roadless areas or wilderness areas, where road and trail access may be lacking, but these factors should be considered during development of FMA boundaries.

*Other Considerations:*

- Along the northern boundary of the GMA, we used roads to guide the boundary location, but also included a buffer area on the other side of the road to avoid situations in which an individual barred owl may be easily accessible from the road, but cannot be removed due to a boundary line along the road.
- As discussed above, this GMA includes a portion of the South Cascades study area. This allows for efficiencies in monitoring and opportunities for research. The GMA includes nearly the entire portion of the study area within the Western Oregon Cascades Province, and in some areas the GMA boundary follows the study area boundaries.

*Focal Management Areas (FMAs)*

In this GMA, we recommend developing FMAs large enough to support as many spotted owl pair sites as possible, up to 50 pair sites per FMA. Generally, larger blocky areas provide a smaller edge-to-area ratio, and this may help reduce the influx of barred owls from outside the FMA in the future. However, where the landscape or forest conditions do not allow this, smaller or more sinuous areas may be appropriate. For example, in higher elevation areas where spotted owl habitat configuration is more linear, large blocky FMAs may not be reasonable or effective, and smaller FMAs, still encompassing multiple pair areas, may be a practical option. These may be more elongated in shape due to the habitat limitations. If smaller FMAs are developed due to funding limitations, design them such that they could be expanded in the future if funding becomes available.

When possible, include multiple FMAs, generally spaced no farther than 12 to 15 miles apart. Where smaller areas are developed due to topography, forest condition, access, funding limitations, or other reasons, we recommend these be closer together and multiple areas be designed with the intent of encouraging exchange of spotted owls between these smaller areas.

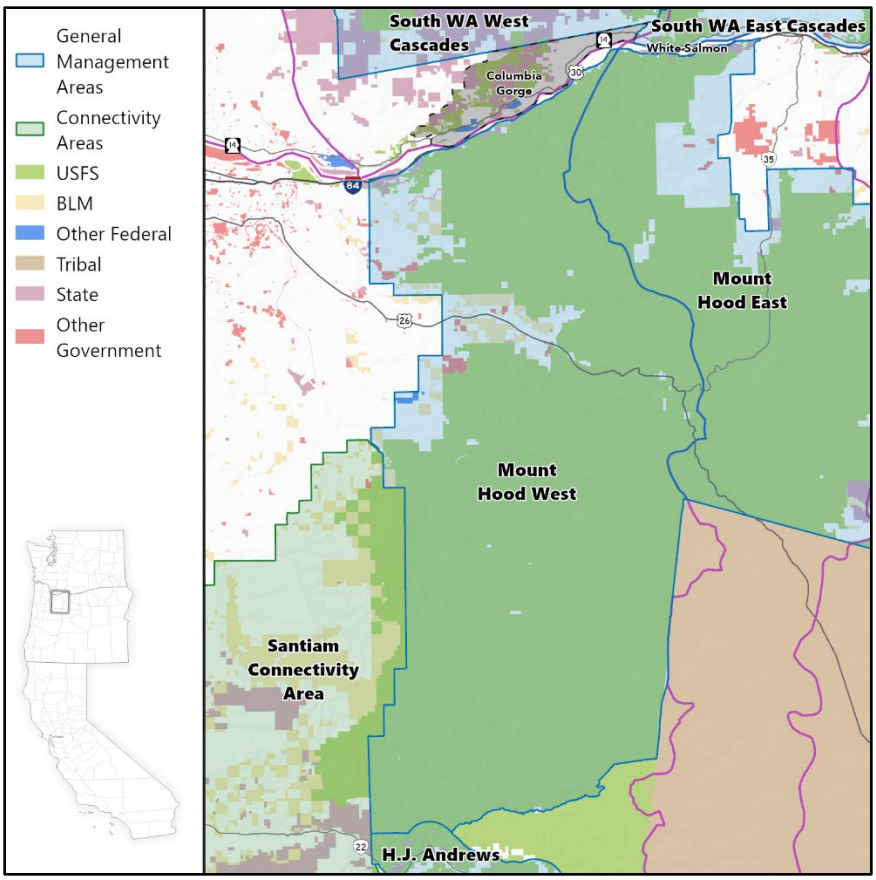
Including recently occupied sites in FMAs provides a starting point for development of spotted owl populations once barred owl populations are reduced. Coordinate FMA locations with the site management described above, with FMA locations in adjacent GMAs, and with barred owl management in the adjacent Connectivity Areas. It may be beneficial to designate FMAs that span the boundary between this GMA and the South Oregon East Cascades GMA, or the North Oregon Klamath GMA. Alternatively, smaller FMAs could be designated on either side of a given boundary, but could effectively function as one spotted owl population.

*Priorities:* The following are our recommended priorities for defining and selecting FMAs within the South Oregon West Cascades GMA. The following are in general priority order; however, local expertise will be important in applying these to specific FMA boundary designs.

1. Build FMAs around current and recent occupied spotted owl sites (sites with presence or occupancy of spotted owls in the last five years). This provides a nucleus of spotted owls for the potential recolonization of sites within the FMA as barred owl numbers are reduced.
2. Place blocks to include spotted owl populations, or clusters of sites, with good current demographic parameters (e.g., higher survival, occupancy, reproductive output, etc.) relative to others in the GMA.
3. Select areas with the highest acreage of high-quality spotted owl habitat, for example, as measured by relative habitat suitability. These are likely to be areas with the highest carrying capacity for spotted owls, which can be measured using a habitat-based calculation of the estimated maximum population of territorial spotted owls without barred owl presence.
4. Place FMAs to minimize the cost of management. Select areas where drivable roads are available and accessible (including access rights and weather conditions) during the period when management is needed. Where roads are not available, trails may be used, but avoid areas lacking in roads and trails. Select areas where existing monitoring will meet some of the monitoring needs associated with barred owl management.

5. Place FMAs to facilitate connectivity between management areas, including the neighboring Connectivity Areas, the South Oregon East Cascades GMA, and the North Oregon Klamath GMA. Place FMAs in areas allowing for connectivity within the local environment, including habitat connectivity within an FMA, between neighboring FMAs, and/or between an FMA and nearby managed spotted owl sites. Consider the capability of the landscape to support dispersal.
6. Include known sites with indicators of high site quality, as determined during evaluations of current and historical sites. These indicators may include, for example, especially good habitat amount, quality, and configuration; a history of good past demographic performance; or a history of long-term occupancy. These are areas that have been shown by past use to be attractive to spotted owls and therefore more likely to be reoccupied, especially as spotted owl populations increase.
7. Include lands of interested and willing landowners or land managers. A focus on areas where landowners have expressed interest in barred owl management will speed the implementation of actual barred owl management and encourage involvement. Focus first on areas where funding is available.
8. Other factors being equal, preferentially select FMAs to include areas where spotted owl habitat has higher projected climate change resilience. This may include indications of higher microclimate stability, lower fire risk, lower risk of tree mortality due to drought, lower likelihood of vegetation shifts away from forest types supporting spotted owl habitat conditions, or other factors.
9. If areas of lower barred owl population density can be identified, include these areas in FMAs. Where barred owls are at lower densities, fewer will need to be removed, and their negative effects on spotted owl populations may be reversed more quickly.
10. Choose areas that may serve as source populations in the future. These will be areas in which the spotted owl population is large enough, with good enough demographic parameters (e.g., survival, site occupancy, and fecundity) to produce enough young that they disperse to other areas. Such areas may not exist now, but habitat and historical information might be informative as to where such spotted owl populations may become possible, with a reduction in barred owl densities.
11. Consider the presence of areas already designated for spotted owl habitat management or compatible conservation purposes, such as Late Successional Reserves, Congressionally reserved areas, designated critical habitat, and areas identified as high priorities in the Northern Spotted Owl Recovery Plan and final Critical Habitat rule. Including these areas provides support for spotted owls and limits impacts on other resources. Because many of these have been managed for older forest over the last decades, these are the likely locations of some of the best habitat conditions.

*A4.6.B.2.c Mount Hood West GMA – Priority C*




The Mount Hood West GMA is located in the northern portion of the Western Oregon Cascades Province and nearly spans the province from west to east. It also includes small neighboring areas of the Eastern Oregon Cascades Province along the Cascades Crest. It includes approximately 791,843 acres in total, of which 765,716 acres (97 percent) are forest lands and 372,313 acres (47 percent) provide spotted owl nesting and roosting habitat. The GMA is primarily made up of Federal lands on the Mount Hood National Forest, but also includes the northernmost portion of the Willamette National Forest, small areas of BLM lands associated with the Northwest Oregon District, and the Eagle Creek National Fish Hatchery. Additionally, the GMA includes small areas of State Park lands, local public lands, and private lands, where these are adjacent to or interspersed with the Federal lands described above. Notably, this GMA includes the Bull Run watershed, which is located mainly on National Forest lands and provides most of the municipal drinking water supply for the City of Portland. Overall, forest lands in the GMA are 92 percent Federal lands (Forest Service, BLM), with the remainder primarily in private ownership.

This GMA was mapped for the following reasons:

- The GMA includes the northern extent of spotted owl distribution in the Western Oregon Cascades.
- It includes large concentrations of spotted owl habitat.
- This area provides many opportunities for connectivity to the Eastern Oregon Cascades Province, and some limited potential for connectivity to the Western Washington Cascades Province to the north. Although historical and current patterns of spotted owl dispersal across the Columbia River are not well understood, there is some possibility that it would occur here, given the relatively narrow width of open water southwest of Cascade Locks, and the presence of spotted owl habitat on both sides of the river, albeit at lower concentrations than farther east.

This GMA is assigned Priority C. Due to low survey effort in recent years, it is unknown whether spotted owls are currently present within this GMA, and if so, their locations are unknown. We expect that spotted owls are likely fewer in number in this GMA, relative to areas farther south, due to the longer time since the initial barred owl invasion. If spotted owls are detected during surveys, site management around these detections (and any other locations with detections in the last five years) will be a Priority A action. Additional management within this GMA beyond site management is likely to increase the effectiveness of management and provide opportunities for recolonization. The focus of block management in this GMA is on building beyond current populations, if and where they exist. Block management in this GMA will take more time to plan and implement than block management in GMAs to the south, where the information associated with study areas can speed block management planning and implementation. Therefore, our expectations of FMA management within this GMA fit well with the definition of Priority C actions.

*Description of the elements considered in mapping:* In mapping the boundaries of the Mount Hood East GMA we used information on the following elements.

*Spotted Owl Data:*

- We included most concentrations of spotted owl habitat in the northernmost portion of the province.
- We included areas of potential connectivity to management blocks in the Eastern Oregon Cascades Province, where habitat to support spotted owl dispersal is present up to the Cascades Crest on both the east and west sides.
- This GMA includes historical spotted owl sites, although recent spotted owl occupancy and presence are unknown due to very low survey effort in recent years.
- We excluded some areas to the south and east where spotted owl habitat was removed by the 2020 Lionshead Fire, including wilderness and roadless areas that may also be inaccessible.
- We did not attempt to exclude all areas that lack habitat due to recent fires. This can be considered during development of FMA boundaries.

*Conditions:*

- We did not exclude most inventoried roadless areas or wilderness areas, or other areas where road and trail access may be lacking, but these factors should be considered during development of FMA boundaries.

*Other Considerations:*

- The northern boundary of the GMA follows the boundary of the Warm Springs Reservation.
- Although we focused on public lands, including local government lands, we also included some areas of private lands with little spotted owl habitat, because these areas may provide barred owl habitat, and if not managed, could be an ongoing source of barred owls entering removal areas within spotted owl habitat.

*Focal Management Areas (FMAs)*

In this GMA, we recommend developing FMAs large enough to support as many spotted owl pair sites as possible, up to 50 pair sites per FMA. Generally, larger blocky areas provide a smaller edge-to-area ratio, and this may help reduce the influx of barred owls from outside the FMA in the future. If smaller FMAs are developed due to funding limitations, design them such that they could be expanded in the future if funding becomes available.

When possible, include multiple FMAs, generally spaced no farther than 12 to 15 miles apart. Where smaller areas are developed due to topography, forest condition, access, funding limitations, or other reasons, we recommend these be closer together and multiple areas be designed with the intent of encouraging exchange of spotted owls between these smaller areas.

Coordinate FMA locations with the site management described above. Including recently occupied sites in FMAs provides a starting point for development of spotted owl populations once barred owl populations are reduced. In this GMA, there is very little information regarding recent spotted owl occupancy or presence. We recommend conducting surveys so that areas of current spotted owl activity can be included in FMAs. Additionally, coordinate FMA locations with barred owl management activity in neighboring GMAs and the Santiam Connectivity Area. It may be beneficial to designate FMAs that span the boundary between the Mount Hood West and Mount Hood East GMAs. Alternatively, smaller FMAs could be designated on either side of the province boundary, but could effectively function as one spotted owl population.

*Priorities:* The following are our recommended priorities for defining and selecting FMAs within the Mount Hood West GMA. The following are in general priority order; however, local expertise will be important in applying these to specific FMA boundary designs.

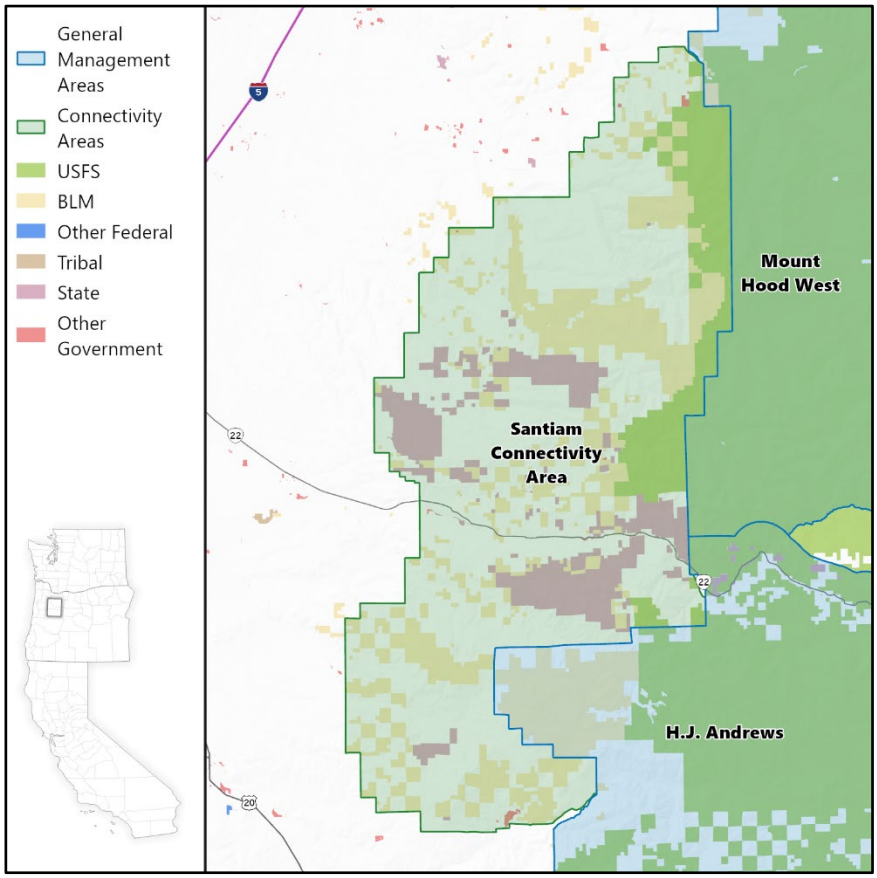
1. Build FMAs around current and recent occupied spotted owl sites (sites with presence or occupancy of spotted owls in the last five years). This provides a nucleus of spotted owls for the potential recolonization of sites within the FMA as barred owl numbers are reduced.
2. Place blocks to include spotted owl populations, or clusters of sites, with good current demographic parameters (e.g., higher survival, occupancy, reproductive output, etc.) relative to others in the GMA.
3. Select areas with the highest acreage of high-quality spotted owl habitat, for example, as measured by relative habitat suitability. These are likely to be areas with the highest carrying capacity for spotted owls, which can be measured using a habitat-based calculation of the estimated maximum population of territorial spotted owls without barred owl presence.
4. Place FMAs to minimize the cost of management. Select areas where drivable roads are available and accessible (including access rights and weather conditions) during the period when management is needed. Where roads are not available, trails may be used, but avoid areas lacking in roads and trails. Select areas where existing monitoring will meet some of the monitoring needs associated with barred owl management.
5. Place FMAs in areas allowing for connectivity within the local environment, including habitat connectivity within an FMA, between neighboring FMAs, and/or between an FMA and nearby managed spotted owl sites. Place FMAs to facilitate connectivity between

management areas, including the Mount Hood East GMA, the H.J. Andrews GMA, the Santiam Connectivity Area, and, to a lesser extent, to management blocks in the Western Washington Cascades Province. Consider the capability of the landscape to support dispersal.

6. Include known sites with indicators of high site quality, as determined during evaluations of current and historical sites. These indicators may include, for example, especially good habitat amount, quality, and configuration; a history of good past demographic performance; or a history of long-term occupancy. These are areas that have been shown by past use to be attractive to spotted owls and therefore more likely to be reoccupied, especially as spotted owl populations increase.
7. Include lands of interested and willing landowners or land managers. A focus on areas where landowners have expressed interest in barred owl management will speed the implementation of actual barred owl management and encourage involvement. Focus first on areas where funding is available.
8. Other factors being equal, preferentially select FMAs to include areas where spotted owl habitat has higher projected climate change resilience. This may include indications of higher microclimate stability, lower fire risk, lower risk of tree mortality due to drought, lower likelihood of vegetation shifts away from forest types supporting spotted owl habitat conditions, or other factors.
9. Consider the presence of areas already designated for spotted owl habitat management or compatible conservation purposes, such as Late Successional Reserves, Congressionally reserved areas, designated critical habitat, and areas identified as high priorities in the Northern Spotted Owl Recovery Plan and final Critical Habitat rule. Including these areas provides support for spotted owls and limits impacts on other resources. Because many of these have been managed for older forest over the last decades, these are the likely locations of some of the best habitat conditions.

### A4.6.B.3 Special Designated Areas

*A4.6.B.3.a Santiam Connectivity Area – Priority D*




The Santiam Connectivity Area is located in the northern portion of the Western Oregon Cascades Province, at lower elevations along the boundary with the Willamette Valley Province. It includes some small adjacent areas of the Willamette Valley Province. It includes approximately 522,965 acres in total, of which 507,261 acres (97 percent) are forest lands and 97,265 acres (19 percent) provide spotted owl nesting and roosting habitat. Federal lands in the Connectivity Area include the southwestern corner of the Mount Hood National Forest, the northeastern corner of the Willamette National Forest, and BLM lands associated with the Northwest Oregon District; State lands include the Santiam State Forest and Silver Falls State Park; and there are also some small areas of county lands. Forest lands in the Connectivity Area are 33 percent Federal lands (BLM and Forest Service), 11 percent State lands, and the remainder in private ownership.

The Santiam Connectivity Area was mapped for the following reasons:

- Following the large, severe Beachie Creek and Lionshead fires of 2020, north-south connectivity between the northern and central portions of the Western Oregon Cascades Province was greatly constricted. The area within this Connectivity Area can provide a low-elevation pathway connecting these two portions of the province.
- The area lies along the west sides of the Mount Hood West and H.J. Andrews GMAs, and could provide connection between spotted owl populations that eventually develop within those GMAs.
- The Connectivity Area includes the Santiam State Forest, which is included in an HCP that is currently in development, and barred owl management could potentially be used to mitigate unavoidable impacts of land management activities. This Connectivity Area includes all of the larger Habitat Conservation Areas proposed for Santiam State Forest within ODF's draft HCP.

This Connectivity Area is assigned Priority D. We expect that spotted owls are likely fewer in number in this area, relative to areas farther south, due to the longer time since the initial barred owl invasion and the more fragmented spotted owl habitat in this area. If spotted owls are detected during surveys, site management around these detections (and any other locations with detections in the last five years) will be a Priority A action. Site management to protect sites with known occupancy during the last ten years remains a Priority C action. Additional management within this Connectivity Area beyond site management could improve demographic connectivity between populations of spotted owls in larger management areas within the northern part of the Western Oregon Cascades. Given the low density of spotted owl habitat in this area, we expect that recolonization of this area would be slow, compared to areas within the GMAs. Management within this Connectivity Area, beyond site management, would provide its greatest value at a later time, once populations of spotted owls in the neighboring GMAs begin to recover.

*Description of the elements considered in mapping:* In mapping the boundaries of the Santiam Connectivity Area we used information on the following elements.

*Spotted Owl Data:*

- While recent survey data is limited, this area contains historical spotted owl activity centers and some concentrations of habitat, although habitat is sparser here than in many other portions of the province.
- The Connectivity Area includes small neighboring areas of the Willamette Valley Province, mainly in and around Silver Falls State Park. Silver Falls State Park was included because of very high habitat density, and the area around it was included to minimize the edge-to-area ratio.
- We did not try to exclude areas where spotted owl habitat has been lost to wildfire. About half of the Connectivity Area was affected by the Beachie Creek Fire in 2020 or the Riverside Fire in 2021, though some of the area burned at lower severities and some habitat remains within the fire perimeters. This can be considered during development of the management area boundaries.

*Conditions:*

- We considered the availability of access via roads and trails in most of this area. This Connectivity Area includes some areas where access may be difficult, such as wilderness and roadless areas, although these designations are not extensive in this Connectivity Area. Accessibility can be considered during development of the management area boundaries.

*Other Considerations:*

- The Connectivity Area includes some areas of private and local public lands with relatively low densities of spotted owl habitat. These areas were included in order to reduce the edge-to-area ratio of the Connectivity Area, making it possible to create management areas with low edge-to-area ratios (see below). These areas also buffer the areas of spotted owl habitat, providing for the possibility of removing barred owls that

would otherwise move into areas of spotted owl habitat where barred owls have been removed.

- The Connectivity Area encompasses the larger proposed Habitat Conservation Areas within Santiam State Forest that were included in ODF's draft HCP.

*Management within the Connectivity Area*

In the Santiam Connectivity Area, the short-term focus for management is to identify remaining occupied spotted owl sites and conduct barred owl management to protect these remaining sites. Longer term, focus on creating smaller blocks of habitat allowing for spotted owl populations to connect across this area and reducing overall barred owl population density to support spotted owl demographic connections across this area.

Initially, we recommend conducting surveys of historical spotted owl sites, and areas with high-quality spotted owl habitat without historical spotted owl data. If occupied sites are found, manage all these sites using the site management described above, with at least 11,581 acres (2 home range radii), and preferably larger.

In the longer term, we recommend developing barred owl management areas around the occupied and historical spotted owl sites, with a focus on scattered small blocks across the entire Connectivity Area to provide for connectivity. In addition, general barred owl removal in this area, designed to reduce barred owl densities, may provide opportunities for successful dispersal of spotted owls. This is not anticipated to be as intense or continuous at that within management blocks.

Coordinate the locations of barred owl management within the Connectivity Area with any other barred owl management activity in surrounding areas. This may include FMAs within the two neighboring GMAs, as well any site management areas near the Connectivity Area.

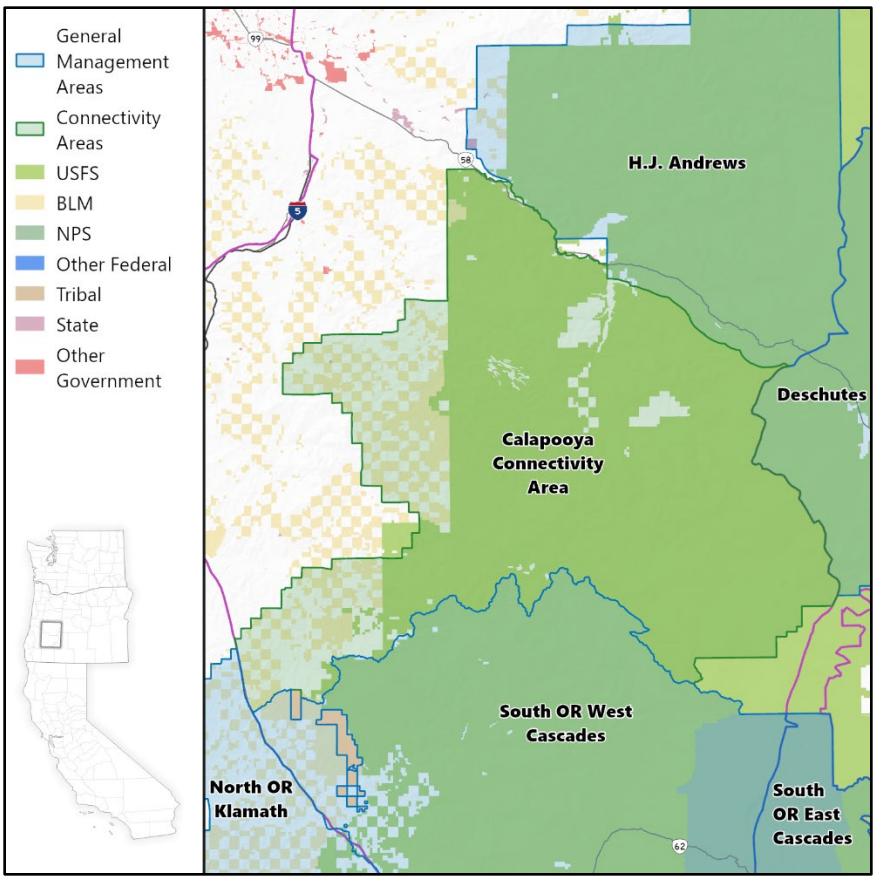
*Priorities:* The following are our recommended priorities for management in the Santiam Connectivity Area. The following are in general priority order; however, local expertise will be important in applying these to specific management area selections.

1. Manage around current and recent occupied spotted owl sites (sites with presence or occupancy of spotted owls in the last five years). This provides a nucleus of spotted owl sites to maintain distribution where it exists across the connectivity area. Where recent survey data are not available, manage around sites that have not undergone significant habitat modification since they were last known to be occupied.
2. Prioritize spotted owl site management, or place small management blocks, to include clusters of sites with good current demographic parameters (e.g., higher survival, occupancy, reproductive output, etc.) relative to others in the Connectivity Area.
3. Select management areas to facilitate connectivity, both within the Connectivity Area and between the Mount Hood West and H.J. Andrews GMAs, via landscapes that can support dispersal. In particular, facilitate connectivity between close management areas, with

management distributed across the Connectivity Area to make steppingstones for generational dispersal between neighboring GMAs.

4. Select clusters of spotted owl sites or place small blocks in areas with the highest acreage of high-quality spotted owl habitat, for example, as measured by relative habitat suitability. These are likely to be areas with the highest per-area carrying capacity for spotted owls, which can be measured using a habitat-based calculation of the estimated maximum population of territorial spotted owls without barred owl presence.
5. Place management areas to minimize the cost of management. Select areas where drivable roads are available and accessible (including access rights and weather conditions) during the period when management is needed. Where roads are not available, trails may be used, but avoid areas lacking in roads and trails. Select areas where existing monitoring will meet some of the monitoring needs associated with barred owl management.
6. Include known spotted owl sites with indicators of high site quality, as determined during evaluations of current and historical spotted owl sites. These indicators may include, for example, especially good habitat amount, quality, and configuration; a history of good past demographic performance; or a history of long-term occupancy. These are areas that have been shown by past use to be attractive to spotted owls and therefore more likely to be reoccupied, especially as spotted owl populations increase.
7. Include lands of interested and willing landowners or land managers. A focus on areas where landowners have expressed interest in barred owl management will speed the implementation of actual barred owl management and encourage involvement. Focus first on areas where funding is available.
8. Other factors being equal, preferentially select management areas where spotted owl habitat has higher projected climate change resilience. This may include indications of higher microclimate stability, lower fire risk, lower risk of tree mortality due to drought, lower likelihood of vegetation shifts away from forest types supporting spotted owl habitat conditions, or other factors.
9. Consider the presence of areas already designated for spotted owl habitat management or compatible conservation purposes, such as Late Successional Reserves, Congressionally reserved areas, proposed Habitat Conservation Areas, designated critical habitat, and areas identified as high priorities in the Northern Spotted Owl Recovery Plan and final Critical Habitat rule. Including these areas provides support for spotted owls and limits impacts on other resources. Because many of these have been managed for older forest over the last decades, these are the likely locations of some of the best habitat conditions.

*A4.6.B.3.b Calapooya Connectivity Area – Priority D*




The Calapooya Connectivity Area is located in the south-central portion of the Western Oregon Cascades Province, and spans the province from west to east. It is situated between the H.J. Andrews and South Oregon West Cascades GMAs, and borders the North Oregon Klamath GMA to the southwest and the Deschutes GMA to the northeast. It includes approximately 1,007,160 acres in total, of which 986,011 acres (98 percent) are forest lands and 447,161 acres (44 percent) provide spotted owl nesting and roosting habitat. Forest lands in this Connectivity Area are 85 percent Federal lands, including portions of the Willamette and Umpqua National Forests, and BLM lands associated with the Northwest Oregon and Roseburg Districts. The remaining forest lands are on adjacent and interspersed areas of private ownership.

The Calapooya Connectivity Area was mapped for the following reasons:

This Connectivity Area includes a large expanse of public lands with high spotted owl habitat density.

- The area lies between the H.J. Andrews and South Oregon West GMAs to the north and south, respectively, and between the North Oregon Klamath GMA to the west and the Deschutes GMA to the east, respectively. It is intended to facilitate connectivity between all of these areas.

This Connectivity Area is assigned Priority D. In the short term, management within this Connectivity Area is primarily intended to preserve the distribution of spotted owls where they are currently present. Site management around current and recent sites (sites with detections within the last 5 years) remains a Priority A action, and site management to protect sites with known occupancy during the last ten years remains a Priority C action. Additional management within this Connectivity Area beyond site management could improve demographic connectivity between populations of spotted owls in larger management areas across three provinces. While this connectivity is likely to be important in the long term, it is likely to have its greatest value later in time, after populations within the neighboring GMAs have begun to recover.

*Description of the elements considered in mapping:* In mapping the boundaries of the Calapooya Connectivity Area we used information on the following elements.

*Spotted Owl Data:*

- While recent survey data is not uniformly available, this area contains current, recent, and historical spotted owl activity centers.
- We included concentrations of spotted owl habitat and excluded areas to the west where both Federal lands and spotted owl habitat become more sparsely distributed.
- We excluded an area along the western boundary where spotted owl habitat was lost to the 2020 Archie Creek Fire. We did not try to exclude all areas where habitat has been lost to wildfire. This can be considered during development of the management area boundaries.

*Conditions:*

- Although we did exclude portions of the Mt. Bailey Roadless Area and the Mount Thielsen Wilderness, we did not try to exclude all inventoried roadless areas or wilderness areas, where road and trail access may be lacking, but these factors should be considered during development of FMA boundaries.

*Other Considerations:*

- The western part of this Connectivity Area includes some areas of BLM checkerboard and private lands with lower densities of spotted owl habitat. These areas were included in order to reduce the edge-to-area ratio of the Connectivity Area, making it possible to create management areas with low edge-to-area ratios (see below). These areas also buffer the areas of spotted owl habitat, providing for the possibility of removing barred owls that would otherwise move into areas of spotted owl habitat where barred owls have been removed.

*Management within the Connectivity Area.*

In the Calapooya Connectivity Area, the short-term focus for management is to identify remaining occupied spotted owl sites and conduct barred owl management to protect these remaining sites. Longer term, focus on creating smaller blocks of habitat allowing for spotted owl populations to connect across this area and reducing overall barred owl population density to support spotted owl demographic connections across this area.

Initially, we recommend conducting surveys of historical spotted owl sites, and areas with high-quality spotted owl habitat without historical spotted owl data. If occupied spotted owl sites are found, manage all these sites using the spotted owl site management described above, with at least 11,581 acres (2 home range radii), and preferably larger.

In the longer term, we recommend developing barred owl management areas around the occupied and historical spotted owl sites, with a focus on scattered small blocks across the entire Connectivity Area to provide for connectivity. In addition, general barred owl removal in this area, designed to reduce barred owl densities, may provide opportunities for successful dispersal

of spotted owls. This is not anticipated to be as intense or continuous at that within management blocks.

Coordinate the locations of barred owl management within the Connectivity Area with any other barred owl management activity in surrounding areas. This may include FMAs within the four neighboring GMAs, as well any site management areas near the Connectivity Area.

*Priorities:* The following are our recommended priorities for management in the Calapooya Connectivity Area. The following are in general priority order; however, local expertise will be important in applying these to specific management area selections.

1. Manage around current and recent occupied spotted owl sites (sites with presence or occupancy of spotted owls in the last five years). This provides a nucleus of spotted owl sites to maintain distribution where it exists across the connectivity area. Where recent survey data are not available, manage around spotted owl sites that have not undergone significant habitat modification since they were last known to be occupied.
2. Prioritize spotted owl site management, or place small management blocks, to include clusters of sites with good current demographic parameters (e.g., higher survival, occupancy, reproductive output, etc.) relative to others in the Connectivity Area.
3. Select management areas to facilitate connectivity, both within the Connectivity Area and between the H.J. Andrews, South Oregon West Cascades, North Oregon Klamath, and Deschutes GMAs, via landscapes that can support dispersal. In particular, facilitate connectivity between close management areas, with management distributed across the Connectivity Area to make steppingstones for generational dispersal between neighboring GMAs.
4. Select clusters of spotted owl sites or place small blocks in areas with the highest acreage of high-quality spotted owl habitat, for example, as measured by relative habitat suitability. These are likely to be areas with the highest per-area carrying capacity for spotted owls, which can be measured using a habitat-based calculation of the estimated maximum population of territorial spotted owls without barred owl presence.
5. Place management areas to minimize the cost of management. Select areas where drivable roads are available and accessible (including access rights and weather conditions) during the period when management is needed. Where roads are not available, trails may be used, but avoid areas lacking in roads and trails. Select areas where existing monitoring will meet some of the monitoring needs associated with barred owl management.
6. Include known spotted owl sites with indicators of high site quality, as determined during evaluations of current and historical sites. These indicators may include, for example, especially good habitat amount, quality, and configuration; a history of good past demographic performance; or a history of long-term occupancy. These are areas that have been shown by past use to be attractive to spotted owls and therefore more likely to be reoccupied, especially as spotted owl populations increase.
7. Include lands of interested and willing landowners or land managers. A focus on areas where landowners have expressed interest in barred owl management will speed the implementation

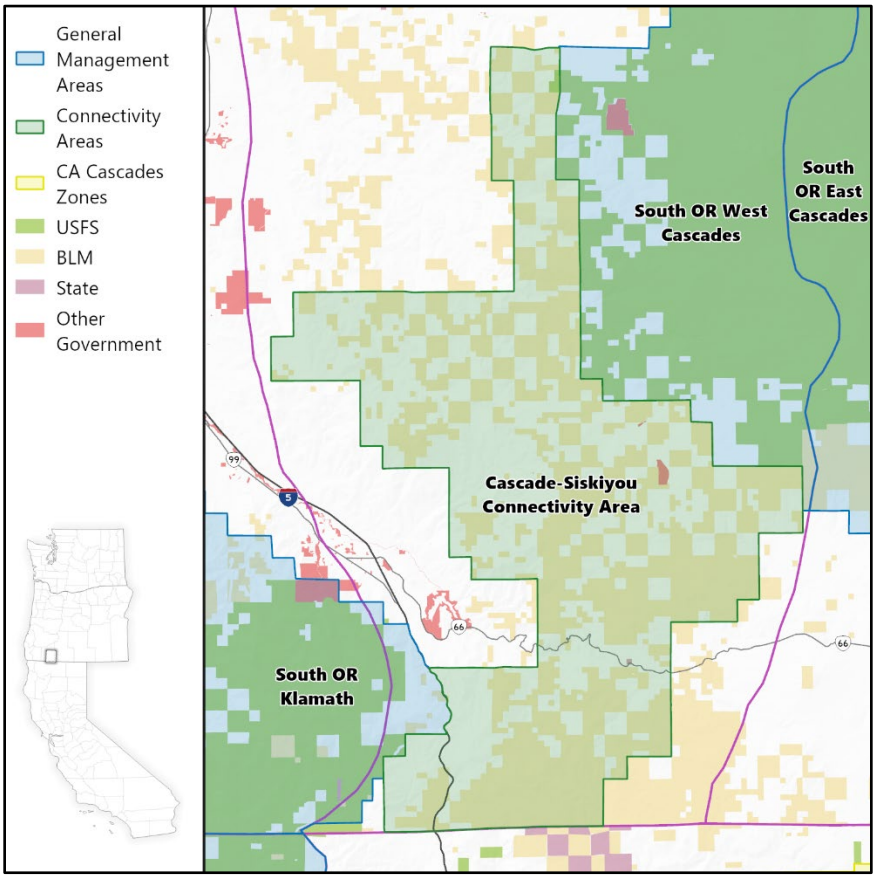
of actual barred owl management and encourage involvement. Focus first on areas where funding is available.

8. Other factors being equal, preferentially select management areas where spotted owl habitat has higher projected climate change resilience. This may include indications of higher microclimate stability, lower fire risk, lower risk of tree mortality due to drought, lower likelihood of vegetation shifts away from forest types supporting spotted owl habitat conditions, or other factors.

9. Consider the presence of areas already designated for spotted owl habitat management or compatible conservation purposes, such as Late Successional Reserves, Congressionally reserved areas, designated critical habitat, and areas identified as high priorities in the Northern Spotted Owl Recovery Plan and final Critical Habitat rule. Including these areas provides support for spotted owls and limits impacts on other resources. Because many of these have been managed for older forest over the last decades, these are the likely locations of some of the best habitat conditions.

*A4.6.B.3.c Cascade-Siskiyou Connectivity Area - Priority D*

The Cascade-Siskiyou Connectivity Area is located in the southernmost portion of the Western Oregon Cascades Province and spans the province from west to east. It is situated between the South Oregon West Cascades and the South Oregon Klamath GMAs. It includes approximately 210,772 acres in total, of which 196,943 acres (93 percent) are forest lands and 48,020 acres (23 percent) provide spotted owl nesting and roosting habitat. The Connectivity Area includes mainly BLM lands within the Cascade-Siskiyou National Monument, as well as other BLM lands associated with the Medford District, and adjacent and interspersed areas of private lands. It also includes a very small area of the Rogue River-



Siskiyou National Forest, as well as a county park. Forest lands in this Connectivity Area are 70 percent Federal lands, with the remainder primarily in private ownership.

The Cascade-Siskiyou Connectivity Area was mapped for the following reasons:

- This Connectivity Area provides another avenue for connectivity between the Western Oregon Cascades and Oregon Klamath Provinces.
- The Connectivity Area is located near, but not quite bordering, both the South Oregon East Cascades and the North California Klamath GMAs, and is close to spotted owl habitat within the California Cascades Province. Thus, management here may facilitate demographic connections across five provinces: Eastern and Western Oregon Cascades, Oregon and California Klamath, and California Cascades.

This Connectivity Area is assigned Priority D. In the short term, management within this Connectivity Area is primarily intended to preserve the distribution of spotted owls where they are currently present. Site management around current sites (sites with detections within the last year) and recent sites (sites with detections within the last five years) remain Priority A and B actions, respectively, and site management to protect historical sites with known occupancy during the last ten years remains a Priority C action. Additional management within this Connectivity Area beyond site management could improve demographic connectivity between populations of spotted owls across five provinces. While this connectivity is likely to be important in the long term, it is likely to have its greatest value later in time, after populations within the neighboring GMAs have begun to recover.

*Description of the elements considered in mapping:* In mapping the boundaries of the Calapooya Connectivity Area we used information on the following elements.

*Spotted Owl Data:*

- This area contains current, recent, and historical spotted owl activity centers.
- We included most concentrations of spotted owl habitat to the south and west of the South Oregon West Cascades GMA, and excluded most areas with little or no habitat, while maintaining a reasonably low edge-to-area ratio.

*Conditions:*

- We considered the availability of access via roads and trails in most of this area. This Connectivity Area includes some areas where access may be difficult, such as wilderness areas, although these are not extensive in this Connectivity Area. Accessibility can be considered during development of the management area boundaries.

*Other Considerations:*

- Portions of this Connectivity Area include some areas with lower densities of spotted owl habitat. These areas were included in order to reduce the edge-to-area ratio of the Connectivity Area, making it possible to create management areas with low edge-to-area ratios (see below). These areas also buffer the areas of spotted owl habitat, providing for the possibility of removing barred owls that would otherwise move into areas of spotted

owl habitat where barred owls have been removed, and in some cases may support spotted owl dispersal across the Connectivity Area.

*Management within the Connectivity Area.*

In the Cascade-Siskiyou Connectivity Area, the short-term focus for management is to identify remaining occupied spotted owl sites and conduct barred owl management to protect these remaining sites. Longer term, focus on creating smaller blocks of habitat allowing for spotted owl populations to connect across this area and reducing overall barred owl population density to support spotted owl demographic connections across this area.

Initially, we recommend conducting surveys of historical spotted owl sites, and areas with high-quality spotted owl habitat without historical spotted owl data. If occupied sites are found, manage all these sites using the site management described above, with at least 11,581 acres (2 home range radii), and preferably larger.

In the longer term, we recommend developing barred owl management areas around the occupied and historical spotted owl sites, with a focus on scattered small blocks across the entire Connectivity Area to provide for connectivity. In addition, general barred owl removal in this area, designed to reduce barred owl densities, may provide opportunities for successful dispersal of spotted owls. This is not anticipated to be as intense or continuous at that within management blocks.

Coordinate the locations of barred owl management within the Connectivity Area with any other barred owl management activity in surrounding areas. This may include FMAs within the South Oregon West Cascades and South Oregon Klamath GMAs, which are directly adjacent; FMAs within the South Oregon East Cascades and North California Klamath GMAs, which are very close to the Connectivity area; any site management areas near the Connectivity Area; and any other barred owl management occurring in the northernmost part of the California Cascades Province.

*Priorities:* The following are our recommended priorities for management in the Cascade-Siskiyou Connectivity Area. The following are in general priority order; however, local expertise will be important in applying these to specific management area selections.

1. Manage around current and recent occupied spotted owl sites (sites with presence or occupancy of spotted owls in the last five years). This provides a nucleus of spotted owl sites to maintain distribution where it exists across the connectivity area. Where recent survey data are not available, manage around sites that have not undergone significant habitat modification since they were last known to be occupied.
2. Prioritize spotted owl site management, or place small management blocks, to include clusters of sites with good current demographic parameters (e.g., higher survival, occupancy, reproductive output, etc.) relative to others in the Connectivity Area.
3. Select management areas to facilitate connectivity, both within the Connectivity Area and between the South Oregon West Cascades, South Oregon Klamath, and to a lesser extent, South Oregon East Cascades, and North California Klamath GMAs, via landscapes that can

support dispersal. In particular, facilitate connectivity between close management areas, with management distributed across the Connectivity Area to make steppingstones for generational dispersal between neighboring GMAs.

4. Select clusters of spotted owl sites or place small blocks in areas with the highest acreage of high-quality spotted owl habitat, for example, as measured by relative habitat suitability. These are likely to be areas with the highest per-area carrying capacity for spotted owls, which can be measured using a habitat-based calculation of the estimated maximum population of territorial spotted owls without barred owl presence.

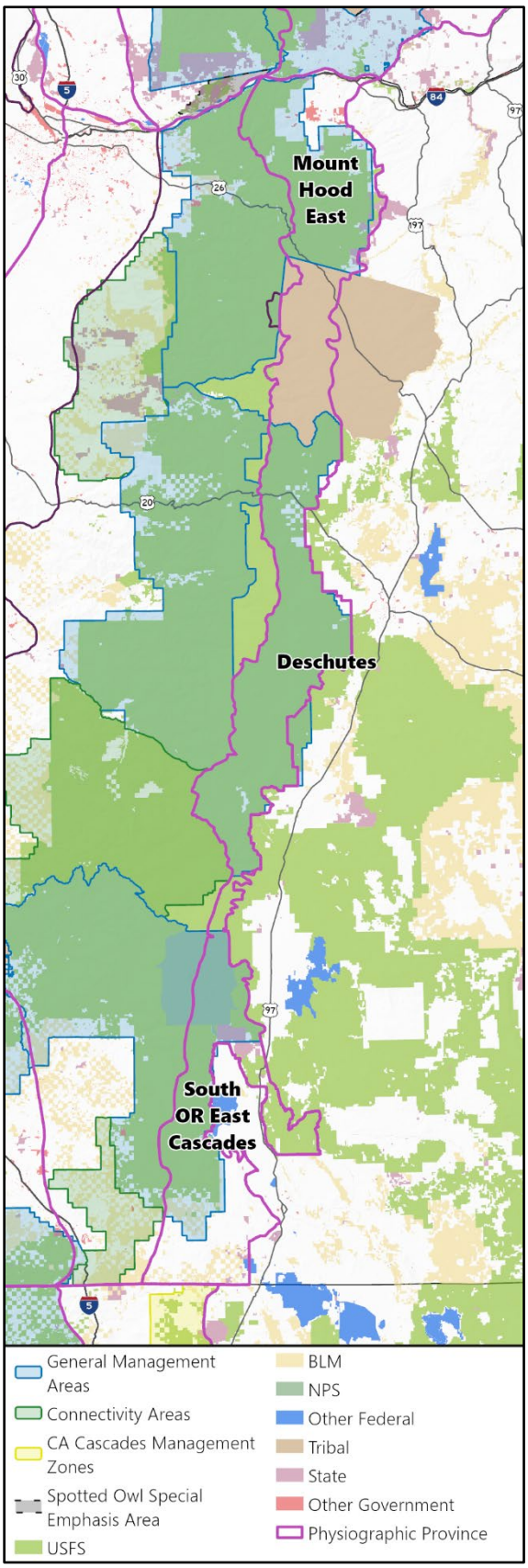
5. Place management areas to minimize the cost of management. Select areas where drivable roads are available and accessible (including access rights and weather conditions) during the period when management is needed. Where roads are not available, trails may be used, but avoid areas lacking in roads and trails. Select areas where existing monitoring will meet some of the monitoring needs associated with barred owl management.

6. Include known spotted owl sites with indicators of high site quality, as determined during evaluations of current and historical sites. These indicators may include, for example, especially good habitat amount, quality, and configuration; a history of good past demographic performance; or a history of long-term occupancy. These are areas that have been shown by past use to be attractive to spotted owls and therefore more likely to be reoccupied, especially as spotted owl populations increase.

7. Include lands of interested and willing landowners or land managers. A focus on areas where landowners have expressed interest in barred owl management will speed the implementation of actual barred owl management and encourage involvement. Focus first on areas where funding is available.

8. Other factors being equal, preferentially select management areas where spotted owl habitat has higher projected climate change resilience. This may include indications of higher microclimate stability, lower fire risk, lower risk of tree mortality due to drought, lower likelihood of vegetation shifts away from forest types supporting spotted owl habitat conditions, or other factors.

9. Consider the presence of areas already designated for spotted owl habitat management or compatible conservation purposes, such as Late Successional Reserves, Congressionally reserved areas, designated critical habitat, and areas identified as high priorities in the Northern Spotted Owl Recovery Plan and final Critical Habitat rule. Including these areas provides support for spotted owls and limits impacts on other resources. Because many of these have been managed for older forest over the last decades, these are the likely locations of some of the best habitat conditions.




# A4.7 Eastern Oregon Cascades Province

## A4.7.A Background

The Eastern Oregon Cascades Province is one of five physiographic provinces in Oregon. In this province, forest lands are 69 percent Federal lands (Forest Service, National Park Service, and BLM), 12 percent Tribal lands, and 2 percent State lands, with the remainder mainly in private ownership. The Eastern Oregon Cascades have a dry climate, with cold winters and warm summers.

### A4.7.A.1 Spotted Owl Condition in the Eastern Oregon Cascades Province

Federal lands in the province include approximately 264,509 acres of spotted owl nesting and roosting habitat. Spotted owl habitat is located in a relatively narrow elevation band where suitable climate and soil conditions support appropriate forest types. Volcanic soils and lava flows influence the distribution of spotted owl habitat in this province. Wildfires and insect outbreaks have also affected the amount and distribution of habitat in this province.

Flying squirrels are the primary prey species in most of the Eastern Oregon Cascades, but woodrats are also very important and may be the primary prey species in some locations, especially where the range of the dusky-footed woodrat overlaps the province in the south. Snowshoe hares and voles in the *Microtus* genus are also important prey species locally or at specific times (Cutler and Hays 1991, p. 67; Forsman et al. 1984, pp. 40-45; Forsman et al. 2004, p. 219).

The Eastern Oregon Cascades Province includes a portion of the South Cascades Demography Study Area, so we use data from this study area to represent the status of spotted owls in the province. This study area may not be fully

representative of the province, but no other study area is active in the province, so it provides the most relevant information.

The South Cascades study area provides data on spotted owl populations since 1991. Monitoring efforts indicate that spotted owl occupancy at historical territories has declined substantially. The spotted owl population within the South Cascades study area declined by nearly 5 percent per year from 1995 through 2017 (Franklin et al. 2021, pp. 11-13). Spotted owl pair occupancy on sites within the South Cascades study area dropped from 70 percent in 1993 to 23 percent in 2018 (Davis et al. 2022, p. 37). Comprehensive call- playback surveys in 2022 detected spotted owls at 17 percent of historical spotted owl sites, including pairs at 11 percent of historical sites (Dugger et al. 2023, p. 5). The 2022 data are not comparable to the 2018 data because they have not been corrected for imperfect detection. Spotted owls were detected via passive acoustic monitoring at 34 percent of sample units (hexagons) in 2021 and at 27 percent in 2022 (Lesmeister et al. 2023, p. 17), but these results are not comparable to the 2018 pair occupancy results or the 2022 call-playback results, because they were obtained using different methods.

This study area is located in the southern portion of the province, and we assume that spotted owl condition in this province may follow a gradient, with smaller numbers and worse demographic conditions in the north and better conditions in the south. Therefore, use of the South Cascades study area to represent conditions throughout the province may provide a more optimistic view than is truly warranted.

#### A4.7.A.2 Barred Owl Condition in the Eastern Oregon Cascades Province

Barred owls may be present at lower densities in the Eastern Oregon Cascades Province than in many other parts of the northern spotted owl range. We expect that this may vary, with higher densities in the north, and lower densities in the south, due to the longer time since the initial invasion in the north, as well as more mesic conditions in the north. However, we lack barred owl data from the northern and central portions of the province. In the South Cascades Demography Study Area in 2022, barred owls were present in 42 percent of spotted owl home ranges (Dugger et al. 2023, p. 8), the second lowest proportion found at any study area throughout the northern spotted owl range.

## A4.7.B Management Strategy

### A4.7.B.1 Spotted Owl Site Management in the Eastern Oregon Cascades Province

*A4.7.B.1.a Background*

Given the limited number of spotted owls in this province, it is crucial to protect the remaining spotted owls through barred owl management at spotted owl sites. Because some areas have not been surveyed consistently in recent years, we recommend surveys of historically active sites, particularly those that have been active within the last 10 years and have not undergone major habitat loss since the last known spotted owl activity.

In some cases, managed sites may eventually be incorporated into block management areas. In other cases, site management of single sites or clusters of sites may be an appropriate long-term action, if larger blocks of spotted owl habitat are not available for management due to landscape

or ownership conditions, or in areas where site management promotes connectivity between block management areas.

- Managing barred owls in recently occupied spotted owl sites is intended to help reduce the rate of spotted owl population decline as quickly as possible and prevent extinction/extirpation of the spotted owl in the province.
- Where spotted owl site management occurs within a GMA, these spotted owl sites may serve as key points for the development of focal management areas, now and in the future. Site management may be expanded into block management over time.
- Barred owl management in spotted owl sites may serve to increase connectivity between and within block management areas. If so, this connectivity may prevent genetic bottlenecks or reductions in genetic diversity.
- Managing barred owls in spotted owl sites that are, or become, reproductively active, may enable those sites to provide a source of young for colonization of nearby management blocks. These sites may interact demographically with nearby management blocks.
- Managing barred owls in spotted owl sites distributed across the province, whether within block management areas or not, may reduce the risk of loss of spotted owls in the province from catastrophic events, such as wildfire, by maintaining spotted owl site occupancy across the area. Managing spotted owl sites also provides the opportunity for maintaining spotted owls in areas where block management is not feasible or recommended. This approach applies across the entire province, whether or not the locations are within a GMA.
- Where sites are not currently occupied, site management will provide areas for recolonization by young produced in nearby management blocks, boosting population growth.

*Selection of spotted owl sites for management*

The number of occupied spotted owl sites is very limited in this province. The primary focus of spotted owl site management in this province is on sites that have been occupied by, or had detections of, spotted owls in the last five years. These areas are more likely to have spotted owls present, or be recolonized by spotted owls after barred owl removal. This is reflected in the priorities for site management.

*Spotted Owl Site Management Priorities*

| Priority | Spotted Owl Site Condition |
|---|---|
| A | Currently and recently active sites, including all areas with any spotted owl detections within the last 5 years |
| C | Historically occupied spotted owl sites (pair or single) with last detection more than 10 years ago |
| D | Potential sites with adequate habitat but no known history of spotted owl occupancy, and without detections within the last 5 years |

*Other considerations for selection of spotted owl sites for management:*

We recommend consideration of the following factors when selecting among sites within a priority category.

- Select sites with the most recent spotted owl detections.
- Focus first on known territorial spotted owl pairs or singles, then on other detections.
- Where relevant information is available, select sites with the best recent demographic performance (for example, select the sites where the largest numbers of young have fledged).
- Consider the history of spotted owl use at the site. Where historical survey information is available, focus first on sites with a steady recent history of occupancy, and next on historical sites with a long history of pair occupancy, including reproduction.
- Prioritize areas with known recent spotted owl occupancy over areas without recent surveys, but prioritize areas without recent surveys over areas that were recently surveyed without any recent spotted owl detections.
- Consider the condition of habitat in the area, particularly loss of habitat since the last surveys. All other things being equal, select sites with abundant high-quality habitat. Spotted owl sites that have lost substantial amounts of habitat to fire, harvest, insect damage, or other disturbances may be lower priority.
- Choose sites within GMAs, near GMAs, or creating steppingstone connectivity between GMAs.
- Where possible, choose sites with lower risk of habitat disturbance, for example, areas with lower fire risk.

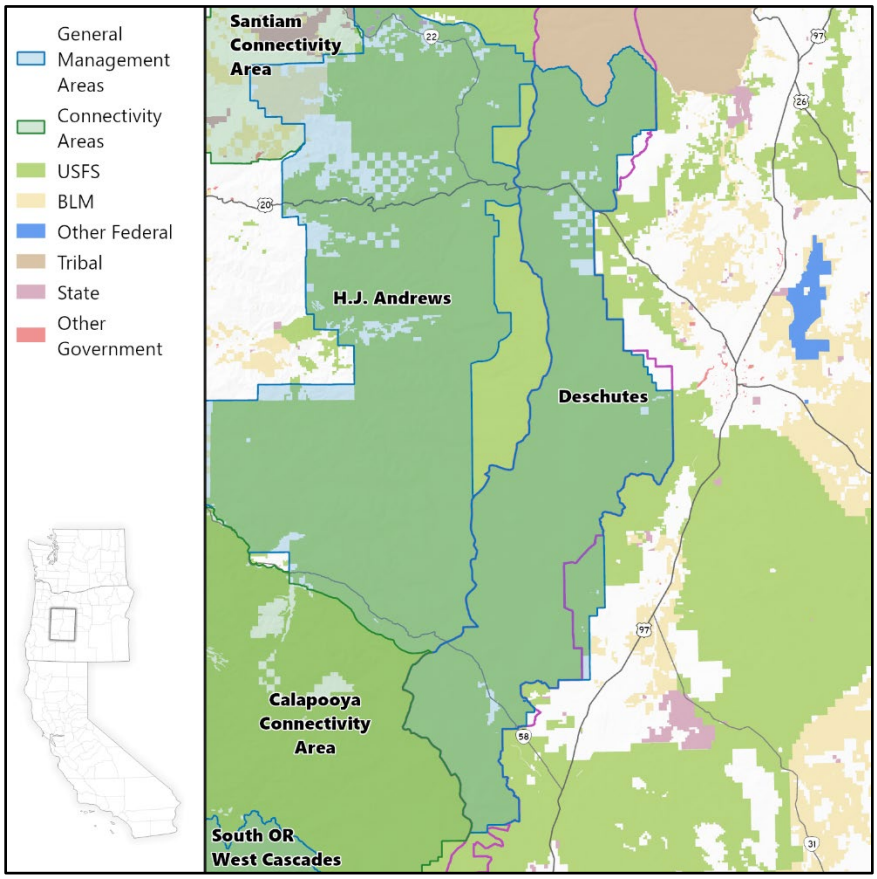
*A4.7.B.1.b Management Recommendations*

Within each individual site, remove barred owls from an area between 6,514 and 11,581 acres. This represents the area in a circle of 1.5 and 2 home range radii (Table 2). This can be distributed in a circle around the activity center, or implementers can use local knowledge, topography, and habitat condition to design a non-circular area of the appropriate size that provides the best conditions for barred owl management.

In areas where spotted owl sites and clusters of sites are isolated, and particularly for sites in Priority A condition (see table above), we recommend a larger management area, up to 26,058 acres (3 home range radii). In particular, these larger management buffers would be appropriate in portions of the Deschutes GMA where connectivity is lacking and on the Ya Whee Plateau. There may be additional areas, especially outside of GMAs, where larger buffers are appropriate, or may become appropriate in the future following habitat losses due to wildfire, insect damage, drought mortality, or other factors. Where possible, applying site management to clusters of two or more sites in close proximity is likely to provide more efficient management conditions and increased benefits for spotted owls present in those sites.

## A4.7.B.2 General Management Areas in the Eastern Oregon Cascades Province

*A4.7.B.2.a Deschutes GMA – Priority A*




The Deschutes GMA is located in the central portion of the Eastern Oregon Cascades Province, spans the province from west to east, and includes a small adjacent area immediately to the east outside of the range of the northern spotted owl. It includes approximately 822,580 acres in total, of which 683,833 acres (83 percent) are forest lands and 50,085 acres (6 percent) provide spotted owl nesting and roosting habitat. Another 187,672 acres (23 percent) provide marginal spotted owl habitat. The GMA generally coincides with the portion of the Deschutes National Forest that is within the range of the northern spotted owl. Overall, forest lands within the GMA are 98 percent Federal lands (Forest Service), with the remainder primarily in private ownership.

This GMA was mapped for the following reasons:

- It encompasses the central portion of the spotted owl range within this province.
- The Deschutes National Forest has a relatively consistent history of surveys for spotted owls, which shows that spotted owls remain present in some areas but are not detected at many historical sites.
- Although we lack demographic information for the GMA, we expect that, like other dry portions of the northern spotted owl range, there is a potential for high fecundity here if the negative influence of barred owls can be reduced.

This GMA is assigned Priority A. Spotted owl populations in this GMA are small and reduced from their historical size, not only by barred owl competition but also by habitat loss due fire, insect damage, and other forest disturbances. Barred owl removal, if implemented immediately, would reduce further impacts from barred owl competition to spotted owls already stressed by habitat loss. This, in turn, could slow population declines and stabilize the population, preventing extirpation. Although the spotted owl population here is small, and the remaining distribution of

spotted owls in the province is not fully known, it appears that this GMA may include the largest number of remaining spotted owls, and is therefore the best positioned to prevent province-wide extirpation. Placing block management areas to encompass fire refugia (including areas identified as likely to burn at low severity), or other areas identified as having greater forest resilience, may be especially beneficial in that it will allow spotted owls to access areas likely to maintain good habitat conditions over the long term. The landscape is relatively well-surveyed and accessible, which allows for relatively rapid implementation of barred owl management.

*Description of the elements considered in mapping:* In mapping the boundaries of the Deschutes GMA we used information on the following elements.

*Spotted Owl Data:*

- This area contains current, recent, and historical spotted owl activity centers.
- We included areas of potential connectivity to management blocks in the Western Oregon Cascades Province, where habitat to support spotted owl dispersal is present up to the Cascades Crest on both the east and west sides.
- The southern boundary of the GMA follows the boundary between the Deschutes and Fremont-Winema National Forests, excluding a segment of the province where the spotted owl range is very narrow from west to east, and much of the width does not have soil conditions capable of supporting any type of forest, including forested habitats for spotted or barred owls.

*Conditions:*

- We did not exclude inventoried roadless areas or wilderness areas, where road and trail access may be lacking, but these factors should be considered during development of FMA boundaries.

*Other Considerations:*

- The northern boundary of the GMA follows the boundary of the Warm Springs Reservation.
- We included lands outside of the spotted owl range around Wickiup Reservoir because there is a known concentration of barred owls in the spotted owl range near this reservoir, and the area surrounding the reservoir may be an ongoing source of barred owls entering the spotted owl range.

*Focal Management Areas (FMAs)*

In this GMA, we recommend developing FMAs large enough to support as many spotted owl pair sites as possible. The maximum practicable size of FMAs is likely to be much smaller than 50 pairs in this GMA, so management of small clusters of sites may be more feasible than block management. Generally, larger blocky areas provide a smaller edge-to-area ratio, and this may help reduce the influx of barred owls from outside the FMA in the future, so when large blocks are not practicable, smaller blocks are preferable to scattered sites. If smaller FMAs are

developed due to funding limitations, rather than habitat configuration, design them such that they could be expanded in the future if funding becomes available.

When possible, include multiple FMAs, generally spaced no farther than 12 to 15 miles apart. Where smaller FMAs are developed due to topography, forest condition, access, funding limitations, or other reasons, we recommend these be closer together and multiple areas be designed with the intent of encouraging exchange of spotted owls between these smaller areas.

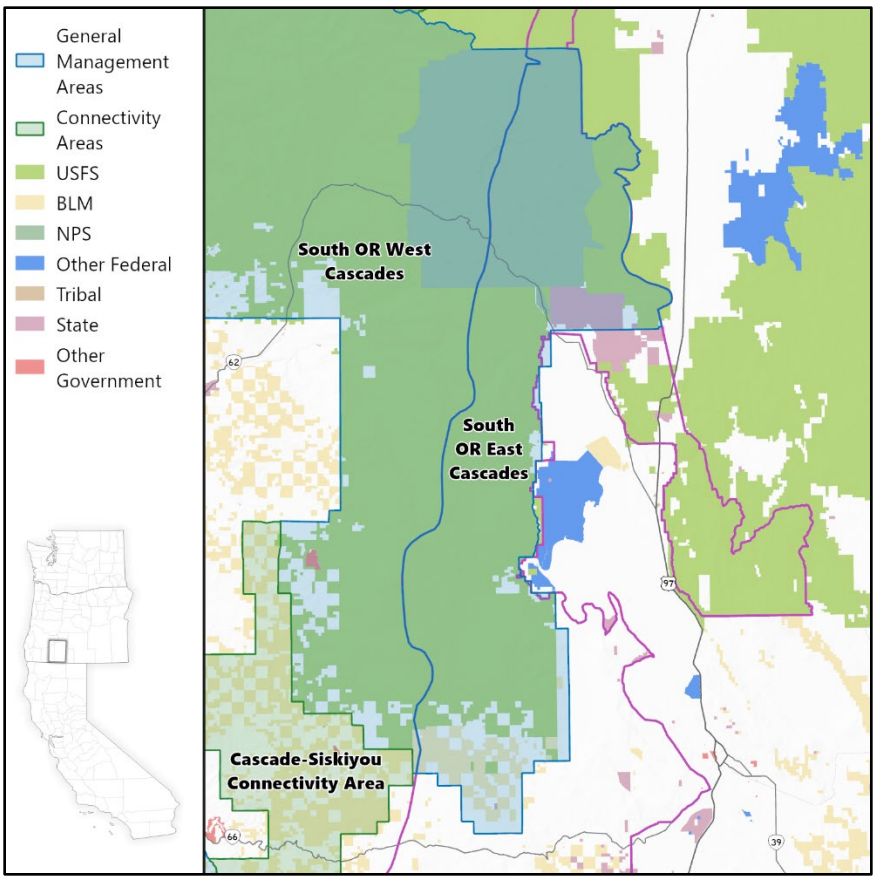
Including recently occupied sites in FMAs provides a starting point for development of spotted owl populations once barred owl populations are reduced. In areas where habitat connectivity is limited, site management may help to provide connectivity between smaller FMAs. Coordinate FMA locations with the site management described above, with FMA locations in the H.J. Andrews GMA, and with barred owl management in the Calapooya Connectivity Area.

*Priorities:* The following are our recommended priorities for defining and selecting FMAs within the Deschutes GMA. The following are in general priority order; however, local expertise will be important in applying these to specific FMA boundary designs.

1. Build FMAs around current and recent occupied spotted owl sites (sites with presence or occupancy of spotted owls in the last five years). This provides a nucleus of spotted owls for the potential recolonization of sites within the FMA as barred owl numbers are reduced.
2. Place blocks to include spotted owl populations, or clusters of sites, with good current demographic parameters (e.g., higher survival, occupancy, reproductive output, etc.) relative to others in the GMA.
3. Place FMAs to minimize the cost of management. For example, select areas where existing monitoring will meet some of the monitoring needs associated with barred owl management. Select areas where drivable roads are available and accessible (including access rights and weather conditions) during the period when management is needed. Where roads are not available, trails may be used, but avoid areas lacking in roads and trails.
4. Select areas with the best spotted owl habitat in terms of acreage or density, and the best quality, as measured by available data (for example, higher proportions of nesting and roosting habitat, or higher relative habitat suitability values). Consider recent fire effects on habitat suitability.
5. Place FMAs to facilitate connectivity between management areas, including management areas in the Western Oregon Cascades Province. Place FMAs in areas allowing for connectivity within the local environment, including habitat connectivity within an FMA, between neighboring FMAs, and/or between an FMA and nearby managed spotted owl sites. The quality or density of dispersal habitat between managed areas may be informative as to the level of connectivity. Consider recent fire effects on connectivity.
6. Other factors being equal, preferentially select FMAs to include spotted owl habitat in areas with cooler, moister microclimates, long-term fire refugia, or other areas where spotted owl habitat has higher projected climate change resilience, rather than focusing mainly on areas where fire suppression has allowed for spotted owl habitat development that will not be sustainable in the long term, often associated with unhealthy true fir (*Abies* spp.) stands.

7. Include known sites with indicators of high site quality, as determined during evaluations of current and historical sites. These indicators may include, for example, especially good habitat amount, quality, and configuration; a history of good past demographic performance; or a history of long-term occupancy. These are areas that have been shown by past use to be attractive to spotted owls and therefore more likely to be reoccupied, especially as spotted owl populations increase.
8. Locate FMAs adjacent to landscapes that are likely to limit barred owl movement into or out of the area, for example, in areas of spotted owl habitat with shrub steppe immediately to the east. Areas of ice and snow, agricultural landscapes, and areas recently burned at high severity may provide smaller-scale limitations to barred owl movement and should also be considered as places to situate FMA boundaries.
9. Consider fire risk in mapping the boundaries of the FMAs. Avoid concentrating FMAs solely in areas identified as having the highest risk of habitat loss to fire; however, some areas with high fire risk may still be important to include in FMAs, particularly where spotted owls are currently present in these areas. Providing connectivity in FMAs from higher risk spotted owl habitat to areas identified as fire refugia and other areas with relatively lower risk will be important in the fire prone landscape of the Eastern Oregon Cascades. Placement of multiple FMAs within the GMA and inclusion of areas with relatively high resistance to uncharacteristic fire could reduce the risk of complete loss.
10. Consider the presence of areas already designated for spotted owl habitat management or compatible conservation purposes, such as Late Successional Reserves, Congressionally reserved areas, designated critical habitat, and areas identified as high priorities in the Northern Spotted Owl Recovery Plan and final Critical Habitat rule. Including these areas provides support for spotted owls and limits impacts on other resources. Because many of these have been managed for older forest over the last decades, these are the likely locations of some of the best habitat conditions.

*A4.7.B.2.b South Oregon East Cascades GMA – Priority A*




The South Oregon East Cascades GMA is located in the southern portion of the Eastern Oregon Cascades Province and spans the province from west to east. It includes approximately 401,337 acres in total, of which 353,120 acres (88 percent) are forest lands and 76,759 acres (19 percent) provide spotted owl nesting and roosting habitat. Another 118,870 acres (30 percent) provide marginal spotted owl habitat. The GMA is primarily made up of Federal lands, including portions of Crater Lake National Park, Fremont-Winema National Forest, and BLM lands associated with the Klamath Falls Field Office of the Lakeview District. Overall, forest lands in the GMA are 87 percent Federal lands (Forest Service, National Park Service, and BLM), 3 percent State lands, and the remainder primarily in private ownership.

This GMA was mapped for the following reasons:

- This area allows for connectivity to the Western Oregon Cascades Province, and from there, to the Oregon Klamath Province and beyond.
- It includes the largest concentrations of spotted owl habitat in the southern portion of the province.
- The GMA includes part of the South Cascades Demography Study Area, with its historical and recent spotted owl data. The Northwest Forest Plan Effectiveness Monitoring program includes passive acoustic monitoring sampling 20 percent of the South Cascades study area. This monitoring program will provide additional future data on both spotted and barred owls, and allow for efficiencies in monitoring barred owl removal and its effects on spotted owls. This portion of the GMA is well known and accessible, allowing for quicker implementation.
- Demographic data from the South Cascades study area, as well as other dry portions of the northern spotted owl range, indicates that spotted owls here have a potential for high fecundity if the negative influence of barred owls can be reduced.

*Description of the elements considered in mapping:* In mapping the boundaries of the South Oregon East Cascades GMA we used information on the following elements.

*Spotted Owl Data:*

- This area contains recent and historical spotted owl activity centers.
- We included all concentrations of spotted owl habitat in the southern portion of the province, starting at the northern boundary of Crater Lake National Park. This includes some areas mapped mainly as marginal habitat, but where local biologists indicated that the habitat in the area comported with local spotted owl habitat usage patterns.
- The GMA includes several areas of potential connectivity to the South Oregon West Cascades GMA, where habitat to support spotted owl dispersal is present up to the Cascades Crest on both the east and west sides.
- The GMA excludes areas of sparse spotted owl habitat to the north and south. In the north, the spotted owl range is very narrow from west to east, and much of the width does not have soil conditions capable of supporting any type of forest, including forested habitats for spotted or barred owls. Spotted owl habitat is extremely sparse in the private lands and BLM checkerboard lands to the south of the GMA. Although rangewide habitat models, such as the ones we used, do not always capture the full spectrum of spotted owl habitat usage in dry forests, we have consulted with local biologists and are confident that the areas to the south are truly lacking in concentrations of adequate habitat.

*Conditions:*

- We did not exclude inventoried roadless areas or wilderness areas, where road and trail access may be lacking, but these factors should be considered during development of FMA boundaries.

*Other Considerations:*

- We included a portion of the Sun Pass State Forest, which is not managed for spotted owl conservation. This portion of Sun Pass State Forest connects two mapped concentrations of spotted owl habitat, one to the northwest mainly on Crater Lake National Park, and the other to the east on Fremont-Winema National Forest. This portion of the State Forest was included to reduce the edge-to-area ratio of the GMA and provide opportunities to remove barred owls that may be present outside of spotted owl habitat, and may otherwise present sources of barred owl influx into spotted owl habitat where barred owls have been removed.
- We did not include concentrations of spotted owl habitat on the Ya Whee Plateau, even though spotted owls have been detected there in recent years, because it is too separated from other areas of the GMA. Instead, we have recommended the use of individual site management with an expanded buffer (3 home range radii, or the equivalent area) in this location (see Spotted Owl Site Management above).
- As discussed above, this GMA includes a portion of the South Cascades study area. This allows for efficiencies in monitoring and opportunities for research. Although the GMA boundaries do not closely follow study area boundaries, the GMA includes nearly all current spotted owl habitat in the study area.

This GMA is assigned Priority A. Spotted owl populations in this GMA appear to be near extirpation. Barred owl removal, if implemented immediately, would reduce the likelihood of spotted owl extirpation in the southern third of the province. The well-studied landscape of the South Cascades study area will allow for rapid implementation of barred owl management to the locations where it can have the most immediate benefit to spotted owls that may still be present.

*Focal Management Areas (FMAs)*

In this GMA, we recommend developing FMAs large enough to support as many spotted owl pair sites as possible, up to 50 pair sites per FMA. Generally, larger blocky areas provide a smaller edge-to-area ratio, and this may help reduce the influx of barred owls from outside the FMA in the future. Due to the configuration of spotted owl habitat in this GMA, however, it may be more practicable to develop long, thin FMAs, even though this configuration does not reduce the edge-to-area ratio. In this case, we still recommend including enough habitat to support as many spotted owl pair sites as possible. If smaller FMAs are developed due to funding limitations, rather than habitat configuration, design them such that they could be expanded in the future if funding becomes available.

When possible, include multiple FMAs, generally spaced no farther than 12 to 15 miles apart. Where smaller areas are developed due to topography, forest condition, access, funding limitations, or other reasons, we recommend these be closer together and multiple areas be designed with the intent of encouraging exchange of spotted owls between these smaller areas.

Including recently occupied sites in FMAs provides a starting point for development of spotted owl populations once barred owl populations are reduced. In areas where habitat connectivity is limited, site management may help to provide connectivity between smaller FMAs. Coordinate FMA locations with the site management described above, with FMAs in the South Oregon West Cascades GMA, and with barred owl management in the Cascade-Siskiyou Connectivity Area and North California Cascades Management Zone. It may be beneficial to develop FMAs that span the boundary between the South Oregon East Cascades and South Oregon West Cascades GMAs. Alternatively, smaller FMAs could be designated on either side of the province boundary, but could effectively function as one spotted owl population.

*Priorities:* The following are our recommended priorities for defining and selecting FMAs within the South Oregon East Cascades GMA. The following are in general priority order; however, local expertise will be important in applying these to specific FMA boundary designs.

1. Build FMAs around current and recent occupied spotted owl sites (sites with presence or occupancy of spotted owls in the last five years). This provides a nucleus of spotted owls for the potential recolonization of sites within the FMA as barred owl numbers are reduced.
2. Place blocks to include spotted owl populations, or clusters of sites, with good current demographic parameters (e.g., higher survival, occupancy, reproductive output, etc.) relative to others in the GMA.
3. Place FMAs to minimize the cost of management. For example, select areas where existing monitoring will meet some of the monitoring needs associated with barred owl management. Select areas where drivable roads are available and accessible (including access rights and

weather conditions) during the period when management is needed. Where roads are not available, trails may be used, but avoid areas lacking in roads and trails.

4. Select areas with the highest carrying capacity for spotted owls. This is a habitat-based calculation of the estimated maximum population of territorial spotted owls without barred owl presence. This may be accomplished by choosing areas with the greatest acreage or density of spotted owl habitat, and the best quality, as measured by available data (for example, higher proportions of nesting and roosting habitat, or higher relative habitat suitability values). Consider recent fire effects on habitat suitability.

5. Place FMAs to facilitate connectivity between management areas, especially management areas in the Western Oregon Cascades Province. Place FMAs in areas allowing for connectivity within the local environment, including habitat connectivity within an FMA, between neighboring FMAs, and/or between an FMA and nearby managed spotted owl sites. The quality or density of dispersal habitat between managed areas may be informative as to the level of connectivity. Consider recent fire effects on connectivity.

6. Other factors being equal, preferentially select FMAs to include spotted owl habitat in areas with cooler, moister microclimates, long-term fire refugia, or other areas where spotted owl habitat has higher projected climate change resilience, rather than focusing mainly on areas where fire suppression has allowed for spotted owl habitat development that will not be sustainable in the long term, often associated with unhealthy true fir stands.

7. Include known sites with indicators of high site quality, as determined during evaluations of current and historical sites. These indicators may include, for example, especially good habitat amount, quality, and configuration; a history of good past demographic performance; or a history of long-term occupancy. These are areas that have been shown by past use to be attractive to spotted owls and therefore more likely to be reoccupied, especially as spotted owl populations increase.

8. Locate FMAs adjacent to landscapes that are likely to limit barred owl movement into or out of the area. Areas of ice and snow, agricultural landscapes, and areas recently burned at high severity may provide limitations to barred owl movement and should also be considered as places to situate FMA boundaries.

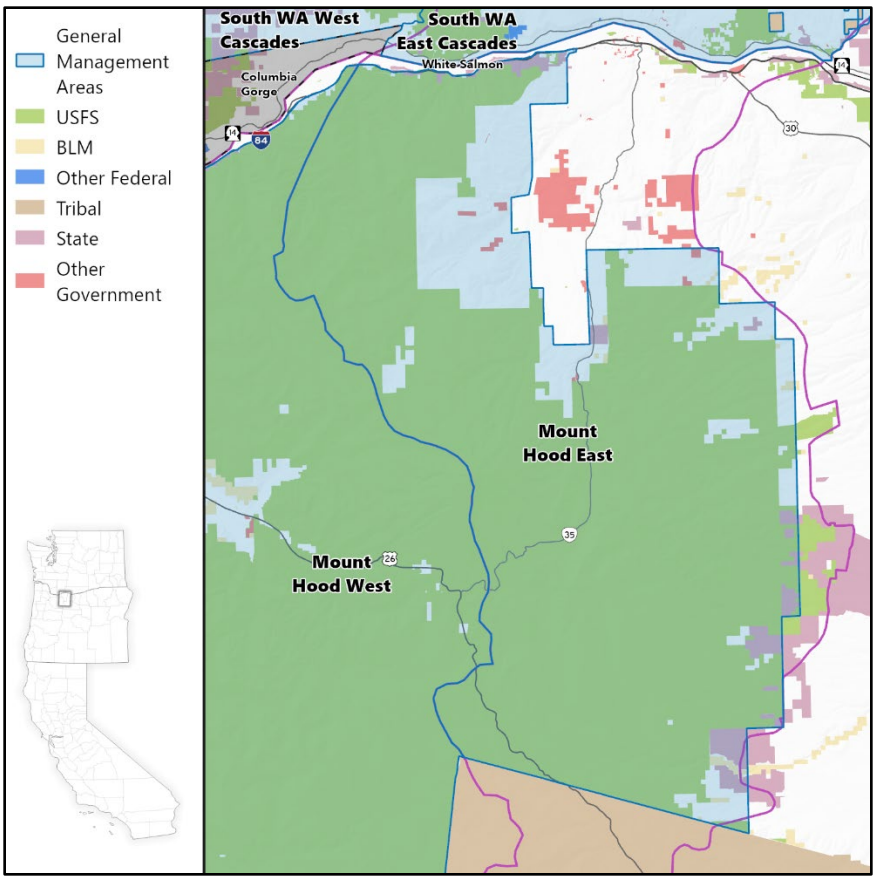
9. Consider fire risk in mapping the boundaries of the FMAs. Avoid concentrating FMAs solely in areas identified as having the highest risk of habitat loss to fire; however, some areas with high fire risk may still be important to include in FMAs, particularly where spotted owls are currently present in these areas. Providing connectivity in FMAs from higher risk spotted owl habitat to areas identified as fire refugia and other areas with relatively lower risk will be important in the fire prone landscape of the Eastern Oregon Cascades. Placement of multiple FMAs within the GMA and inclusion of areas with relatively high resistance to uncharacteristic fire could reduce the risk of complete loss.

10. Consider the presence of areas already prioritized for spotted owl habitat management or compatible conservation purposes, such as Late Successional Reserves, Congressionally reserved areas, designated critical habitat, and areas identified as high priorities in the Northern Spotted Owl Recovery Plan and final Critical Habitat rule. Including these areas provides support for spotted owls and limits impacts on other resources. Because many of

these have been managed for older forest over the last decades, these are the likely locations of some of the best habitat conditions.

11. Include lands of interested and willing landowners or land managers. A focus on areas where landowners have expressed interest in barred owl management will speed the implementation of actual barred owl management and encourage involvement.

*A4.7.B.2.c Mount Hood East GMA – Priority C*




The Mount Hood East GMA is located in the northernmost portion of the Eastern Oregon Cascades Province and spans the province from west to east. It includes approximately 432,972 acres in total, of which 401,858 acres (93 percent) are forest lands and 135,727 acres (31 percent) provide spotted owl nesting and roosting habitat. The GMA is primarily made up of Federal lands on the Mount Hood National Forest, but also includes small parcels of BLM lands associated with the Deschutes Resource Area of the Prineville District. Additionally, the GMA includes small areas of State lands, municipal lands, and private lands. Overall, forest lands in the GMA are 83 percent Federal lands (Forest Service), 2 percent State lands, and the remainder primarily in private ownership.

This GMA was mapped for the following reasons:

- The GMA includes the northern extent of spotted owl distribution in the Eastern Oregon Cascades.
- It includes the largest concentrations of spotted owl habitat in the Eastern Oregon Cascades province. The density of spotted owl habitat is higher here than in other parts of the province.
- This area provides many opportunities for connectivity to the Western Oregon Cascades Province, and the potential for connectivity to the Eastern Washington Cascades Province to the north. Although historical and current patterns of spotted owl dispersal across the Columbia River are not well understood, this GMA is likely in the best location for such dispersal events, due to concentrations of spotted owl habitat on both sides of the river, and places where the expanse of open water is narrower than in many other nearby portions of the river.
- Spotted owl habitat within the GMA appears to be at lower risk of natural disturbances, for example, wildfires, than spotted owl habitat in other areas of the province.
- Although demographic data from this area is not available, we assume that, similar to other dry portions of the northern spotted owl range, spotted owls here have a potential for high fecundity if the negative influence of barred owls can be reduced.

This GMA is assigned Priority C. Due to low survey effort in recent years, the number and distribution of spotted owls within this GMA is not well known. We expect that spotted owls are likely fewer in number in this GMA, relative to areas farther south, due to the longer time since the initial barred owl invasion and more mesic habitat here compared with the rest of the province. Site management around current and recent spotted owl sites, and any others that may be discovered in the future, remains a Priority A action. Additional management within this GMA beyond site management is likely to increase the effectiveness of management and provide opportunities for recolonization. The focus of block management in this GMA is on building beyond current populations, if and where they exist. Block management in this GMA will take more time to plan and implement than block management in GMAs to the south, where the information associated with study areas or other recent survey efforts can speed block management planning and implementation. Therefore, our expectations of FMA management within this GMA fit well with the definition of Priority C actions.

*Description of the elements considered in mapping:* In mapping the boundaries of the Mount Hood East GMA we used information on the following elements.

*Spotted Owl Data:*

- This GMA includes at least one current spotted owl site, as well as historical sites.
- We included most concentrations of spotted owl habitat in the northernmost portion of the province.
- We included areas of potential connectivity to management blocks in the Western Oregon Cascades Province, where habitat to support spotted owl dispersal is present up to the Cascades Crest on both the east and west sides.

*Conditions:*

- We excluded some areas of mapped spotted owl habitat concentrations where they coincided with human population centers.
- We did not exclude inventoried roadless areas or wilderness areas, where road and trail access may be lacking, but these factors should be considered during development of FMA boundaries.

*Other Considerations:*

- The southern boundary of the GMA follows the boundary of the Warm Springs Reservation.
- We included some areas with little spotted owl habitat, especially along the eastern boundary of the GMA, because barred owls are known to be present, and if not managed, these areas may be an ongoing source of barred owls entering the spotted owl range.

*Focal Management Areas (FMAs)*

In this GMA, we recommend developing FMAs large enough to support as many spotted owl pair sites as possible, up to 50 pair sites per FMA. Generally, larger blocky areas provide a

smaller edge-to-area ratio, and this may help reduce the influx of barred owls from outside the FMA in the future. However, where the landscape or forest conditions do not allow this, smaller or more sinuous FMAs, still encompassing multiple pair areas, may be appropriate. If smaller FMAs are developed due to funding limitations, design them such that they could be expanded in the future if funding becomes available.

When possible, include multiple FMAs, generally spaced no farther than 12 to 15 miles apart. Where smaller areas are developed due to topography, forest condition, access, funding limitations, or other reasons, we recommend these be closer together and multiple areas be designed with the intent of encouraging exchange of spotted owls between these smaller areas.

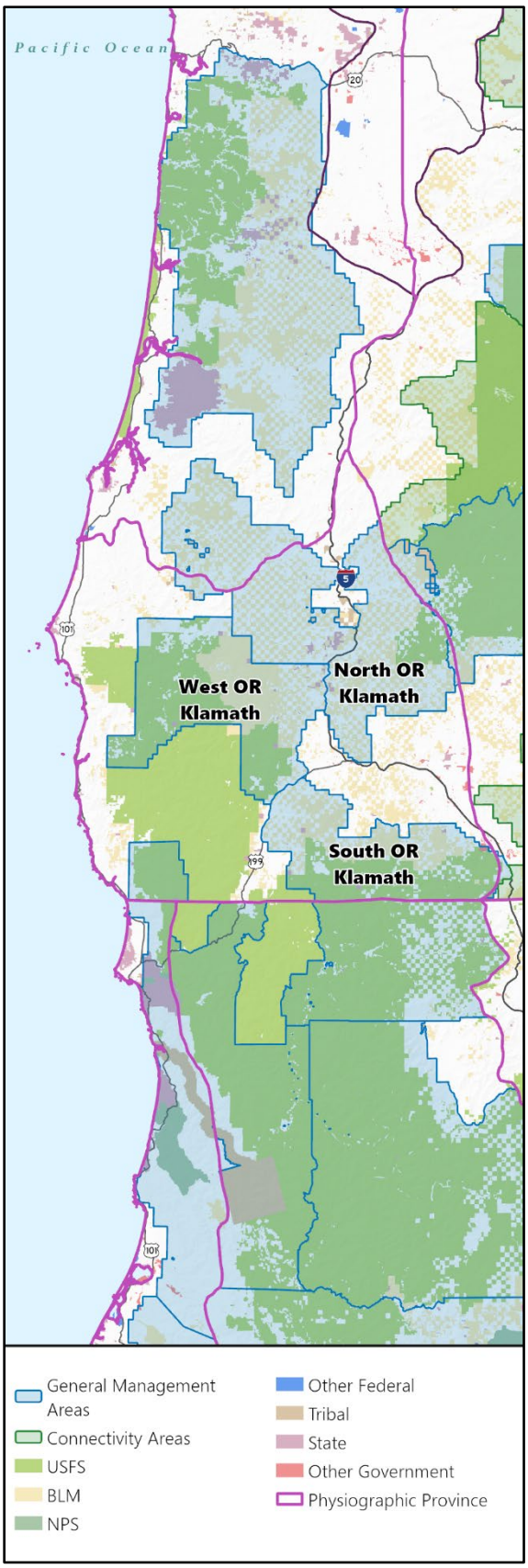
Including recently occupied sites in FMAs provides a starting point for development of spotted owl populations once barred owl populations are reduced. In areas where habitat connectivity is limited, site management may help to provide connectivity between smaller FMAs. Coordinate FMA locations with the site management described above, and with FMAs in adjacent GMAs. It may be beneficial to designate FMAs that span the boundary between the Mount Hood East and Mount Hood West GMAs. Alternatively, smaller FMAs could be designated on either side of the province boundary, but could effectively function as one spotted owl population.

*Priorities:* The following are our recommended priorities for defining and selecting FMAs within the Mount Hood East GMA. The following are in general priority order, however; local expertise will be important in applying these to specific FMA boundary designs.

1. Build FMAs around current and recent occupied spotted owl sites (sites with presence or occupancy of spotted owls in the last five years). This provides a nucleus of spotted owls for the potential recolonization of sites within the FMA as barred owl numbers are reduced.
2. Place blocks to include spotted owl populations, or clusters of sites, with good current demographic parameters (e.g., higher survival, occupancy, reproductive output, etc.) relative to others in the GMA.
3. Place FMAs to minimize the cost of management. For example, select areas where existing monitoring will meet some of the monitoring needs associated with barred owl management. Select areas where drivable roads are available and accessible (including access rights and weather conditions) during the period when management is needed. Where roads are not available, trails may be used, but avoid areas lacking in roads and trails.
4. Select areas with the highest carrying capacity for spotted owls. This is a habitat-based calculation of the estimated maximum population of territorial spotted owls without barred owl presence. This may be accomplished by choosing areas with the greatest acreage or density of spotted owl habitat, and the best quality, as measured by available data (for example, higher proportions of nesting and roosting habitat, or higher relative habitat suitability values). Consider recent fire effects on habitat suitability.
5. Place FMAs to facilitate connectivity between management areas, including management areas in the Western Oregon Cascades and, potentially, the Eastern Washington Cascades Provinces. Place FMAs in areas allowing for connectivity within the local environment, including habitat connectivity within an FMA, between neighboring FMAs, and/or between an FMA and nearby managed spotted owl sites. The quality or density of dispersal habitat

between managed areas may be informative as to the level of connectivity. Consider recent fire effects on connectivity.

6. Other factors being equal, preferentially select FMAs to include spotted owl habitat in areas with cooler, moister microclimates, long-term fire refugia, or other areas where spotted owl habitat has higher projected climate change resilience, rather than areas where fire suppression has allowed for spotted owl habitat development that will not be sustainable in the long term, often associated with unhealthy true fir stands.
7. Include known sites with indicators of high site quality, as determined during evaluations of current and historical sites. These indicators may include, for example, especially good habitat amount, quality, and configuration; a history of good past demographic performance; or a history of long-term occupancy. These are areas that have been shown by past use to be attractive to spotted owls and therefore more likely to be reoccupied, especially as spotted owl populations increase.
8. Locate FMAs adjacent to landscapes that are likely to limit barred owl movement into or out of the area, for example, in areas of spotted owl habitat with shrub steppe immediately to the east. Areas of ice and snow, agricultural landscapes, and areas recently burned at high severity may provide smaller-scale limitations to barred owl movement and should also be considered as places to situate FMA boundaries.
9. Consider fire risk in mapping the boundaries of the FMAs. Avoid concentrating FMAs solely in areas identified as having the highest risk of habitat loss to fire; however, some areas with high fire risk may still be important to include in FMAs, particularly where spotted owls are currently present in these areas. Providing connectivity in FMAs from higher risk spotted owl habitat to areas identified as fire refugia and other areas with relatively lower risk will be important in the fire prone landscape of the Eastern Oregon Cascades. Placement of multiple FMAs within the GMA and inclusion of areas with relatively high resistance to uncharacteristic fire could reduce the risk of complete loss.
10. Consider the presence of areas already prioritized for spotted owl habitat management or compatible conservation purposes, such as Late Successional Reserves, Congressionally reserved areas, designated critical habitat, and areas identified as high priorities in the Northern Spotted Owl Recovery Plan and final Critical Habitat rule. Including these areas provides support for spotted owls and limits impacts on other resources. Because many of these have been managed for older forest over the last decades, these are the likely locations of some of the best habitat conditions.
11. Include lands of interested and willing landowners or land managers. A focus on areas where landowners have expressed interest in barred owl management will speed the implementation of actual barred owl management and encourage involvement.




# A4.8 Oregon Klamath Province

## A4.8.A Background

The Oregon Klamath Province is the southwestern-most of the five physiographic provinces in Oregon within the range of the northern spotted owl. The province predominantly consists of Federal lands, with 58 percent of forest lands managed by the Forest Service and BLM, 1 percent by State agencies, and the remainder mainly in private ownership. Within the Federal lands, BLM checkerboard and large contiguous patches comprise most of the eastern two-thirds and Forest Service occupies the western third of the province as well as the area along the California border. River valleys and parts of central area of province are non-forest. The prevalent mixed conifer forest type and mixed-severity fire have resulted in heterogeneous landscapes.

### A4.8.A.1 Spotted Owl Condition in the Oregon Klamath Province

Federal lands in the province include approximately 980,193 acres of spotted owl nesting and roosting habitat. Some of this habitat may be present as a result of fire suppression, which has allowed mature, closed-canopy forest to develop in areas that historically burned frequently prior to the era of fire suppression. Habitat patches of this type may be at elevated risk of loss to high-severity fire. There has been a series of large fires primarily on Forest Service land in the western part of the province and across the northern section. The repeated fires in the western section have removed spotted owl habitat function from large expanses of this area.

Spotted owls consume a variety of prey in the Oregon Klamath Province. Woodrats (both dusky-footed and bushy-tailed) and flying squirrels provide the majority of biomass consumed. Snowshoe hares, brush rabbits, red tree voles, red-backed voles, and pocket gophers also compose a

substantial portion of the diet in some locations (Forsman et al. 1984, pp. 40-45; Forsman et al. 2004, p. 219; Zabel et al. 1995, pp. 435-436).

The Oregon Klamath Province includes the Klamath Demography Study Area, which provides the most relevant information on spotted owl population status and trends in the province. The Klamath study area provides data on spotted owl populations since 1990. Monitoring efforts indicate that spotted owl occupancy at historical territories has declined substantially. The spotted owl population within the South Cascades study area declined by more than 6 percent per year from 1995 through 2017 (Franklin et al. 2021, pp. 11-13). Spotted owl occupancy on sites within the Klamath study area dropped from 68 percent in 1993 to 20 percent in 2018 (Davis et al. 2022, p. 37). Call-playback surveys of the study area in 2020 detected spotted owls at 13 percent of the surveyed historical sites, including pairs at 6 percent of surveyed sites (Lesmeister et al. 2020, p. 3). The 2020 results are not directly comparable to the 2018 results because they are not corrected for imperfect detection. Demography surveys have been phased out and are being replaced with passive acoustic based monitoring. The proportion of acoustic monitoring sites (hexagons) where spotted owls were detected has varied from 43 percent in 2019 to 53 percent in 2020, with 2021 and 2022 detection rates falling within this range (Lesmeister et al. 2023, p. 17). Again, we note that these data are not directly comparable to those for 2018 or 2020 because they were obtained using different survey methods.

#### A4.8.A.2 Barred Owl Condition in the Oregon Klamath Province

There are no barred owl population size or trend estimates available; however various studies in the province give some relevant information. Barred owl numbers appear to have steadily increased in the province as their apparent southward migration progresses (Franklin et al. 2021, p. 17). Experimental barred owl removal efforts occurred from 2016 through 2018 in the Klamath-Union/Myrtle study area, with the Klamath study area as the control area, where no barred owls were removed. In the Klamath study area, the number of sample units (hexagons surveyed via call-playback) with at least one pair of barred owls present increased from 48 percent in 2016 to 68 percent in 2018 (Wiens et al. 2019, p. 6). In 2019, barred owls were detected (regardless of pair status) via passive acoustic monitoring in 90 percent of the sample units (hexagons) in the Klamath study area, and in 2020 they were detected in 95 percent (Lesmeister et al. 2022a, Table 8). Note that the 2016 through 2018 data are not directly comparable to the 2019-2020 data, due to differences in survey methods and because the earlier data report pair occupancy while the later data report all detections.

## A4.8.B Management Strategy

### A4.8.B.1 Spotted Owl Site Management in the Oregon Klamath Province

*A4.8.B.1.a Background*

Maintaining the existing spotted owl population to the maximum extent possible will provide for greater potential for recruitment and population expansion. Because some areas of this province have not been surveyed consistently in recent years, we recommend surveys of historically active sites, particularly those that have been active within the last 10 years and have not undergone major habitat loss since the last known spotted owl activity.

In some cases, managed sites may eventually be incorporated into block management areas. In other cases, site management of single sites or clusters of sites may be an appropriate long-term action, if larger blocks of habitat are not available for management due to landscape or ownership conditions, or in areas where site management promotes connectivity between block management areas or between provinces.

- Managing barred owls in occupied spotted owl sites is intended to help retain the existing population and increase the potential for recruitment of young.
- Managing barred owls in occupied spotted owl sites may enable those sites to provide a source of young for recolonization of nearby management blocks.
- Managing barred owls in spotted owl sites distributed across the province, whether within block management areas or not, may reduce the risk of loss of spotted owls in the province from catastrophic events, such as wildfire, by maintaining spotted owl site occupancy across the area.
- Managing spotted owl sites also provides the opportunity for maintaining spotted owls in areas where block management is not feasible or recommended. This approach applies across the entire province, whether or not the locations are within a GMA.
- These spotted owl sites may serve to increase connectivity between and within block management areas, and provide sites in the vicinity of blocked management areas that can interact at a demographic level with those management areas. This is particularly important in the northeastern and southernmost portions of this province where demographic connectivity is possible with the Western Oregon Cascades, Oregon Coast Ranges, California Coast, and California Klamath Provinces.
- Spotted owl site management, due to its smaller size when compared to block management, provides a wider range of options for landowner contribution to barred owl management, particularly for smaller landowners. The smaller size also makes site management suitable for areas where there are not large amounts of spotted owl habitat due to terrain, or extensive loss of habitat from wildfires, harvest, or other disturbances.

*Selection of spotted owl sites for management*

Although greatly reduced from historical numbers, the Oregon Klamath Province retains a comparatively large number of occupied spotted owl territories, relative to the provinces to the north. The focus of spotted owl site management in this province is primarily on currently active sites, to provide existing spotted owls relief from competitive pressure, and secondarily on recently active sites, where recolonization of sites after barred owl removal is more likely. This is reflected in the priorities for site management.

*Spotted Owl Site Management Priorities.*

| Priority | Spotted Owl Site Condition |
|---|---|
| A | Currently active sites, including all areas with any spotted owl detections within the last year |
| B | Recently active sites, including all areas where the most recent spotted owl detection was between 1 and 5 years ago |
| C | Historically occupied spotted owl sites (pair or single) with last detection between 5 and 10 years ago |
| D | Historically occupied spotted owl sites (pair or single) with last detection more than 10 years ago, and potential sites with adequate habitat but no known history of spotted owl occupancy, and without detections within the last 5 years |

*Other considerations for selection of spotted owl sites for management:*

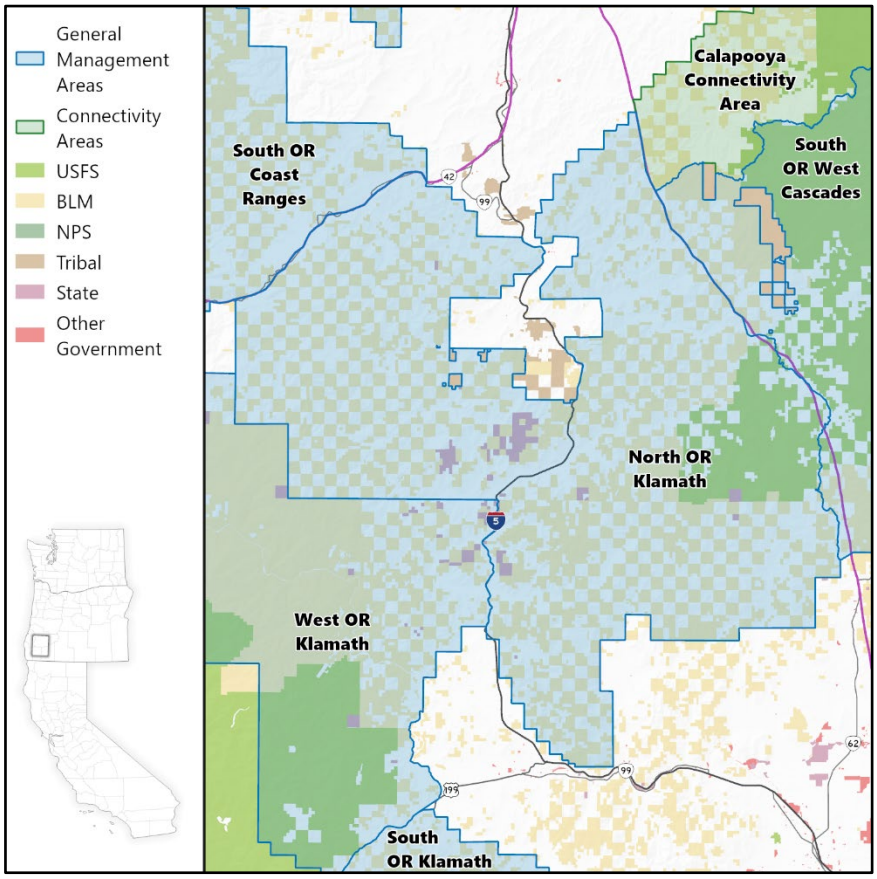
- We recommend consideration of the following factors when selecting among sites within a priority category. Focus first on spotted owl sites with recent occupancy by pairs, then singles, then detections.
- Consider past reproductive history of the site. Select sites with a history of reproduction on the site where surveys are available.
- Consider the condition of habitat in the area, particularly loss of habitat since the last surveys. All other things being equal, select sites with abundant high-quality habitat. Spotted owl sites that have lost substantial amounts of habitat to fire, harvest, insect damage, or other disturbances, may be lower priority.

*A4.8.B.1.b Management Recommendations*

Within each individual site, remove barred owls from an area between 7,645 and 13,592 acres. This represents the area in a circle of 1.5 and 2 home range radii (Table 2). This can be distributed in a circle around the activity center, or implementers can use local knowledge, topography, and habitat condition to design a non-circular area of the appropriate size that provides the best conditions for barred owl management. In areas where spotted owl sites are isolated, and particularly for sites in Priority A condition (see table above), we recommend a larger management area, up to 30,582 acres (3 home range radii). Where sites are not isolated, applying site management to clusters of two or more sites in close proximity is likely to provide more efficient management conditions and increased benefits for spotted owls present in those sites.

## A4.8.B.2 General Management Areas in the Oregon Klamath Province

*A4.8.B.2.a North Oregon Klamath GMA – Priority A*




The North Oregon Klamath GMA is in the northern part of the province straddling Interstate 5 and bounded by the Oregon Coast Ranges Province to the northwest and the Western Oregon Cascades Province to the east. It includes approximately 786,129 acres in total, of which 755,556 acres (96 percent) are forest lands and 334,005 acres (42 percent) provide spotted owl nesting and roosting habitat. The GMA includes the southernmost portion of the Umpqua National Forest and BLM lands managed by the Roseburg and Medford Districts. Forest lands in this GMA are 47 percent Federal lands (BLM and Forest Service), 1 percent State lands, and the remainder primarily in private ownership.

This GMA was mapped for the following reasons:

- This is an important area for inter-province movement of spotted owls between the Western Oregon Cascades and Oregon Coast Ranges.
- Relative to areas in the northern portion of the northern spotted owl range, it retains a comparatively large population of spotted owls, and therefore has good potential for recovery.
- The GMA includes Klamath Demography Study Area, with its historical and recent spotted owl data. The Northwest Forest Plan Effectiveness Monitoring program includes passive acoustic monitoring sampling 20 percent of the study area. This monitoring program will provide additional future data on both spotted and barred owls, and allow for efficiencies in monitoring barred owl removal and its effects on spotted owls. This portion of the GMA is well known and accessible, allowing for quicker implementation.
- The GMA includes the Union-Myrtle study area, where barred owls were experimentally removed in 2016 through 2019. The Klamath study area served as the control, where spotted and barred owls were monitored but barred owls were not removed. This work demonstrated

benefits to spotted owls. Information collected during the experiment regarding barred and spotted owl use of the landscape would support quicker and more effective implementation.

This GMA was assigned Priority A due to the demonstrated previous success here of barred owl management for spotted owl conservation, and the potential for this area to serve as a source population if barred owl populations can be reduced. The well-studied landscape of the Klamath and Union-Myrtle study areas and practical knowledge gained during experimental removals allow for rapid deployment of barred owl management to the locations where it can have the most immediate benefit to existing spotted owls. Given the relatively robust spotted owl populations in this area, along with the potential for rapid, effective implementation, barred owl removal efforts within this GMA are likely to result in an especially fast and positive response in terms of spotted owl population recovery. The location of this GMA at a meeting point of three different provinces creates the potential for population recovery here to support population recovery in other provinces as well. Actions here are intended to create refugia to secure and improve spotted owl populations here, which may in turn serve as source populations for the rest of the province and other provinces.

*Description of the elements considered in mapping:* In mapping the boundaries of the North Oregon Klamath GMA we used information on the following elements.

*Spotted Owl Data:*

- The GMA includes current, recent, and historical spotted owl sites.
- This GMA includes all concentrations of spotted owl habitat in the northeastern portion of the province are included within this GMA. We excluded some areas to the south where habitat density was lower.
- The GMA boundary includes a long segment along the province boundary with the Western Oregon Cascades Province, allowing for good connectivity with the South Oregon West Cascades GMA, as well as the Calapooya Connectivity Area. Spotted owl habitat is present on both sides of the boundary.
- The GMA boundary includes a segment along the province boundary with the Oregon Coast Ranges Province, allowing for good connectivity with the South Oregon Coast Ranges GMA. Spotted owl habitat is patchy in the checkerboard landscape along this boundary, but there are areas of habitat connectivity between the two provinces.

*Conditions:*

- This GMA includes extensive BLM and Forest Service lands, with both contiguous and checkerboard ownership patterns.
- We considered the high availability of access via roads and trails in most of this area.

*Other Considerations:*

- As discussed above, this GMA overlaps the Klamath and Union-Myrtle study areas, one encompassing a former experimental barred owl removal area. This allows for efficiencies in monitoring and opportunities for research. Although the GMA boundaries do not closely follow study area boundaries, the GMA includes the bulk of these study areas.

- We excluded non-forest valley bottoms and developed areas.

*Focal Management Areas (FMAs)*

In this GMA, we recommend developing FMAs large enough to support as many spotted owl pair sites as possible, up to 50 pair sites per FMA. Generally, larger blocky areas provide a smaller edge-to-area ratio, and this may help reduce the influx of barred owls from outside the FMA in the future. However, where the landscape or forest conditions do not allow this, smaller or more sinuous FMAs, still encompassing multiple pair areas may be appropriate. If smaller FMAs are developed due to funding limitations, design them such that they could be expanded in the future if funding becomes available.

When possible, include multiple FMAs, generally spaced no farther than 12 to 15 miles apart. Where smaller areas are developed due to topography, forest condition, access, funding limitations, or other reasons, we recommend these be closer together and multiple areas be designed with the intent of encouraging exchange of spotted owls between these smaller areas.

Because of the history of barred owl research and experimental management in parts of this area, additional information may be available regarding areas with higher and lower barred owl influxes, and implementers should refer to this information in FMA development.

Including recently occupied sites in FMAs provides the starting point for development of spotted owl populations as barred owl populations are reduced. In areas where habitat connectivity is limited, site management may help to provide connectivity between smaller FMAs. Coordinate FMA locations with the spotted owl site management described above, with FMA locations in adjacent GMAs, and with any other barred owl management activity.

*Priorities:* The following are our recommended priorities for defining and selecting FMAs within the North Oregon Klamath GMA. The following are in general priority order; however, local expertise will be important in applying these to specific FMA boundary designs.

1. Build FMAs around current occupied spotted owl sites (sites with presence or occupancy of spotted owls within the last year). This provides a nucleus of spotted owls for the potential recolonization of sites within the FMA as barred owl numbers are reduced.
2. Focus on areas with reasonable access, in terms of road networks where available, and trail systems where roads do not exist. Avoid large areas without roads or trails. Closed roads may be used like a trail system if they can be safely walked.
3. Consider fire risk in mapping the boundaries of the FMAs. Avoid concentrating FMAs solely in areas identified as having the highest risk of habitat loss to fire; however, some areas with high fire risk may still be important to include in FMAs, particularly where spotted owls are currently present in these areas. Providing connectivity in FMAs from higher risk spotted owl habitat to areas identified as fire refugia and other areas with relatively lower risk will be important in the mixed-severity fire regime of the Oregon Klamath Province. Placement of multiple FMAs within the GMA and inclusion of areas with relatively high resistance to uncharacteristic fire would reduce the risk of complete loss.

4. Place blocks where the best spotted owl habitat remains, and on blocks allowing for the maximum number of spotted owls to be supported. Focus on designating FMAs in areas with the potential for at least 20 spotted owl pairs, though 50 pair sized areas are the target where possible.

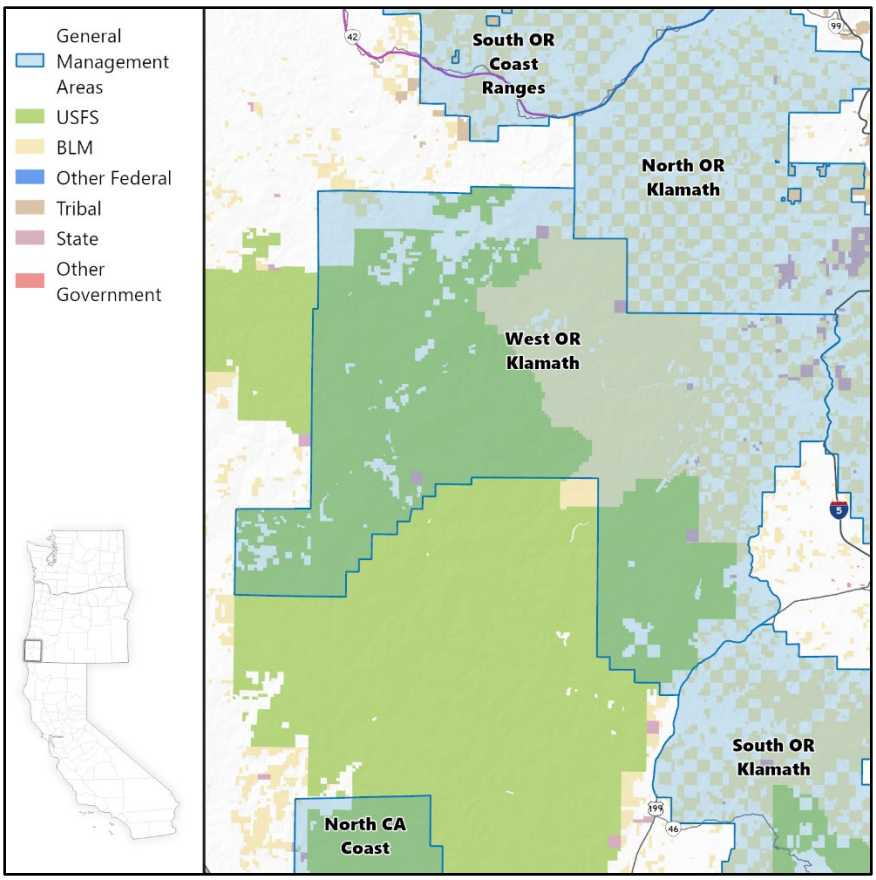
5. Include lands of interested and willing landowners or land managers. A focus on areas where landowners have expressed interest in barred owl management will speed the implementation of actual barred owl management and encourage involvement.

6. Include areas with high-quality historical spotted owl sites (sites with no confirmed occupancy in the last five years or more). Indicators may include, for example, especially good habitat amount, quality, and configuration; a history of good past demographic performance; or a history of long-term occupancy. These are areas that have been shown by past use to be attractive to spotted owls and therefore more likely to be reoccupied as spotted owl populations increase.

7. Consider the potential for connection to other FMAs in the GMA, and to neighboring management areas in the Oregon Klamath, Western Oregon Cascades, and Oregon Coast Ranges Provinces. Placement of FMAs within close proximity to other management areas, and where there is forest that may provide connectivity to other portions of the Oregon Klamath Province, can connect populations in these areas.

8. Consider the presence of areas already designated for spotted owl habitat management or compatible conservation purposes, such as Late Successional Reserves, Congressionally reserved areas, designated critical habitat, and areas identified as high priorities in the Northern Spotted Owl Recovery Plan. Including these areas provides support for spotted owls and limits impacts on other resources. As many of these have been managed for older forest over the last decades, these are the likely locations of some of the best habitat conditions.

*A4.8.B.2.b West Oregon Klamath GMA – Priority B*




Bounded by Interstate 5 along the west, the West Oregon Klamath GMA occupies the central portion of the province. It includes approximately 667,080 acres in total, of which 660,033 acres (99 percent) are forest lands and 347,841 acres (52 percent) provide spotted owl nesting and roosting habitat. The GMA includes a portion of the Rogue River-Siskiyou National Forest, and lands managed by the Medford District of the BLM. Forest lands in this GMA are 80 percent Federal lands (Forest Service and BLM), 1 percent State lands, and the remainder primarily in private ownership.

This GMA was mapped for the following reasons:

- The GMA includes large contiguous blocks of National Forest and BLM land, and relatively contiguous large patches of older forest cover.
- It provides a key linkage in the only continuously forested connection between provinces to the north and to the south, and also provides connectivity within the province.

This GMA is assigned Priority B. Spotted owl populations in this area are declining, but remain large enough that extirpation is not imminent. Block management within this GMA has good potential to slow or halt population declines. Site management around currently occupied sites within this GMA remains a Priority A action, but additional management outside of these sites is likely to increase the effectiveness of management. Although this area likely retains good potential for population recovery, the potential for this area to become a source population for multiple provinces is lower here than in the more strategically located North Oregon Klamath GMA. Additionally, implementation is likely to be slower here than in the North Oregon Klamath GMA, because experimental barred owl management was not conducted here previously, and parts of this GMA may not have been surveyed recently. Therefore, block management in this GMA is less urgent, and meets the description of a Priority B action.

*Description of the elements considered in mapping*: In mapping the boundaries of the West Oregon Klamath GMA we used information on the following elements.

*Spotted Owl Data:*

- The GMA includes current, recent, and historical spotted owl sites.
- We included large concentrations of spotted owl habitat in the western-central portions of the province. We excluded areas to the south and west where habitat density is lower.
- The GMA provides connectivity between the North and South Oregon Klamath GMAs. Although habitat is present between this GMA and the North California Coast GMA, habitat density in this area is lower, so we excluded it from the GMA.

*Conditions:*

- This GMA includes areas where access may be difficult, such as wilderness and roadless areas, especially in the western portion of the GMA. This should be considered during development of the Focal Management Area boundaries.
- The GMA includes extensive BLM- and Forest Service-managed lands, mainly in contiguous blocks, but with some areas of checkerboard ownership.

*Other Considerations:*

- The excluded area to the south is largely within the area burned by the 2002 Biscuit Fire, portions of which also burned in the 1987 Silver Fire and the 2018 Klondike Fire, among others. Although the GMA boundary does not follow fire perimeters, the repeatedly burned areas lack spotted owl habitat, which did influence the boundary.
- We excluded non-forest valley bottoms and developed areas.

*Focal Management Areas (FMAs)*

In this GMA, we recommend developing FMAs large enough to support as many spotted owl pair sites as possible, up to 50 pair sites per FMA. Generally, larger blocky areas provide a smaller edge-to-area ratio, and this may help reduce the influx of barred owls from outside the FMA in the future. However, where the landscape or forest conditions do not allow this, smaller or more sinuous FMAs, still encompassing multiple pair areas may be appropriate. If smaller FMAs are developed due to funding limitations, design them such that they could be expanded in the future if funding becomes available.

When possible, include multiple FMAs, generally spaced no farther than 12 to 15 miles apart. Where smaller areas are developed due to topography, forest condition, access, funding limitations, or other reasons, we recommend these be closer together and multiple areas be designed with the intent of encouraging exchange of spotted owls between these smaller areas.

Including recently occupied sites in FMAs provides the starting point for development of spotted owl populations as barred owl populations are reduced. In areas where habitat connectivity is limited, site management may help to provide connectivity between smaller FMAs. Coordinate FMA locations with the spotted owl site management described above, with FMA locations in adjacent GMAs, and with any other barred owl management activity.

*Priorities:* The following are our recommended priorities for defining and selecting FMAs within the West Oregon Klamath GMA. The following are in general priority order; however, local expertise will be important in applying these to specific FMA boundary designs.

1. Build FMAs around current occupied spotted owl sites (sites with presence or occupancy of spotted owls within the last year). This provides a nucleus of spotted owls for the potential recolonization of sites within the FMA as barred owl numbers are reduced.

2. Focus on areas with reasonable access, in terms of road networks where available, and trail systems where roads do not exist. Avoid large areas without roads or trails. Closed roads may be used like a trail system if they can be safely walked.

3. Consider fire risk in mapping the boundaries of the FMAs. Avoid concentrating FMAs solely in areas identified as having the highest risk of habitat loss to fire; however, some areas with high fire risk may still be important to include in FMAs, particularly where spotted owls are currently present in these areas. Providing connectivity in FMAs from higher risk spotted owl habitat to areas identified as fire refugia and other areas with relatively lower risk will be important in the mixed-severity fire regime of the Oregon Klamath Province. Placement of multiple FMAs within the GMA and inclusion of areas with relatively high resistance to uncharacteristic fire would reduce the risk of complete loss.

4. Place blocks where the best spotted owl habitat remains, and on blocks allowing for the maximum number of spotted owls to be supported. Focus on designating FMAs in areas with the potential for at least 20 spotted owl pairs, though 50 pair sized areas are the target where possible.

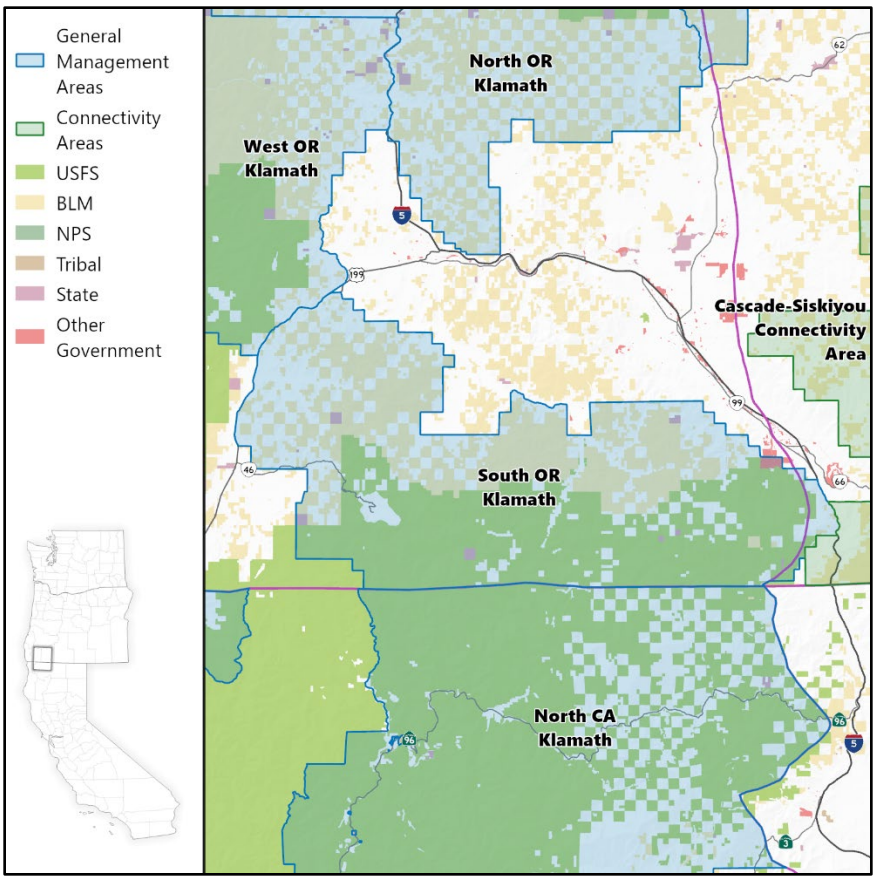
5. Include lands of interested and willing landowners or land managers. A focus on areas where landowners have expressed interest in barred owl management will speed the implementation of actual barred owl management and encourage involvement.

6. Include areas with high-quality historical spotted owl sites (sites with no confirmed occupancy in the last five years or more). Indicators may include, for example, especially good habitat amount, quality, and configuration; a history of good past demographic performance; or a history of long-term occupancy. These are areas that have been shown by past use to be attractive to spotted owls and therefore more likely to be reoccupied as spotted owl populations increase.

7. Consider the potential for connection to other FMAs in the GMA, and to neighboring GMAs within the Oregon Klamath Province. Placement of FMAs within close proximity to other GMAs, or where there is forest that may provide connectivity to the North California Coast GMA, can connect populations in these areas.

8. Consider the presence of areas already designated for spotted owl habitat management or compatible conservation purposes, such as Late Successional Reserves, Congressionally reserved areas, designated critical habitat, and areas identified as high priorities in the Northern Spotted Owl Recovery Plan. Including these areas provides support for spotted owls and limits impacts on other resources. As many of these have been managed for older forest over the last decades, these are the likely locations of some of the best habitat conditions.

*A4.8.B.2.c South Oregon Klamath GMA – Priority B*




The South Oregon Klamath GMA extends south from the West Oregon Klamath GMA to the California border, and east to the Cascade-Siskiyou Connectivity Area. It includes approximately 535,001 acres in total, of which 516,220 acres (96 percent) are forest lands and 263,408 acres (49 percent) provide spotted owl nesting and roosting habitat. The GMA includes a portion of the Rogue River-Siskiyou National Forest and a small part of the Klamath National Forest that extends into Oregon. It also includes lands managed by the Medford District of the BLM and the Oregon Caves National Monument. A small portion of this GMA extends into the Western Oregon Cascades Province. Forest lands in the GMA are 74 percent Federal lands (Forest Service, BLM, and National Park Service), 1 percent State lands, and the remainder primarily in private ownership.

This GMA was mapped for the following reasons:

- It provides connectivity to the Western Oregon Cascades and the California Klamath Provinces, and part of the California Cascades Province.
- It provides a key linkage in the only continuously forested connection from provinces to north to those to the south.
- It includes a large concentration of spotted owl habitat in the southern portion of the province.

This GMA is assigned Priority B. Spotted owl populations in this area are declining, but remain large enough that extirpation is not imminent. Block management within this GMA has good potential to slow or halt population declines. Site management around currently occupied sites within this GMA remains a Priority A action, but additional management outside of these sites is likely to increase the effectiveness of management. Implementation is likely to be slower here than in the North Oregon Klamath GMA, because experimental barred owl management was not conducted here previously, and parts of this GMA may not have been surveyed recently.

Therefore, block management in this GMA is less urgent, and meets the description of a Priority B action.

*Description of the elements considered in mapping:* In mapping the boundaries of the South Oregon Klamath GMA we used information on the following elements.

*Spotted Owl Data:*

- The GMA includes current, recent, and historical spotted owl sites.
- We included areas with dense concentrations of spotted owl habitat in the southeastern portion of the province.
- The GMA boundary includes a long segment along the province boundary with the California Klamath Province, allowing for good connectivity with the North California Klamath GMA. Spotted owl habitat is abundant in both provinces along most of this border.
- The GMA boundary includes a segment along the province boundary with the Western Oregon Cascades Province, allowing for connectivity with the Cascade-Siskiyou Connectivity Area. Spotted owl habitat is present on both sides of the boundary.
- We excluded areas to the north and west, where habitat density is lower.

*Conditions:*

- This GMA includes areas where access may be difficult, such as wilderness and roadless areas. This should be considered during development of the FMA boundaries.
- The GMA includes extensive BLM and Forest Service lands, with both contiguous and checkerboard ownership patterns.

*Other Considerations:*

- The southwestern boundary is influenced by a large area that burned at high severity during the 2020 Slater Fire. Most of the high-severity burned area is outside of the GMA.
- We excluded non-forest valley bottoms and developed areas.

*Focal Management Areas (FMAs)*

In this GMA, we recommend developing FMAs large enough to support as many spotted owl pair sites as possible, up to 50 pair sites per FMA. Generally, larger blocky areas provide a smaller edge-to-area ratio, and this may help reduce the influx of barred owls from outside the FMA in the future. However, where the landscape or forest conditions do not allow this, smaller or more sinuous FMAs, still containing multiple pair areas, may be appropriate. If smaller FMAs are developed due to funding limitations, design them such that they could be expanded in the future if funding becomes available.

When possible, include multiple FMAs, generally spaced no farther than 12 to 15 miles apart. Where smaller areas are developed due to topography, forest condition, access, funding limitations, or other reasons, we recommend these be closer together and multiple areas be designed with the intent of encouraging exchange of spotted owls between these smaller areas.

Including recently occupied sites in FMAs provides the starting point for development of spotted owl populations as barred owl populations are reduced. In areas where habitat connectivity is limited, site management may help to provide connectivity between smaller FMAs. Coordinate FMA locations with the spotted owl site management described above, with FMA locations in adjacent GMAs, and with any other barred owl management activity.

*Priorities:* The following are our recommended priorities for defining and selecting FMAs within the South Oregon Klamath GMA. The following are in general priority order; however, local expertise will be important in applying these to specific FMA boundary designs.

1. Build FMAs around current occupied spotted owl sites (sites with presence or occupancy of spotted owls within the last year). This provides a nucleus of spotted owls for the potential recolonization of sites within the FMA as barred owl numbers are reduced.

2. Focus on areas with reasonable access, in terms of road networks where available, and trail systems where roads do not exist. Avoid large areas without roads or trails. Closed roads may be used like a trail system if they can be safely walked.

3. Consider fire risk in mapping the boundaries of the FMAs. Avoid concentrating FMAs solely in areas identified as having the highest risk of habitat loss to fire; however, some areas with high fire risk may still be important to include in FMAs, particularly where spotted owls are currently present in these areas. Providing connectivity in FMAs from higher risk spotted owl habitat to areas identified as fire refugia and other areas with relatively lower risk will be important in the mixed-severity fire regime of the Oregon Klamath Province. Placement of multiple FMAs within the GMA and inclusion of areas with relatively high resistance to uncharacteristic fire would reduce the risk of complete loss.

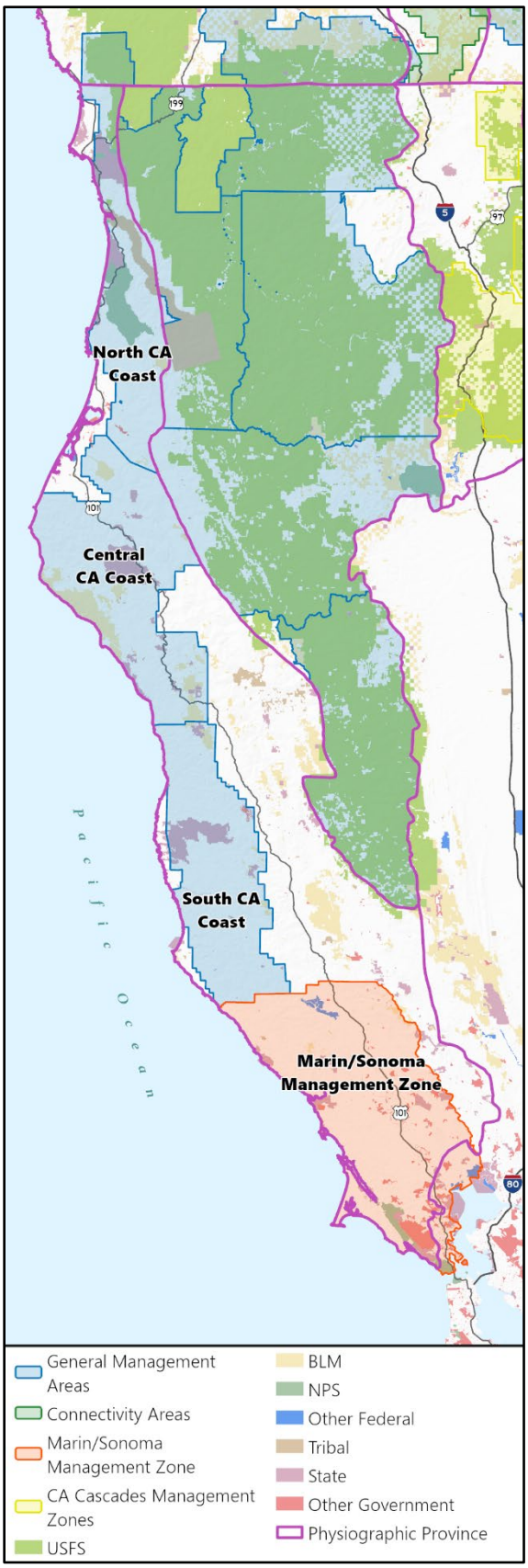
4. Place blocks where the best spotted owl habitat remains, and on blocks allowing for the maximum number of spotted owls to be supported. Focus on designating FMAs in areas with the potential for at least 20 spotted owl pairs, though 50 pair sized areas are the target where possible.

5. Include lands of interested and willing landowners or land managers. A focus on areas where landowners have expressed interest in barred owl management will speed the implementation of actual barred owl management and encourage involvement.

6. Include areas with high-quality historical spotted owl sites (sites with no confirmed occupancy in the last five years or more). Indicators may include, for example, especially good habitat amount, quality, and configuration; a history of good past demographic performance; or a history of long-term occupancy. These are areas that have been shown by past use to be attractive to spotted owls and therefore more likely to be reoccupied as spotted owl populations increase.

7. Consider the potential for connection to other FMAs in the GMA, and to neighboring management areas. Placement of FMAs within close proximity to other management areas in the Oregon Klamath, California Klamath, and Western Oregon Cascades Provinces, and where there is forest that may provide connectivity within the Oregon Klamath, or to the California Klamath or California Cascades Provinces, can connect populations in these areas.

8. Consider the presence of areas already designated for spotted owl habitat management or compatible conservation purposes, such as Late Successional Reserves, Congressionally reserved areas, designated critical habitat, and areas identified as high priorities in the Northern Spotted Owl Recovery Plan. Including these areas provides support for spotted owls and limits impacts on other resources. As many of these have been managed for older forest over the last decades, these are the likely locations of some of the best habitat conditions.




# A4.9 California Coast Province

## A4.9.A Background

The California Coast Province extends from the Oregon border south to the San Francisco Bay. Forest lands in the province are predominantly privately owned. There is a smaller percentage of Federal lands, compared with most other provinces, with 1 percent of forest lands being managed by the Forest Service, 2 percent by the National Park Service, and 6 percent by the BLM. Federally managed land is concentrated in the northern portion of the province. State and local government agencies respectively manage 6 percent and 1 percent of forest lands. Approximately 1 percent is under Tribal management. The remainder of forest lands are primarily in private ownership.

Forest cover in the province is dominated by coastal redwood (*Sequoia sempervirens*) and mixed evergreen or Douglas-fir/tanoak (*Notholithocarpus densiflorus*) communities. Forest cover is more contiguous in the northern portion of the province and becomes more limited by topographic conditions in the southern portions, where the drier and hotter southern aspect slopes are more commonly dominated by grasslands, shrublands, or oak (*Quercus*) woodlands. In the far southern portion of the province this results in relatively small, discrete patches of forest cover.

### A4.9.A.1 Spotted Owl Condition in the California Coast Province

The California Coast Province includes the southernmost extent of the range of the northern spotted owl. Federal lands in the province include approximately 117,891 acres of spotted owl nesting and roosting habitat (Davis et al. 2024a). State lands are important in this province and include approximately 122,550 acres of spotted owl nesting and roosting habitat (Davis et al. 2024a). In the redwood forests found in this province, spotted owl populations can reach higher

densities than in other forest types, with home range radii as small as 0.7 miles, and spotted owls can make use of younger forests, though older redwood forests also provide uniquely valuable habitat. Spotted owls also use Douglas-fir and mixed conifer forests in this province, with home range sizes similar to those in the neighboring Oregon and California Klamath Provinces. Dusky-footed woodrats are the primary prey for spotted owls in the California Coast Province. Flying squirrels and red tree voles are also important prey species here (Barrows 1980, p. 75; Barrows 1985, p. 51; Barrows 1987, p. 96).

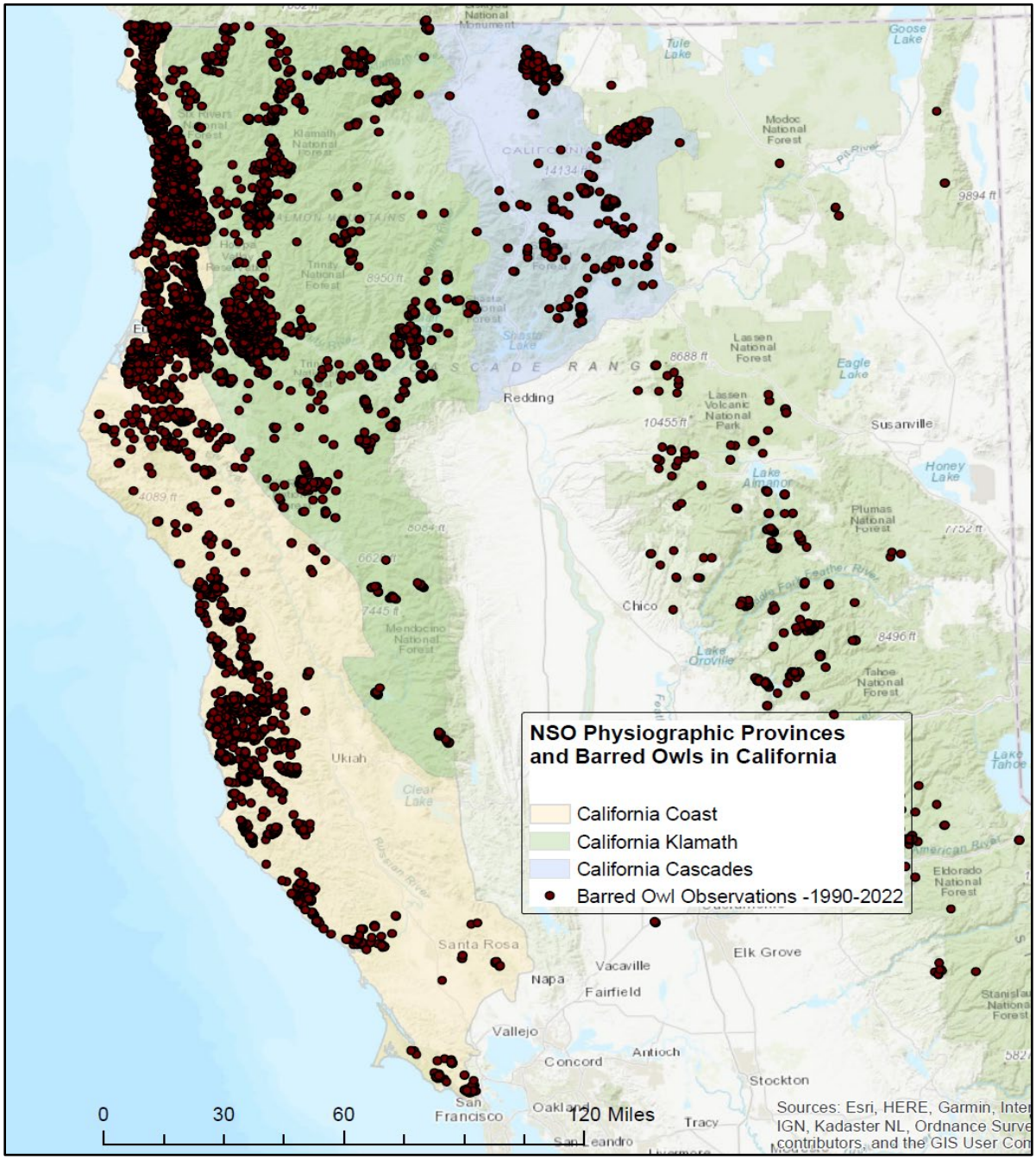
The California Coast Province includes most of the Green Diamond Demography Study Area, which provides the most relevant information on spotted owl population trends in the northern two-thirds of the province. The Northwestern California Demography Study Area also includes a small number of individual spotted owl sites within the province where long-term monitoring has occurred, but the large majority of the Northwestern California study area is within the California Klamath Province, so the Green Diamond study area provides a better representation of California Coast spotted owl populations. Within the portions of the Green Diamond study area where barred owls have not been removed, spotted owl occupancy dropped from 97 percent in 1993 to 35 percent in 2018 (Davis et al. 2022, p. 37). This decrease reflects a rate of population decline of more than 5 percent per year between 1995 and 2017 (Franklin et al. 2021, pp. 11-13).

Spotted owl densities show a strong gradient of low numbers in the north with some areas experiencing local extirpation (e.g., Redwood National Park) and higher densities in the south. The southern portion of the northern spotted owl range in Marin County supports a stable population of spotted owls. Spotted owls were detected via passive acoustic monitoring at 95 percent of sample units (hexagons) within Marin County in 2021, and at 100 percent of sample units in 2022 (Lesmeister et al. 2023, p. 17). However, the break in forest lands between Marin County and Sonoma and Napa Counties to the north limits spotted owl gene flow (Barrowclough et al. 2005, p. 1115; Henke 2005, pp. 23-25). This means that although the population is stable, it is also isolated from other spotted owl populations, which may increase the population's sensitivity to stressors, such as habitat loss or competitive pressure from barred owls, if these stressors become more prevalent in the future.

### A4.9.A.2 Barred Owl Condition in the California Coast Province

There are no barred owl population size or trend estimates available, but various studies in the province provide some relevant information. Barred owl numbers appear to have steadily increased in the northern parts of the province as their apparent southward migration progresses (Franklin et al. 2021, p. 11-17; Franklin et al. 2022, pp. 10, 12, 24, 29), but remain less common in the south. Although barred owls have been detected in Marin County, at the southern end of the province, scientific barred owl collections in 2015 and again in 2021 through 2023 have prevented the establishment of any substantial barred owl populations in this area. The break in forest lands between Marin County and Sonoma and Napa Counties to the north is a possible factor in the slow growth in the number of barred owls in Marin County. Map A4-1 shows known barred owl occurrence data for the province.

Experimental barred owl removals have been conducted intermittently on a subset of the Green Diamond Demography Study Area since 2009 (Diller et al. 2016, p. 692; Green Diamond Resource Company 2019, pp. 5-9 – 5-10). Additional experimental removal in this province has occurred or is occurring on Yurok Tribal lands, Redwood National Park and Prairie Creek State Park, Six Rivers National Forest, Headwaters Preserve, the King Range, Jackson State Forest, Mendocino State Parks, and small areas of Sierra Pacific Industries lands.




**Map A4-1.** Barred owl detections in the California provinces 1990 to 2022. This distribution partially reflects the location of survey efforts for spotted owls.

## A4.9.B Management Strategy

### A4.9.B.1 Spotted Owl Site Management in the California Coast Province

*A4.9.B.1.a Background*

Maintaining the existing spotted owl population to the maximum extent possible will provide greater potential for recruitment and population expansion. Much, but not all, of the available spotted owl habitat in this province has been surveyed in recent years. Where recent survey coverage is incomplete, we recommend surveys of areas with adequate habitat, especially historically active sites where the last spotted owl detections occurred between 5 and 10 years ago.

In some cases, managed sites may eventually be incorporated into block management areas. In other cases, site management of single sites or clusters of sites may be an appropriate long-term action, if larger blocks of habitat are not available for management due to landscape or ownership conditions, or in areas where site management promotes connectivity between block management areas.

- Managing barred owls in occupied spotted owl sites is intended to help retain the existing population and increase the potential for recruitment of young.
- Managing barred owls in occupied spotted owl sites may enable those sites to provide a source of young for recolonization of nearby management blocks.
- Managing barred owls in spotted owl sites distributed across the province, whether within block management areas or not, may reduce the risk of loss of spotted owls in the province from catastrophic events, such as wildfire, by maintaining spotted owl site occupancy across the area. Managing spotted owl sites also provides the opportunity for maintaining spotted owls in areas where block management is not feasible or recommended. This approach applies across the entire province, whether or not the locations are within a GMA or other mapped designation.
- Managing spotted owl sites in close proximity to other barred owl removal areas, whether those removal areas are part of this Strategy or other programs (e.g., scientific experiments), will create efficiencies by reinforcing and expanding zones of reduced barred owl density. These spotted owl sites may serve to increase connectivity between and within block management areas, and provide sites in the vicinity of block management areas that can interact at a demographic level with those management areas.
- Spotted owl site management, due to its smaller size when compared to block management, provides a wider range of options for landowner contribution to barred owl management, particularly for smaller landowners. The smaller size also makes site management suitable for areas where there are not large amounts of spotted owl habitat due to terrain, or extensive loss of habitat from wildfires, harvest, or other disturbances.

*Selection of spotted owl sites for management*

Although greatly reduced from historical numbers, the California Coast Province retains a comparatively large number of occupied spotted owl territories, relative to the northern provinces. The focus of spotted owl site management in this province is primarily on currently active sites, to provide existing spotted owls relief from competitive pressure, and secondarily on

recently active sites, where recolonization of sites after barred owl removal is more likely. This is reflected in the priorities for site management.

*Spotted Owl Site Management Priorities*

| Priority | Spotted Owl Site Condition |
|---|---|
| A | Currently active sites, including all areas with any spotted owl detections within the last year |
| B | Recently active sites, including all areas where the most recent spotted owl detection was between 1 and 5 years ago |
| C | Historically occupied spotted owl sites (pair or single) with last detection between 5 and 10 years ago |
| D | Historically occupied spotted owl sites (pair or single) with last detection more than 10 years ago, and potential sites with adequate habitat but no known history of spotted owl occupancy, and without detections within the last 5 years |

*Other considerations for selection of spotted owl sites for management:*

We recommend consideration of the following factors when selecting among sites within a priority category.

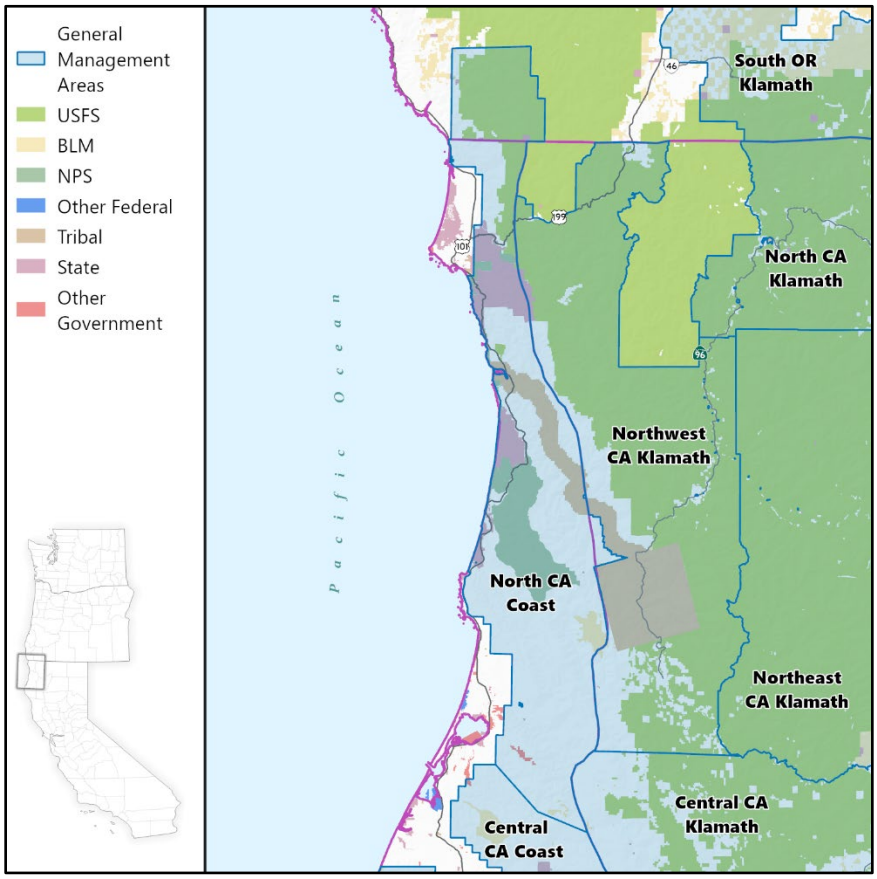
- Focus first on spotted owl sites with recent occupancy by pairs, then singles, then detections.
- Consider past reproductive history of the site. Select sites with a history of reproduction on the site where surveys are available.
- Consider the condition of habitat in the area, particularly loss of habitat since the last surveys. All other things being equal, select sites with abundant high-quality habitat. Spotted owl sites that have lost substantial amounts of habitat to fire, harvest, insect damage, or other disturbances, may be lower priority.

*A4.9.B.1.b. Management Recommendations*

Within each individual site, remove barred owls from an area at least 2,217 acres in the redwood zone and 7,645 acres in the mixed conifer zone. This represents the area in a circle of 1.5 times the home range radii (Table 2). This can be distributed in a circle around the activity center, or implementers can use local knowledge, topography, and habitat condition to design a non-circular area of the appropriate size that provides the best conditions for barred owl management. In areas where spotted owl sites are isolated, and particularly for sites in Priority A condition (see table above), we recommend a larger management area, 8,867 to 20,582 acres (3 home range radii). Where sites are not isolated, applying site management to clusters of two or more sites in close proximity is likely to provide more efficient management conditions and increased benefits for spotted owls present in those sites.

## A4.9.B.2 General Management Areas in the California Coast Province

*A4.9.B.2.a North California Coast GMA – Priority A*




This GMA includes a small portion of the Oregon Klamath Province that is otherwise isolated from other large forest patches. The GMA is bounded by the California Klamath Province along the east, the Pacific Ocean along the west, and extends to just south of Arcata. It includes approximately 725,807 acres in total, of which 679,747 acres (94 percent) are forest lands and 310,646 acres (43 percent) provide spotted owl nesting and roosting habitat. Forest lands in this GMA are 28 percent Federal lands (Forest Service, National Park Service, and BLM), 7 percent State land, 5 percent Yurok Tribal lands, and the remainder in primarily in private ownership. Among the private landowners in this GMA, Green Diamond Resource Company operates under an HCP that includes experimental barred owl removal. Although primarily in private ownership, this GMA includes the largest areas of Federal lands in the California Coast Province, including Redwood National Park, the westernmost portion of Six Rivers National Forest, the southwestern corner of the Rogue River-Siskiyou National Forest, and the Lacks Creek Area of Critical Environmental Concern, managed by the Northern California District of the BLM. It also includes large California State Parks: Del Norte Coast Redwoods State Park and Prairie Creek Redwoods State Park.

This GMA was mapped for the following reasons:

- This is an important area for movement of spotted owls to and from the Oregon Klamath and California Klamath Provinces.
- There are previous and ongoing barred owl removal research efforts in portions of the GMA which can be restarted, continued, and easily expanded. The Yurok Tribe, Green Diamond Resource Company, and University of Wisconsin are currently conducting barred owl removal research in portions of the GMA. The benefits to spotted owl populations from the Green Diamond removal experiment have been documented (Diller et al. 2016, entire; Wiens et al. 2021, entire).

- Some of these ongoing efforts also include barred owl removal research in adjacent portions of the Northwest California Klamath GMA. Expanding these efforts farther into the Northwest California Coast GMA would allow for the creation of a relatively large area of reduced barred owl density that includes portions of two provinces. This in turn would support recovery of spotted owls in this area where recovery potential is high.
- State and National Parks, where experimental barred owl removal has already begun, provide a public land anchor for barred owl management that is unique within the California Coast Province.
- The GMA includes the bulk of the Green Diamond Demography Study Area, with its historical and recent spotted owl data. Green Diamond conducts annual monitoring as a component of their HCP. This monitoring programs will provide additional future data on both spotted and barred owls, and allow for efficiencies in monitoring barred owl removal and its effects on spotted owls.

This GMA is assigned Priority A. Barred owl pressure is high here, and spotted owl populations have declined precipitously in parts of this GMA, with local extirpations in some areas. However, there is also good potential for spotted owl population recovery in this area. Given the existing barred owl removal research efforts both within this GMA and in the adjacent North California Klamath GMA, additional barred owl removal efforts within this GMA are likely to result in a fast and positive response in terms of spotted owl population recovery. Actions here are intended both to prevent extirpation and to create refugia to secure and improve spotted owl populations here, which may in turn serve as source populations for the rest of the province and other provinces.

*Description of the elements considered in mapping*: In mapping the boundaries of the North California Coast GMA we used information on the following elements.

*Spotted Owl Data:*

- We included dense concentrations of spotted owl habitat in the northern portion of the province.
- We also included contiguous dense concentrations of spotted owl habitat in a neighboring portion of the Oregon Klamath Province. Habitat in the included area of the Oregon Klamath Province is better connected to the habitat in this GMA than it is to GMAs or other concentrations of habitat within the Oregon Klamath Province.
- The GMA includes current, recent, and historical spotted owl sites.
- The GMA boundary includes a long segment along the province boundary with the California Klamath Province, allowing for good connectivity with the Northwest California Klamath GMA. Spotted owl habitat is abundant along both sides of most of the boundary.
- To the north of the GMA, forested areas outside of the GMA in the Oregon Klamath Cascades Province may allow for connectivity to the West Oregon Klamath GMA. The adjacent habitat in the Oregon Klamath Province is not within a GMA, but if spotted owls are present, site management could help to promote the exchange of spotted owls between these GMAs.

*Conditions:*

- We considered the availability of access via roads and trails in most of this area.
- We included most public lands in the northern portion of the province.
- South of the California border, the eastern boundary of the GMA follows the province boundary with the California Klamath Province, except that this GMA also includes lands in the California Klamath Province to the east of the Yurok Reservation, and excludes the Hoopa Valley Reservation, which is entirely within the Northwest California Klamath GMA.

*Other Considerations:*

- We excluded developed areas and estuarine floodplains that were largely lacking in spotted owl habitat.
- As discussed above, this GMA includes a large portion of the Green Diamond Study Area, which encompasses an experimental barred owl removal area, as well as a number of other experimental barred owl removal areas. This allows for efficiencies in monitoring and opportunities for additional research. Although the GMA boundaries do not follow study area boundaries, the bulk of the study area is within the GMA.

*Focal Management Areas (FMAs)*

In this GMA, we recommend developing FMAs large enough to support as many spotted owl pair sites as possible, up to 50 pair sites per FMA. Generally, larger blocky areas provide a smaller edge-to-area ratio, and this may help reduce the influx of barred owls from outside the FMA in the future. However, where the landscape or forest conditions do not allow this, smaller or more sinuous FMAs, still encompassing multiple pair areas, may be appropriate. If smaller FMAs are developed due to funding limitations, design them such that they could be expanded in the future if additional funding becomes available.

When possible, include multiple FMAs, generally spaced no farther than 12 to 15 miles apart. Where smaller areas are developed due to topography, forest condition, access, funding limitations, or other reasons, we recommend these be closer together and multiple areas be designed with the intent of encouraging exchange of spotted owls between these smaller areas.

Because of the history of barred owl research and experimental management in parts of this area, additional information may be available regarding areas with higher and lower barred owl influxes, and implementers should refer to this information in FMA development.

Including recently occupied sites in FMAs provides the starting point for development of spotted owl populations as barred owl populations are reduced. In areas where habitat connectivity is limited, site management may help to provide connectivity between smaller FMAs. Coordinate FMA locations with the spotted owl site management described above, with FMA locations in adjacent GMAs, and with any other barred owl management activity, whether or not it is conducted under this Strategy.

*Priorities:* The following are our recommended priorities for defining and selecting FMAs within the North California Coast GMA. The following are in general priority order; however, local expertise will be important in applying these to specific FMA boundary designs.

1. Build FMAs around current occupied spotted owl sites (sites with presence or occupancy of spotted owls within the last year). This provides a nucleus of spotted owls for the potential recolonization of sites within the FMA as barred owl numbers are reduced.

2. Where barred owl removal efforts have already occurred or are ongoing, build FMAs to restore, maintain, or expand those efforts.

3. Focus on areas with reasonable access, in terms of road networks where available, and trail systems where roads do not exist. Avoid large areas without roads or trails. Closed roads may be used like a trail system if they can be safely walked.

4. Consider fire risk in mapping the boundaries of the FMAs. Avoid concentrating FMAs solely in areas identified as having the highest risk of habitat loss to fire; however, some areas with high fire risk may still be important to include in FMAs, particularly where spotted owls are currently present in these areas. Providing connectivity in FMAs from higher risk spotted owl habitat to areas identified as fire refugia and other areas with relatively lower risk will be important, given the varied fire regimes within the California Coast Province. Placement of multiple FMAs within the GMA and inclusion of areas with relatively high resistance to uncharacteristic fire would reduce the risk of complete loss.

5. Place blocks where the best spotted owl habitat remains, and on blocks allowing for the maximum number of spotted owls to be supported. Focus on designating FMAs in areas with the potential for at least 20 spotted owl pairs, though 50 pair sized areas are the target where possible.

6. Include lands of interested and willing landowners or land managers. A focus on areas where landowners have expressed interest in barred owl management will speed the implementation of actual barred owl management and encourage involvement.

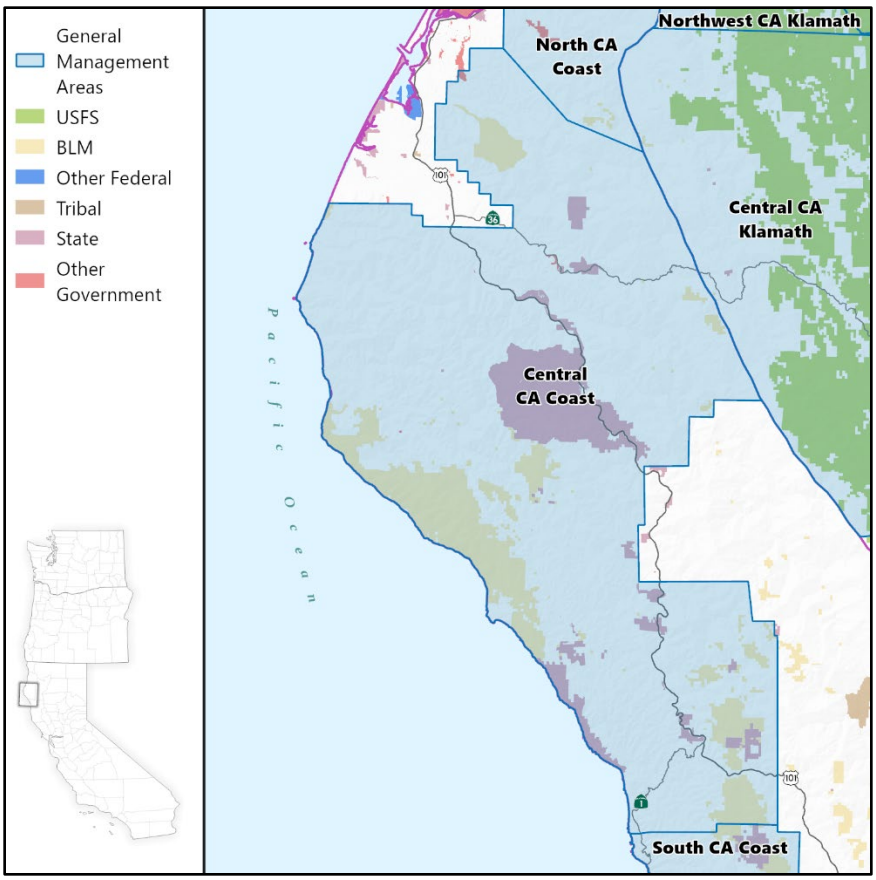
7. Include areas with high-quality historical spotted owl sites (sites with no confirmed occupancy in the last five years or more). Indicators may include, for example, especially good habitat amount, quality, and configuration; a history of good past demographic performance; or a history of long-term occupancy. These are areas that have been shown by past use to be attractive to spotted owls and therefore more likely to be reoccupied as spotted owl populations increase.

8. Consider the potential for connection to other FMAs in the GMA, and to neighboring GMAs, in the California Coast and Klamath Provinces. Placement of FMAs within close proximity to other GMAs, and where there is forest that may provide connectivity to the other GMAs within the Oregon Klamath Province, can connect populations in these areas.

9. Consider the presence of areas already designated for spotted owl habitat management or compatible conservation purposes, such as Late Successional Reserves, Congressionally reserved areas, designated critical habitat, and areas identified as high priorities in the Northern Spotted Owl Recovery Plan. Including these areas provides support for spotted owls and limits impacts on other resources. As many of these have been managed for older

forest over the last decades, and older forest is limited in this landscape, these are likely locations of high-quality habitat.

*A4.9.B.2.b Central California Coast – Priority B*




This GMA borders the North California Coast GMA to the north and the South California Coast GMA to the south. It spans the width of the California Coast in the north, but narrows in the south along the coast. It includes approximately 1,018,973 acres in total, of which 879,473 acres (86 percent) are forest lands and 360,701 acres (35 percent) provide spotted owl nesting and roosting habitat. Land ownership in the area is predominantly private with small amounts of Federal and State lands. Federal lands within this GMA are managed by the Northern California District of the BLM and include the Headwaters Forest Reserve and the King Range National Conservation Area, as well as portions of the South Fork Eel River and Elkhorn Ridge Wilderness Areas. State lands include the Humboldt Redwoods State Park. Forest lands in this GMA are 12 percent Federal lands (BLM), 8 percent State lands, and the remainder primarily in private ownership.

This GMA was mapped for the following reasons:

- It provides connectivity between the Central California Klamath GMA in the adjacent province, the North California Coast GMA, and the South California Coast GMA.
- It includes relatively contiguous large patches of spotted owl habitat and older forest cover.
- There are ongoing barred owl removal research efforts in portions of the GMA which can be continued and expanded. Barred owl removal research currently occurs on BLM lands in the Headwaters Forest Reserve and the King Range National Conservation Area, and on or near Sierra Pacific Industries lands as part of their HCP.
- California Department of Fish and Wildlife's Barred Owl Science Team has identified the Humboldt Redwoods State Park as a priority area for barred owl removal in its interim removal strategy.
- The Central California Coast GMA includes a small portion of the Northwestern California Demography Study Area, with its historical and recent spotted owl data. The Northwest Forest Plan Effectiveness Monitoring program includes passive acoustic monitoring sampling 20 percent of the Northwestern California study area. Additionally, Sierra Pacific

Industries conducts monitoring as a component of their HCP. These monitoring programs will provide additional future data on both spotted and barred owls, and allow for efficiencies in monitoring barred owl removal and its effects on spotted owls.

This GMA is assigned Priority B. Block management within this GMA has good potential to slow or halt population declines, especially where it extends current scientific barred owl removal efforts. Site management around currently occupied sites within this GMA remains a Priority A action, but additional management outside of these sites is likely to increase the effectiveness of management. Portions of the area are relatively well-surveyed and accessible, which allows for relatively rapid implementation of barred owl management, especially where barred owl removal research is already ongoing. However, extirpations over large areas are not imminent here, and the potential for this area to become a source population is also lower here than in the more strategically located North California Coast GMA. Therefore, block management in this GMA is less urgent, and meets the description of a Priority B action.

*Description of the elements considered in mapping:* In mapping the boundaries of the Central California Coast GMA we used information on the following elements.

*Spotted Owl Data:*

- We included dense concentrations of spotted owl habitat in the central portion of the province.
- The GMA includes current, recent, and historical spotted owl sites.
- The GMA boundary includes a segment along the province boundary with the California Klamath Province, allowing for good connectivity with the Central California Klamath GMA. Spotted owl habitat is present along both sides of the boundary.
- We excluded some areas of patchy spotted owl habitat, which reflect patchy distribution of forest lands, to the east, mainly along the Eel River drainage.

*Conditions:*

- This GMA includes areas where access may be difficult, such as wilderness areas, especially in the western portion of the GMA. This should be considered during development of the Focal Management Area boundaries.
- We included some areas of public lands, in spite of slightly lower spotted owl habitat density, but we excluded other areas of public lands where habitat and forest lands were very patchy or the public lands were small, isolated parcels.

*Other Considerations:*

- We excluded non-forest valley bottoms, estuarine floodplains, and developed areas.
- As discussed above, this GMA includes a small portion of the Northwestern California study area, and barred owl research is carried out in an area managed and monitored under an HCP. This allows for efficiencies in monitoring and opportunities for research. However, the GMA boundaries do not follow the study area or HCP area boundaries, and include relatively small portions of each area.

*Focal Management Areas (FMAs)*
In this GMA, we recommend developing FMAs large enough to support as many spotted owl pair sites as possible, up to 50 pair sites per FMA. Generally, larger blocky areas provide a smaller edge-to-area ratio, and this may help reduce the influx of barred owls from outside the FMA in the future. However, where the landscape or forest conditions do not allow this, smaller or more sinuous FMAs, still encompassing multiple pair areas, may be appropriate. If smaller FMAs are developed due to funding limitations, design them such that they could be expanded in the future if additional funding becomes available.

When possible, include multiple FMAs, generally spaced no farther than 12 to 15 miles apart. Where smaller areas are developed due to topography, forest condition, access, funding limitations, or other reasons, we recommend these be closer together and multiple areas be designed with the intent of encouraging exchange of spotted owls between these smaller areas.

Because of the history of barred owl research and experimental management in parts of this area, additional information may be available regarding areas with higher and lower barred owl influxes, and implementers should refer to this information in FMA development.

Including recently occupied sites in FMAs provides the starting point for development of spotted owl populations as barred owl populations are reduced. In areas where habitat connectivity is limited, site management may help to provide connectivity between smaller FMAs. Coordinate FMA locations with the spotted owl site management described above, with FMA locations in adjacent GMAs, and with any other barred owl management activity, whether or not it is conducted under this Strategy.

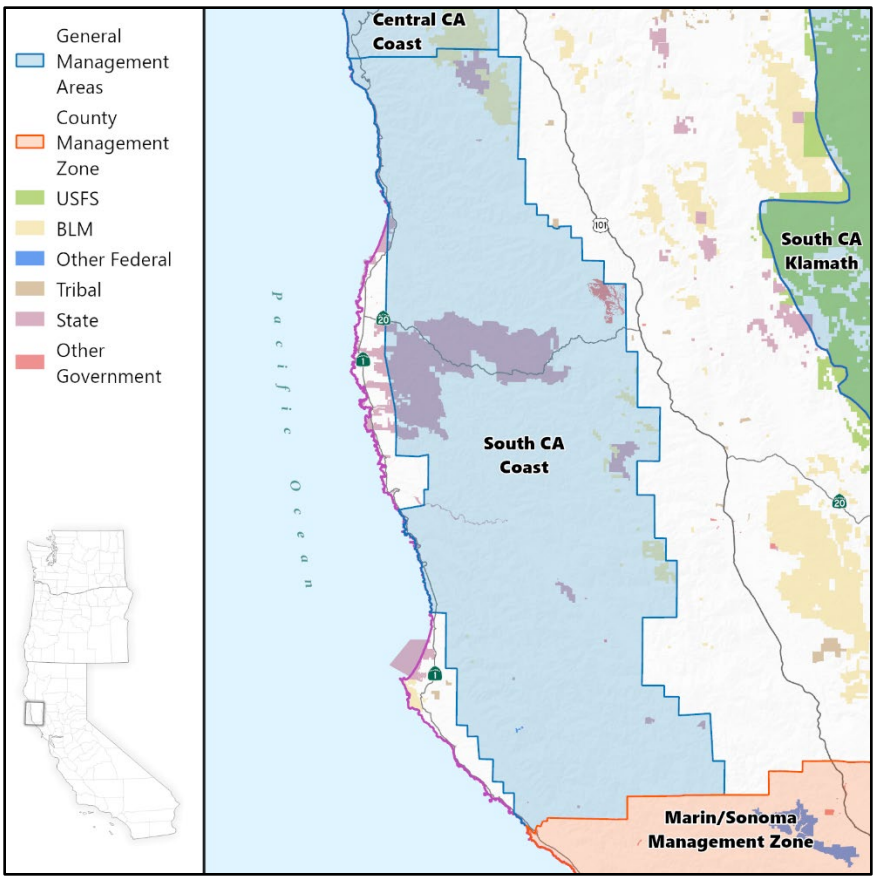
*Priorities:* The following are our recommended priorities for defining and selecting FMAs within the California Coast GMA. The following are in general priority order; however, local expertise will be important in applying these to specific FMA boundary designs.

1. Build FMAs around current occupied spotted owl sites (sites with presence or occupancy of spotted owls within the last year). This provides a nucleus of spotted owls for the potential recolonization of sites within the FMA as barred owl numbers are reduced.
2. Where barred owl removal efforts have already occurred or are ongoing, build FMAs to restore, maintain, or expand those efforts.
3. Focus on areas with reasonable access, in terms of road networks where available, and trail systems where roads do not exist. Avoid large areas without roads or trails. Closed roads may be used like a trail system if they can be safely walked.
4. Place FMAs first in areas with moderate to high barred owl densities. In areas with lower barred owl densities, spotted owl site management may be adequate, or if not, FMAs may be expanded to these areas after the initial effort.
5. Consider fire risk in mapping the boundaries of the FMAs. Avoid concentrating FMAs solely in areas identified as having the highest risk of habitat loss to fire; however, some areas with high fire risk may still be important to include in FMAs, particularly where spotted owls are currently present in these areas. Providing connectivity in FMAs from higher risk spotted owl habitat to areas identified as fire refugia and other areas with relatively lower risk will be

important, given the varied fire regimes within the California Coast Province. Placement of multiple FMAs within the GMA and inclusion of areas with relatively high resistance to uncharacteristic fire would reduce the risk of complete loss.

6. Place blocks where the best spotted owl habitat remains, and on blocks allowing for the maximum number of spotted owls to be supported. Focus on designating FMAs in areas with the potential for at least 20 spotted owl pairs, though 50 pair sized areas are the target where possible.
7. Include lands of interested and willing landowners or land managers. A focus on areas where landowners have expressed interest in barred owl management will speed the implementation of actual barred owl management and encourage involvement.
8. Include areas with high-quality historical spotted owl sites (sites with no confirmed occupancy in the last five years or more). Indicators may include, for example, especially good habitat amount, quality, and configuration; a history of good past demographic performance; or a history of long-term occupancy. These are areas that have been shown by past use to be attractive to spotted owls and therefore more likely to be reoccupied as spotted owl populations increase.
9. Consider the potential for connection to other FMAs in the GMA, and to neighboring GMAs in the California Coast and California Klamath Provinces. Placement of FMAs within close proximity to other GMAs, and where there is forest that may provide connectivity California Klamath Province, can connect populations in these areas.
10. Consider the presence of areas already designated for spotted owl habitat management or compatible conservation purposes, such as Late Successional Reserves, Congressionally reserved areas, designated critical habitat, and areas identified as high priorities in the Northern Spotted Owl Recovery Plan. Including these areas provides support for spotted owls and limits impacts on other resources. As many of these have been managed for older forest over the last decades, and older forest is limited in this landscape, these are likely locations of high-quality habitat.

*A4.9.B.2.c. South California Coast GMA – Priority B*




The South California Coast GMA is contiguous with the Central California Coast GMA in the north, and extends to the northern border of Sonoma County. It includes approximately 802,450 acres in total, of which 738,184 acres (92 percent) are forest lands and 328,981 acres (41 percent) provide spotted owl nesting and roosting habitat. There is very little public forest land, with 89 percent of forest land in private ownership. Forest lands in this GMA are 2 percent Federal lands and 9 percent State lands. Federal lands are managed by the Northern California District of BLM. State lands include the Jackson Demonstration State Forest and Mendocino Headlands State Park.

This GMA was mapped for the following reasons:

- It includes a dense area of spotted owl habitat running north and south near the coast.
- It provides connectivity north and south within the California Coast Province.
- There are ongoing barred owl removal research efforts in portions of the GMA which can be continued and expanded. Barred owl removal research currently occurs on the Jackson State Forest and Mendocino State Parks.
- California Department of Fish and Wildlife's Barred Owl Science Team has identified the Humboldt Redwoods State Park as a priority area for barred owl removal in its interim removal strategy.
- Barred owl management here is intended to slow southward barred owl movements into Sonoma and Marin Counties, where barred owl densities are currently low.

This GMA is assigned Priority B. Block management within this GMA has good potential to slow or halt population declines, especially where it extends current scientific barred owl removal efforts. Block management in this GMA is also intended to stem barred owl movements into areas to the south, thereby preventing population declines in the Marin County spotted owl population. Site management around currently occupied sites within this GMA remains a Priority A action, but additional management outside of these sites is likely to increase the effectiveness of management. Portions of the area are relatively well-surveyed and accessible, which allows

for relatively rapid implementation of barred owl management, especially where barred owl removal research is already ongoing. However, extirpations over large areas are not imminent here, and the potential for this area to become a source population is also lower here than in the more strategically located North California Coast GMA. Therefore, block management in this GMA is less urgent, and meets the description of a Priority B action.

*Description of the elements considered in mapping:*
In mapping the boundaries of the South California Coast GMA we used information on the following elements.

*Spotted Owl Data:*

- We included dense concentrations of spotted owl habitat in the southern portion of the province (north of Sonoma County).
- This GMA occupies one portion of a continuous area of habitat that continues north into the Central California Coast GMA and south into Sonoma County.
- The GMA includes current, recent, and historical spotted owl sites.
- We excluded areas of patchy habitat, which reflect patchy distribution of forest lands, to the east along the Eel River and Russian River drainages.

*Conditions:*

- Lands in this GMA are predominantly privately owned, with only small areas of public lands managed by Federal, State, or local agencies.

*Other Considerations:*

- We excluded non-forest valley bottoms and developed areas.
- As discussed above, this GMA includes current barred owl removal research areas. However, the GMA boundaries do not follow research area boundaries and may not include all areas where research currently occurs.

*Focal Management Areas (FMAs)*
In this GMA, we recommend developing FMAs large enough to support as many spotted owl pair sites as possible, up to 50 pair sites per FMA. Generally, larger blocky areas provide a smaller edge-to-area ratio, and this may help reduce the influx of barred owls from outside the FMA in the future. However, where the landscape or forest conditions do not allow this, smaller or more sinuous FMAs, still encompassing multiple pair areas, may be appropriate. If smaller FMAs are developed due to funding limitations, design them such that they could be expanded in the future if additional funding becomes available.

When possible, include multiple FMAs, generally spaced no farther than 12 to 15 miles apart. Where smaller areas are developed due to topography, forest condition, access, funding limitations, or other reasons, we recommend these be closer together and multiple areas be designed with the intent of encouraging exchange of spotted owls between these smaller areas.

Because of the history of barred owl research and experimental management in parts of this area, additional information may be available regarding areas with higher and lower barred owl influxes, and implementers should refer to this information in FMA development.

Including recently occupied sites in FMAs provides the starting point for development of spotted owl populations as barred owl populations are reduced. In areas where habitat connectivity is limited, site management may help to provide connectivity between smaller FMAs. Coordinate FMA locations with the spotted owl site management described above, with FMA locations in adjacent GMAs, and with any other barred owl management activity, whether or not it is conducted under this Strategy.

*Priorities:* The following are our recommended priorities for defining and selecting FMAs within the South California Coast GMA. The following are in general priority order; however, local expertise will be important in applying these to specific FMA boundary designs.

1. Include lands of interested and willing landowners or land managers. A focus on areas where landowners have expressed interest in barred owl management will speed the implementation of actual barred owl management and encourage involvement.
2. Where barred owl removal efforts have already occurred or are ongoing, build FMAs to restore, maintain, or expand those efforts.
3. Build FMAs around current occupied spotted owl sites (sites with presence or occupancy of spotted owls within the last year). This provides a nucleus of spotted owls for the potential recolonization of sites within the FMA as barred owl numbers are reduced.
4. Place FMAs first in areas with moderate to high barred owl densities. In areas with lower barred owl densities, spotted owl site management may be adequate, or if not, FMAs may be expanded to these areas after the initial effort.
5. Focus on areas with reasonable access, in terms of road networks where available, and trail systems where roads do not exist. Avoid large areas without roads or trails. Closed roads may be used like a trail system if they can be safely walked.
6. Consider fire risk in mapping the boundaries of the FMAs. Avoid concentrating FMAs solely in areas identified as having the highest risk of habitat loss to fire; however, some areas with high fire risk may still be important to include in FMAs, particularly where spotted owls are currently present in these areas. Providing connectivity in FMAs from higher risk spotted owl habitat to areas identified as fire refugia and other areas with relatively lower risk will be important, given the varied fire regimes within the California Coast Province. Placement of multiple FMAs within the GMA and inclusion of areas with relatively high resistance to uncharacteristic fire would reduce the risk of complete loss.
7. Place blocks where the best spotted owl habitat remains, and on blocks allowing for the maximum number of spotted owls to be supported. Focus on designating FMAs in areas with the potential for at least 20 spotted owl pairs, though 50 pair sized areas are the target where possible.
8. Include areas with high-quality historical spotted owl sites (sites with no confirmed occupancy in the last five years or more). Indicators may include, for example, especially

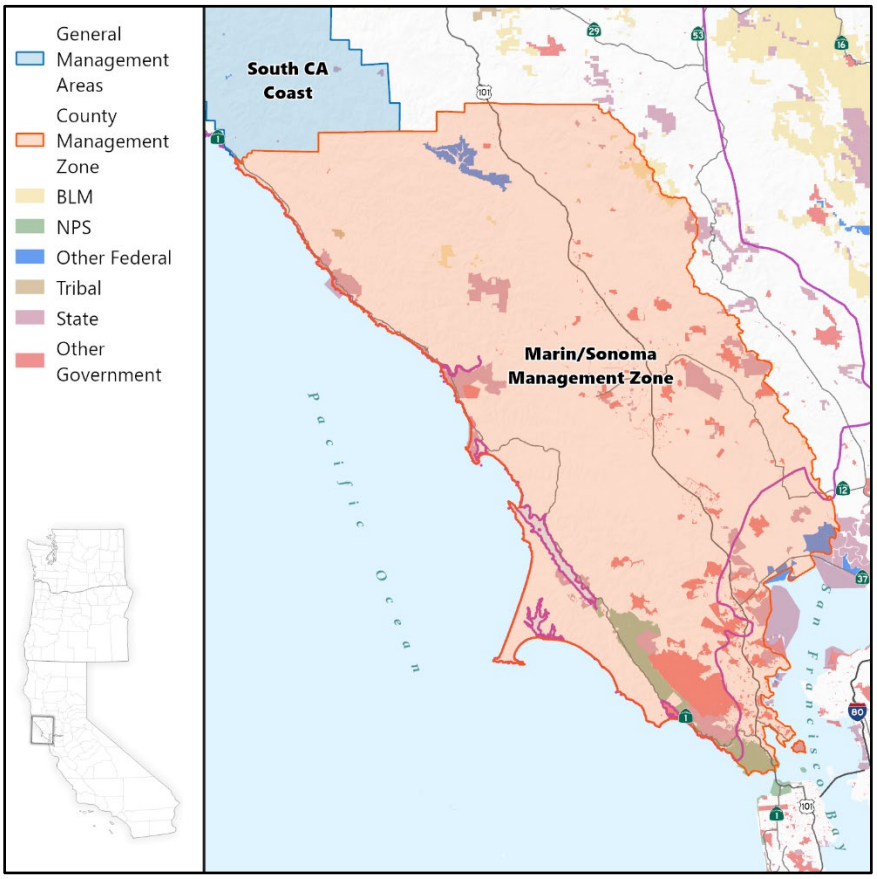
good habitat amount, quality, and configuration; a history of good past demographic performance; or a history of long-term occupancy. These are areas that have been shown by past use to be attractive to spotted owls and therefore more likely to be reoccupied as spotted owl populations increase.

9. Consider the potential for connection to other FMAs in the GMA, and to the Central California Coast GMA. Placement of FMAs within close proximity to the neighboring GMA, and where there is forest that may provide connectivity to Sonoma County or the California Klamath Province, can connect populations in these areas.

10. Consider the presence of areas already designated for spotted owl management and compatible conservation purposes, such as Late Successional Reserves, Congressionally reserved areas, designated critical habitat, and areas identified as high priorities in the Northern Spotted Owl Recovery Plan. Including these areas provides support for spotted owls and limits impacts on other resources. As many of these have been managed for older forest over the last decades, and older forest is limited in this landscape, these are likely locations of high-quality habitat.

## A4.9.B.3 Special Designated Areas

*A4.9.B.3.a Marin/Sonoma Management Zone – Priority A*




The Marin/Sonoma Management Zone consists of the entirety of Marin County and Sonoma County. It includes approximately 1,365,201 acres in total, of which 587,434 acres (43 percent) are forest lands and 114,105 acres (8 percent) provide spotted owl nesting and roosting habitat. Conditions in Marin and Sonoma Counties are substantially different than in the rest of the northern spotted owl range. Barred owls are present in small numbers and have not yet established significant populations, and many of the individual barred owls that have reached this area have been removed for research purposes. Although the spotted owl population appears to be stable, the remaining spotted owl habitat is found in blocks of limited size managed by a variety of agencies and landowners, including the National Park Service (Point Reyes National Seashore, Muir Woods National Monument, and the Golden Gate National Recreation Area), BLM (Central California District), California Department of Parks and Recreation (Sonoma Coast State Park, Salt Point State Park, Fort Ross State Historic Park, Austin Creek State Recreation Area), the Marin Municipal Water District, Marin County Open Space District, Sonoma County Agricultural Preservation and Open Space District, as well as private lands. Forest lands in this Management Zone are 3 percent Federal lands (mainly National Park Service and BLM), 5 percent State lands, 5 percent local public lands, and the remainder primarily in private ownership.

This Management Zone was mapped for the following reasons:

- Barred owls are present here in small numbers and have not yet established significant populations.
- Previous and ongoing scientific barred owl collections in this area have contributed to the current small number of barred owls here.
- A relatively stable, but isolated, spotted owl population is present in Marin County.
- It encompasses the southernmost extent of the northern spotted owl range.

The Marin/Sonoma Management Zone is assigned Priority A. The spotted owl population in Marin County is more stable than spotted owl populations elsewhere in the range, likely in large part due to the smaller barred owl influence. Immediate action to prevent further barred owl invasion of this area will secure the Marin County spotted owl population as a refuge. Removal of barred owls now, while the population is small, will avert the need for the more extensive and expensive future action needed elsewhere in the northern spotted owl range.

*Description of the elements considered in mapping:* In mapping the boundaries of the South Marin/Sonoma Management Zone, we used information on the following elements.

*Spotted Owl Data:*

- This area includes current, recent, and historical sites, including a number of long-term occupied sites.
- Spotted owl habitat is present in limited quantities and its distribution is patchy due to vegetation communities, agriculture, and developed areas. This Zone includes many areas without spotted owl habitat.

*Conditions:*

- We did not try to exclude developed areas, where barred owl management may be difficult due to the proximity to human dwellings, as well as the number and variety of different landowners and land managers.

*Other Considerations:*

- The boundaries of this Zone follow the Marin County and Sonoma County boundaries.
- As discussed above, barred owl removal research is currently being carried out in a portion of this area.

*Management Recommendations for the Marin/Sonoma Management Zone*
Our management focus in this area is on preventing barred owls from becoming established and displacing the remaining spotted owls. Therefore, we recommend surveillance monitoring to detect the presence of barred owls in this Zone, and all barred owls should be removed from the lands of willing landowners and land managers anywhere within these counties when they are detected, regardless of proximity to current, recent, or historical spotted owl sites.

We recommend monitoring similar to the monitoring recommended in the California spotted owl range and potential invasion pathways (see section A4.12). Those implementing the Strategy should make use of all existing data sources that include information on barred owl detections, continue existing monitoring efforts (for example, passive acoustic monitoring associated with the Northwest Forest Plan Effectiveness Monitoring), and expand monitoring efforts to areas not covered by current programs. As in the California spotted owl range, develop an interactive database and rapid-response system to collate all barred owl detections that are identified through ongoing demographic and research projects, project-level management surveys, and anecdotal observations within Marin and Sonoma Counties. Develop an interagency database where records can be submitted that can facilitate a rapid-response follow-up to any detection.

Develop a web-based portal where individuals outside of agencies may voluntarily provide data on locations of barred owls in this area, including educational and outreach material to encourage its use by the general public. Conduct lethal removal of all barred owls located on surveys or otherwise identified in this Zone as soon as practicable from the lands of willing landowners and land managers. This may include capture and euthanasia in areas where firearms may not be used. Establish and maintain response team capacity so that follow-up surveys and lethal removals can be conducted as soon as possible following reports of barred owl detections.

If barred owls begin invading this area more rapidly than they can be removed, development of block management areas may also be beneficial for the spotted owl population here. Depending on the density of barred owls at any given time and the available funding to carry out barred owl management, block management could include a block covering large portions of the Management Zone. However, the land ownership pattern may make large block management difficult in some areas. If barred owl densities become very high or funding is very limited, we recommend a FMA approach similar to that used in other portions of the northern spotted owl range.

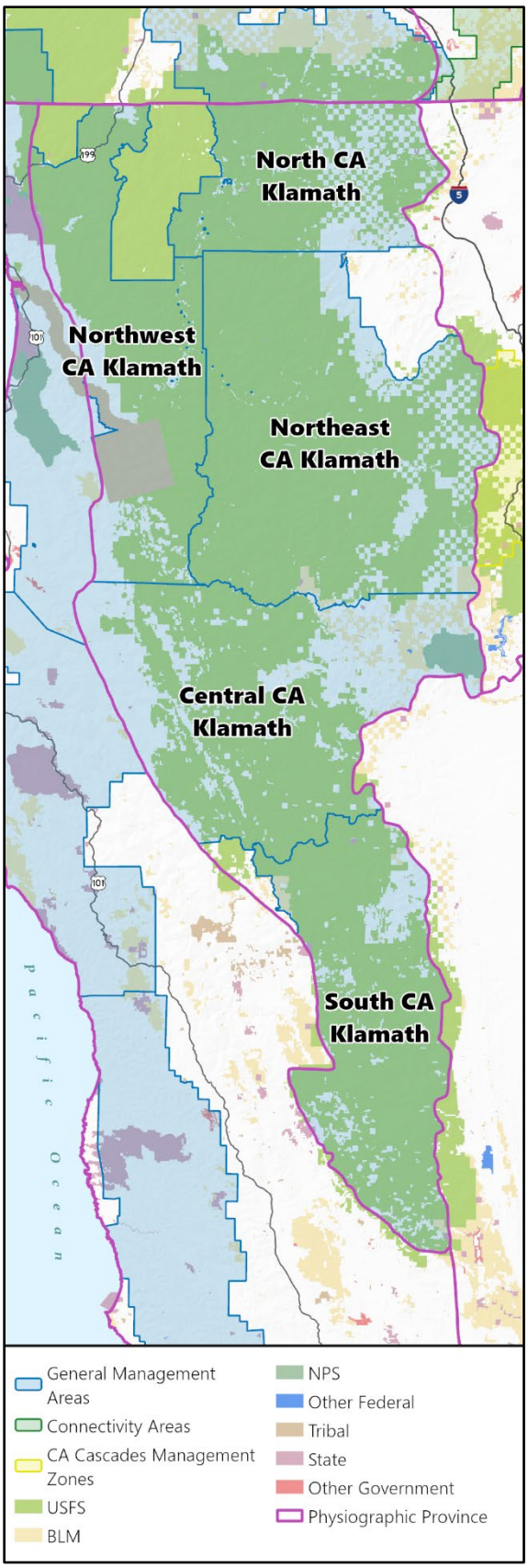
We recommend developing FMAs large enough to support as many spotted owl pair sites as possible, up to 50 pair sites per FMA. Due to ownership patterns, in some parts of this Zone, the maximum practicable FMA size may be much smaller than a 50 pair area, and in these areas management of smaller clusters of sites may be more feasible than block management. Generally, larger blocky areas provide a smaller edge-to-area ratio, and this may help reduce the influx of barred owls from outside the FMA in the future, so when large blocks are not practicable, smaller blocks are preferable to scattered sites. We recommend these small FMAs be located less than 12 miles apart and multiple areas be designed with the intent of encouraging exchange of spotted owls between these smaller areas. Where possible, when setting up smaller FMAs, design them such that they could be expanded in the future if funding becomes available.

In areas where habitat connectivity is limited, site management may help to provide connectivity between smaller FMAs. Coordinate FMA locations with the spotted owl site management described above, with FMA locations in the adjacent South California Coast GMA, and with any other barred owl management activity, whether or not it is conducted under this Strategy.

*Priorities:* The following are our recommended priorities for defining and selecting FMAs within the Marin/Sonoma Management Zone. The following are in general priority order; however, local expertise will be important in applying these to specific FMA boundary designs.

1. Include lands of interested and willing landowners or land managers. A focus on areas where landowners have expressed interest in barred owl management will speed the implementation of actual barred owl management and encourage involvement.
2. Where barred owl removal efforts have already occurred or are ongoing, build FMAs to restore, maintain, or expand those efforts.
3. Build FMAs around current occupied spotted owl sites (sites with presence or occupancy of spotted owls within the last year).

4. Place FMAs first in areas with moderate to high barred owl densities. In areas with lower barred owl densities, spotted owl site management may be adequate, or if not, FMAs may be expanded to these areas after the initial effort.
5. Focus on areas with reasonable access, in terms of road networks where available, and trail systems where roads do not exist. Avoid large areas without roads or trails. Closed roads may be used like a trail system if they can be safely walked.
6. Consider fire risk in mapping the boundaries of the FMAs. Avoid concentrating FMAs solely in areas identified as having the highest risk of habitat loss to fire; however, some areas with high fire risk may still be important to include in FMAs, particularly where spotted owls are currently present in these areas. Providing connectivity in FMAs from higher risk spotted owl habitat to areas identified as fire refugia and other areas with relatively lower risk will be important, given the varied fire regimes within the California Coast Province. Placement of multiple FMAs within the Management Zone and inclusion of areas with relatively high resistance to uncharacteristic fire would reduce the risk of complete loss.
7. Place blocks where the best spotted owl habitat remains, and on blocks allowing for the maximum number of spotted owls to be supported. Focus on designating FMAs in areas with the potential for at least 20 spotted owl pairs, though 50 pair sized areas are the target where possible.
8. Include areas with high-quality spotted owl sites, regardless of current occupancy status. Indicators may include, for example, especially good habitat amount, quality, and configuration; a history of good past demographic performance; or a history of long-term occupancy.
9. Consider the presence of areas already designated for spotted owl habitat management and compatible conservation purposes, such as Congressionally reserved areas, designated critical habitat, and areas identified as high priorities in the Northern Spotted Owl Recovery Plan. Including these areas provides support for spotted owls and limits impacts on other resources. As many of these have been managed for older forest over the last decades, and older forest is limited in this landscape, these are likely locations of high-quality habitat.




# A4.10 California Klamath Province

## A4.10.A Background

This physiographic province for the northern spotted owl is the largest in California, encompassing approximately six million acres. It extends from the Oregon border south through the Mendocino Range to the Clear Lake Basin. It lies between the California Coast and California Cascades Provinces and is bordered to the north by the Oregon Klamath Province.

Land management is primarily Federal (Forest Service, BLM, and National Park Service). There are several moderate to large-sized wilderness areas in the western extent on Forest Service lands. Private industrial timberlands are also intermixed, resulting in an extensive checkerboard ownership pattern throughout the eastern extent of the province. In addition, there are numerous non-industrial timber land managers and private landowners. Forest lands in the province are 78 percent Federal lands, 2 percent Tribal lands, and the remainder primarily in private ownership.

The forest landscapes in this province are unique due to complex interactions among topography, biomes (e.g., forests, grasslands), forest and vegetation types, and regional climate. Steep, dissected topography dominates much of this landscape, generally resulting in more flammable fuels on southwest aspects and in upper slope positions, where more severe fires occur (Taylor and Skinner 1998, pp. 291-292). Winters are cool and wet, and summers are hot and dry. These conditions result in productive forests that historically experienced frequent low and mixed-severity fires of various sizes. Forests on the east side of the province are more fragmented, and characterized by a checkerboard of Federal and private ownerships where management regimes have exacerbated fragmentation.

### A4.10.A.1 Spotted Owl Condition in the California Klamath Province

Based on an assessment of habitat conditions after the 2023 wildfire season, there are approximately 1.2 million acres of spotted owl nesting and roosting habitat and 626,524 acres of marginal spotted owl habitat in the California Klamath Province on Federal lands (Davis et al. 2024a). The monitoring of spotted owl nesting and roosting conditions shows a flat trend, with losses of nesting and roosting forest balanced by ingrowth, between 1986 and 2017, though habitat fragmentation increased during that period (Davis et al. 2022, p. 15). However, there has been a series of large mixed-severity fires between 2014 and 2023. Several high-severity fires occurred in 2020. The recent fires have reduced the amount of habitat from that reported for 2017.

Spotted owls in this region are associated with landscapes containing mosaics of vegetation types. Occupied sites, in particular, show a high degree of vegetative heterogeneity with more variable patch sizes and more perimeter edge than other regions (Franklin and Gutiérrez 2002, p. 212). In the Klamath region, ecotones, or edges between older forests and other seral stages, likely contribute to improved access to prey, particularly dusky-footed woodrats (Franklin and Gutiérrez 2002, p. 215). Dusky-footed woodrats are the primary prey consumed in this province, with flying squirrels as the secondary prey species and some contributions from other species, such as red tree voles and brush rabbits, depending on location (Farber and Whitaker 2005, p. 9; Ward et al. 1998, p. 85; White 1996, p. 235; Solis 1983, pp. 58-61).

The California Klamath Province includes most of the Northwestern California Demography Study Area, as well as the study area associated with the Hoopa Valley Reservation, both of which provide information regarding spotted owl population status and trend in the province. The Northwestern California study area includes long-term monitoring at spotted owl sites distributed across the northern and central portions of the province, as well as a larger, contiguous monitoring area adjacent to the Hoopa Valley Reservation along the western central portion of the province.

The Northwestern California study area provides data on spotted owl populations since 1985. Spotted owl occupancy within the Northwestern California study area dropped from 75 percent in 1993 to 38 percent in 2018, reflecting an approximately 3 percent annual rate of population decline (Davis et al. 2022, p. 37; Franklin et al. 2021, pp. 11-13). In 2021, call-playback surveys detected spotted owls at 21 percent of the surveyed historical sites, including pairs at 20 percent of surveyed sites (Franklin et al. 2022, pp. 7, 18). The 2021 values represent raw data, and the 2018 results are corrected for imperfect detection, so these percentages are not directly comparable. Passive acoustic monitoring has been conducted at the Northwestern California study area since 2021, with spotted owl detections at 77 percent of sample units (hexagons) in 2021 and at 73 percent in 2022 (Lesmeister et al. 2023, p. 17). These percentages are not directly comparable with 2018 or 2021 results, because they were obtained using different methods.

The Hoopa Valley study area provides data on spotted owl populations since 1992. Spotted owl occupancy within the Hoopa Valley Reservation study area dropped from 92 percent in 1993 to 55 percent in 2018 (C. Yackulic 2023, pers. comm.). In 2022, call-playback surveys detected spotted owls at 40 percent of the historical sites, including pairs at 30 percent of surveyed sites

(Higley 2022, p. 5). The 2022 results represent raw data, and the 2018 results are corrected for imperfect detection, so these percentages are not directly comparable.

In 2014, modeling of rangewide population dynamics indicated that the northern spotted owl population in the province was a source population for the range, with a critical role in overall population stability (Schumaker et al. 2014, p. 587). Although the Northwestern California study area now indicates that the population is declining by nearly 3 percent per year, this is the slowest rate of decline among all of the long-term study areas. At the Hoopa Valley Reservation study area, where experimental barred owl removal began in 2013, the rate of population change now appears to be positive. Although spotted owl populations are depleted in this province, they appear to be in better condition than northern spotted owl populations in most other parts of the range, and likely have the capacity to recover more quickly.

### A4.10.A.2 Barred Owl Condition in the California Klamath Province

There are no barred owl population size or trend estimates available, but various studies in the province provide relevant information regarding barred owl population status. Barred owls were first detected in the Northwestern California Demography Study Area in 1991, with the first nesting pair detected in 1999 (Franklin et al. 2022, p. 10). Their numbers in the province have steadily increased as their apparent southward and eastward migration from the California Coast province has progressed (Franklin et al. 2021, pp. 11-17; Franklin et al. 2022, pp. 10, 12, 24, 29 ). Based on the results from consistent barred owl-specific surveys, the estimated number of barred owl sites within the study area quadrupled between 2009 and 2019. In 2021, 56 percent of spotted owl territories in the Northwestern California study area had barred owl detections (Franklin et al. 2022, pp. 10, 24).

At the Hoopa Valley study area, barred owl detections gradually increased between 1992 and 2005, and then rapidly increased between 2005 and 2013 (Higley 2022, p. 17). By 2013 barred owls occupied 60 percent of spotted owl sites in the study area, and had been detected at some point between 2008 and 2013 in 90 percent of all historical spotted owl sites in the study area (Higley 2023, p. 4). Barred owl removals occurred beginning in 2013, and between 2016 and 2021, all barred owls removed were colonizers, meaning that they came from outside of the study area and had not previously held a territory within the study area (Higley 2023, p. 28).

Based on the information from the study areas, it appears that barred owl densities continue to increase in the province, with an observed trend in population movement from the California Coast Province along the Trinity and Klamath Rivers to areas inland. Project-level survey detections on Forest Service lands in the northern portion of the province have increased over the last five years (J. Allen, pers. comm., January 11, 2023). Similar trends may be occurring in the southern portion of the province on the Mendocino National Forest. Map A4-1 shows known barred owl occurrence data for the province.

Barred owl removal experiments have been ongoing since 2013 on the Hoopa Valley Reservation and on Sierra Pacific Industries lands since 2014. A barred owl removal experiment on the Yurok Indian Reservation, which extends into this province along the Klamath River, began in 2023.

## A4.10.B Management Strategy

### A4.10.B.1 Spotted Owl Site Management in the California Klamath Province

*A4.10.B.1.a Background*

Maintaining the existing spotted owl population to the maximum extent possible will provide for greater potential for recruitment and population expansion. Because some areas of this province have not been surveyed consistently in recent years, we recommend surveys of historically active sites, particularly those that have been active within the last 10 years and have not undergone major habitat loss since the last known spotted owl activity.

In some cases, managed sites may eventually be incorporated into block management areas. In other cases, site management of single sites or clusters of sites may be an appropriate long-term action, if larger blocks of habitat are not available for management due to landscape or ownership conditions, or in areas where site management promotes connectivity between block management areas or between provinces.

- Managing barred owls in occupied spotted owl sites is intended to help retain the existing population and increase the potential for recruitment of young.
- Managing barred owls in occupied spotted owl sites may enable those sites to provide a source of young for recolonization of nearby management blocks.
- Managing barred owls in spotted owl sites distributed across the province, whether in block management areas or not, may reduce the risk of losing spotted owls in the province from catastrophic events, such as wildfire, by maintaining site occupancy across the area.
- Managing spotted owl sites also provides an opportunity for maintaining spotted owls in areas where block management is not feasible or recommended. This approach applies across the entire province, whether or not the locations are in a GMA.
- Managing spotted owl sites in close proximity to other barred owl removal areas, whether those removal areas are part of this Strategy or other programs (e.g., scientific experiments), will create efficiencies by reinforcing and expanding zones of reduced barred owl density.
- These spotted owl sites may serve to increase connectivity between and within block management areas, and provide sites in the vicinity of block management areas that can interact at a demographic level. This is particularly important in the northern and northwestern portions of the California Klamath province where demographic connectivity with the California Coast and Oregon Klamath Provinces is possible.
- Site management for spotted owls, due to its smaller size when compared to block management, also provides a wider range of options for landowner contribution to barred owl management, particularly for smaller landowners. The smaller size also makes site management suitable for areas where there are not large amounts of spotted owl habitat due to terrain, or extensive loss of habitat from wildfires, harvest, or other disturbances.

*Selection of Spotted Owl Sites for Management*

Although reduced from its historical numbers by both land management actions (timber harvest) and large, intense wildfires between 2014 and 2023, the spotted owl population in the California Klamath Province retains a comparatively large number of occupied territories, relative to the

northern portion of the range. The focus of spotted owl site management in the province is primarily on currently active sites, to provide existing spotted owls relief from competitive pressure, and secondarily, on recently active sites, where recolonization of sites after barred owl removal is more likely. This is reflected in the priorities for site management.

*Spotted Owl Site Management Priorities*

| Priority | Spotted Owl Site Condition |
|---|---|
| A | Currently active sites, including all areas with any spotted owl detections within the last year |
| B | Recently active sites, including all areas where the most recent spotted owl detection was between 1 and 5 years ago |
| C | Historically occupied spotted owl sites (pair or single) with last detection between 5 and 10 years ago |
| D | Historically occupied spotted owl sites (pair or single) with last detection more than 10 years ago, and potential sites with adequate habitat but no known history of spotted owl occupancy, and without detections within the last 5 years |

*Other considerations for selection of spotted owl sites for management:*

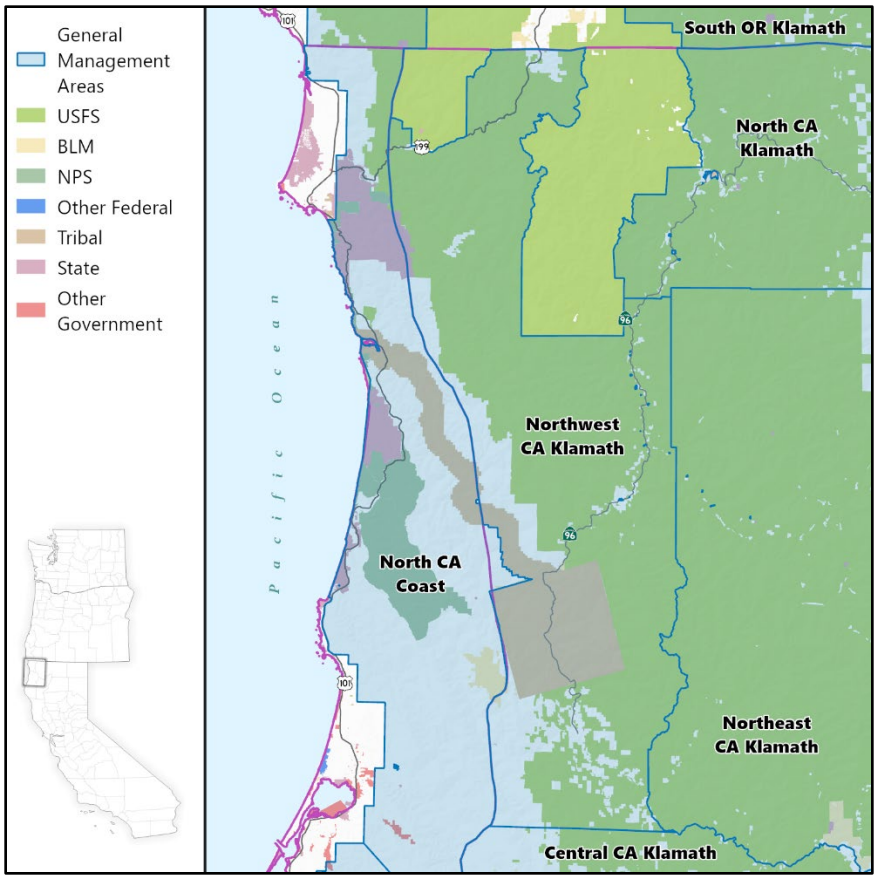
- We recommend consideration of the following factors when selecting among sites within a priority category. Focus first on spotted owl sites with recent occupancy by pairs, then singles, then detections.
- Consider past reproductive history of the site. Select sites with a history of reproduction on the site where surveys are available.
- Consider the condition of habitat in the area, particularly loss of habitat since the last surveys. All other things being equal, select sites with abundant high-quality habitat. Spotted owl sites that have lost substantial amounts of habitat to fire, harvest, insect damage, or other disturbances, may be lower priority.

*A4.10.B.1.b Management Recommendations*

Within each individual site, remove barred owls from an area between 7,645 and 13,592 acres. This represents the area in a circle of 1.5 and 2 home range radii (Table 2). This can be distributed in a circle around the activity center, or implementers can use local knowledge, topography, and habitat condition to design a non-circular area of the appropriate size that provides the best conditions for barred owl management. In areas where spotted owl sites are isolated, and particularly for sites in Priority A condition (see table above), we recommend a larger management area, up to 30,582 acres (3 home range radii). Where sites are not isolated, applying site management to clusters of two or more sites in close proximity is likely to provide more efficient management conditions and increased benefits for spotted owls present in those sites.

## A4.10.B.2 General Management Areas in the California Klamath Province

*A4.10.B.2.a Northwest California Klamath GMA – Priority A*




The Northwest California Klamath GMA includes approximately 928,156 acres in total, of which 902,936 acres (97 percent) are forest lands and 538,577 acres (58 percent) provide spotted owl nesting and roosting habitat. It is located in the northwestern extent of the province with the California Coast Province to the west and the Oregon Klamath Province to the north. It encompasses most of the northern portion of the Six Rivers National Forest, a small portion of the Klamath National Forest, and a small portion of the Rogue River-Siskiyou National Forest, as well as a few small areas managed by the Northern California District of the BLM. It also includes the Hoopa Valley Reservation and portions of the Yurok Reservation that fall within the California Klamath Province. Forest lands in this GMA are 75 percent Federal lands (Forest Service and BLM), 11 percent Tribal lands (Hoopa Valley Tribe and Yurok Tribe), and the remainder primarily in private ownership.

This GMA was mapped for the following reasons:

- Relatively robust spotted owl populations here, compared to other portions of the range, have good potential for recovery.
- Current spotted owl occupancy information is available in most places, on both public and private lands.
- There are previous and ongoing barred owl removal research efforts in portions of the GMA which can be restarted, continued, and easily expanded. The Hoopa Valley Tribe, Yurok Tribe, Green Diamond Resource Company, and University of Wisconsin are currently conducting barred owl removal research in portions of the GMA. The benefits to spotted owl populations from the Hoopa and Green Diamond removal experiments have been documented (Diller et al. 2016, entire; Wiens et al. 2021, entire).
- Some of these ongoing efforts also include barred owl removal research in adjacent portions of the North California Coast GMA. Expanding these efforts farther into the

Northwest California Klamath GMA would allow for the creation of a relatively large area of reduced barred owl density that includes portions of two provinces. This in turn would support recovery of spotted owls in this area where recovery potential is high.

- The California Department of Fish and Wildlife's Barred Owl Science Team identified the Six Rivers National Forest as the highest priority for barred owl removal in its interim removal strategy.
- The GMA includes a large portion of the Northwestern California Demography Study Area, with its historical and recent spotted owl data. The Northwest Forest Plan Effectiveness Monitoring program includes passive acoustic monitoring sampling 20 percent of the Northwestern California study area. This monitoring program will provide additional future data on both spotted and barred owls, and allow for efficiencies in monitoring barred owl removal and its effects on spotted owls. Additionally, similar historical and recent spotted owl and barred owl data are available from the Hoopa Valley Study Area. These portions of the GMA are well known and accessible, allowing for quicker implementation.

This GMA is assigned Priority A. Given the relatively robust spotted owl population in this area, and the existing barred owl removal research efforts both within this GMA and in the adjacent North California Coast GMA, barred owl removal efforts within this GMA are likely to result in an especially fast and positive response in terms of spotted owl population recovery. Actions here are intended to create refugia to secure and improve spotted owl populations here, which may in turn serve as source populations for the rest of the province and other provinces.

*Description of the elements considered in mapping:* In mapping the boundaries of the Northwest California Klamath GMA we used information on the following elements.

*Spotted Owl Data:*

- This GMA includes large areas of high-value nesting and roosting habitat, and the densest concentrations of spotted owl habitat in the province are within this GMA. We excluded several areas where habitat density was lower.
- The GMA includes current, recent, and historical spotted owl sites.
- The GMA boundary includes a long segment along the province boundary with the California Coast Province, allowing for good connectivity with the North California Coast GMA. Spotted owl habitat is abundant on both sides of the boundary and movement of banded spotted owls across the province boundary has been documented at study areas.
- The northernmost portion of the GMA allows for connectivity to the Oregon Klamath Province. Although portions of this area have burned in a succession of recent fires, some spotted owl habitat remains. The adjacent habitat in the Oregon Klamath Province is not within a GMA, but if spotted owls are present, site management could help to promote the exchange of spotted owls between these provinces.

*Conditions:*

- We excluded the North Fork Smith Roadless Area, most of the Siskiyou Roadless Area, and a portion of the Siskiyou Wilderness. Accessibility is low in these areas, little spotted

owl habitat is available in these areas, and the excluded areas have burned and lost habitat to various fires including the 2002 Biscuit Fire, 2008 Siskiyou Complex, 2017 Oak Fire, 2020 Slater Fire, and 2023 Smith River Complex, among others. In some cases the GMA boundary follows land allocation boundaries, and in other cases is influenced by fire severity maps.
- We did not exclude all wilderness or roadless areas, where road and trail access may be lacking, nor did we try to exclude all high elevation areas without habitat, or areas where habitat has been lost to wildfire. These factors can be considered during development of the Focal Management Area boundaries.

*Other Considerations:*

- We considered the presence of ongoing barred owl removal research within this province and the neighboring California Coast Province.
- As discussed above, this GMA includes portions of two study areas, one of which encompasses an experimental barred owl removal area. This allows for efficiencies in monitoring and opportunities for research. The GMA boundary is drawn along the western and northern borders of the Hoopa Valley Reservation and the entire Hoopa Valley study area is included. Although the GMA boundaries do not follow Northwestern California study area boundaries, the GMA includes the bulk of this study area as well.

*Focal Management Areas (FMAs) for the Northwest California Klamath GMA*

In the Northwest California Klamath GMA, we recommend developing FMAs large enough to support as many spotted owl pair sites as possible, up to 50 pair sites per FMA. Generally, larger block areas provide a smaller edge-to-area ratio. This may help reduce the influx of barred owls from outside the FMA in the future. However, where the landscape or forest conditions do not allow this, smaller or more sinuous FMAs, still encompassing multiple pair areas, may be appropriate. If smaller FMAs are developed due to funding limitations, design them such that they could be expanded in the future if funding becomes available.

When possible, include multiple FMAs, generally spaced no farther than 12 to 15 miles apart. Where smaller FMAs are developed due to topography, forest condition, access, funding limitations, or other reasons, we recommend these be closer together and multiple areas be designed with the intent of encouraging exchange of spotted owls between these smaller areas.

Because of the history of barred owl research and experimental management in parts of this area, additional information may be available regarding areas with higher and lower barred owl influxes, and implementers should refer to this information in FMA development.

Including recently occupied sites in FMAs provides the starting point for development of spotted owl populations as barred owl populations are reduced. In areas where habitat connectivity is limited, site management may help to provide connectivity between smaller FMAs. Coordinate FMA locations with the spotted owl site management described above, with FMA locations in adjacent GMAs, and with any other barred owl management activity, whether or not it is conducted under this Strategy.

*Priorities:* The following are our recommended priorities for defining and selecting FMAs within the Northwest California Klamath GMA. The following are in general priority order; however, local expertise will be important in applying these to specific FMA boundary designs.

1. Build FMAs around current occupied spotted owl sites (sites with presence or occupancy of spotted owls within the last year). This provides a nucleus of spotted owls for the potential recolonization of sites in the FMA as barred owl numbers are reduced.

2. Focus on areas with reasonable access, in terms of road networks where available, and trail systems where roads do not exist. Avoid large areas without roads or trails. Closed roads may be used like a trail system if they can be safely walked.

3. Consider fire risk when mapping FMA boundaries. Avoid concentrating FMAs solely in areas identified as having the highest risk of habitat loss to fire; however, some areas with high fire risk may still be important to include in FMAs, particularly where spotted owls are currently present in these areas. Providing connectivity in FMAs from higher risk spotted owl habitat to areas identified as fire refugia and other areas with relatively lower risk will be important in the mixed-severity fire regime of the California Klamath Province. Placement of multiple FMAs in the GMA and inclusion of areas with relatively high resistance to uncharacteristic fire could reduce the risk of complete loss.

4. Place FMA blocks where the best spotted owl habitat remains, and areas which allow for the maximum number of spotted owls to be supported. Focus on designating FMAs in areas with the potential for at least 20 spotted owl pairs, though 50 pair sized areas are the target where possible.

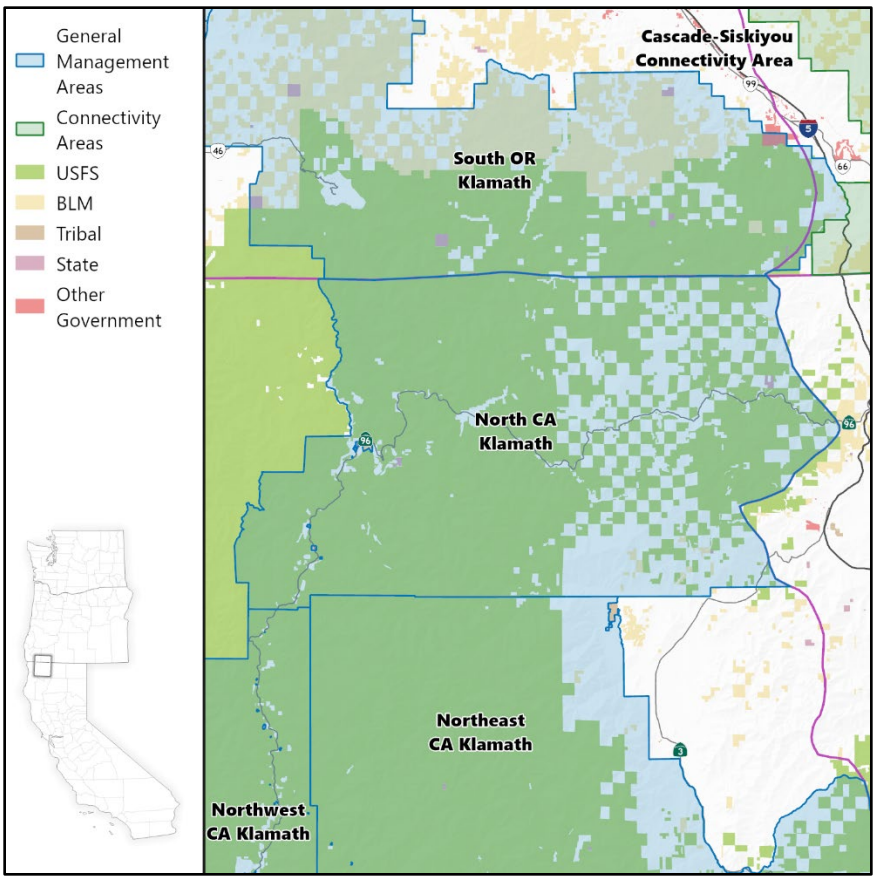
5. Include lands of interested and willing landowners or land managers. A focus on areas where landowners have expressed interest in barred owl management can help expedite implementation of barred owl management and encourage involvement.

6. Include areas with high-quality historical spotted owl sites (sites with no confirmed occupancy in the last five years or more). Indicators may include, for example, especially good habitat amount, quality, and configuration; a history of good past demographic performance; or a history of long-term occupancy. These are areas that have been shown by past use to be attractive to spotted owls and therefore more likely to be reoccupied as populations recover.

7. Consider the potential for connection to other FMAs in the GMA, and to neighboring GMAs. Placement of FMAs in close proximity to other GMAs in the California Klamath and California Coast Provinces, and where there is forest that may provide connectivity to the Oregon Klamath Province, can connect populations in these areas.

8. Consider the presence of areas already designated for spotted owl habitat management or compatible conservation purposes, such as Late Successional Reserves, Congressionally reserved areas, designated critical habitat, and areas identified as high priorities in the Northern Spotted Owl Recovery Plan. Including these areas provides support for spotted owls and limits impacts on other resources. As many of these have been managed for older forest over the last decades, these are the likely locations of higher value habitat.

*A4.10.B.2.b North California Klamath GMA – Priority B*




The North California Klamath GMA includes approximately 657,293 acres in total, of which 608,764 acres (93 percent) are forest lands and 152,796 acres (23 percent) provide spotted owl nesting and roosting habitat. It is located in the northern part of the province, and bounded by the Oregon Klamath Province to the north and the California Cascades Province to the east. It includes the northern portion of Klamath National Forest within California and a small southern extension of the Rogue River-Siskiyou National Forest into California, as well as a few parcels managed by the Northern California District of the BLM. Forest lands in this GMA are 77 percent Federal lands (Forest Service and BLM), with the remainder primarily in private ownership.

This GMA was mapped for the following reasons:

- Relatively robust spotted owl populations here, relative to other portions of the range, have good potential for recovery.
- Current spotted owl occupancy information is available in most places, on both public and private lands.
- This area provides connectivity to the Oregon Klamath Province to the north, and also provides connectivity within the province.
- The stabilization and recovery of spotted owl populations here, combined with beneficial effects of ongoing experimental barred owl management efforts in the adjacent Northwest California Klamath GMA, could support spotted owl population recovery not only in the California Klamath Province, but potentially in neighboring provinces as well.

This GMA is assigned Priority B. Spotted owl populations in this GMA have been affected not only by barred owl competition but also by habitat loss due to many large fires, including some areas that have been burned repeatedly and some recent high-severity fires leading to habitat loss over large areas. Barred owl removal, if implemented soon, would reduce further impacts from barred owl competition to spotted owls already stressed by fire-related habitat loss. This, in turn,

could slow population declines and stabilize the population. Placing block management areas to encompass fire refugia (including areas identified as likely to burn at low severity) may be especially beneficial, in that it will allow spotted owls to access areas likely to maintain good habitat conditions over the long term. Site management around currently occupied sites within this GMA remains a Priority A action, but additional management outside of these sites is likely to increase the effectiveness of management and offer opportunities for spotted owls to recolonize high-value habitat within fire refugia, that in some cases barred owls currently prevent them from accessing. The landscape is relatively well-surveyed and accessible, which allows for relatively rapid implementation of barred owl management, but likely not as immediately as in landscapes where experimental barred owl removals are already occurring (e.g., in the Northwest California Klamath GMA).

*Description of the elements considered in mapping:* In mapping the boundaries of the North California Klamath GMA we used information on the following elements.

*Spotted Owl Data:*

- The GMA includes current, recent, and historical spotted owl sites.
- This GMA includes the major concentrations of spotted owl habitat in the northeasternmost portion of the province. The density of habitat is moderate in the western portion of the GMA and lower in the eastern portion, with patchy distribution due to vegetation communities, past timber harvest on private lands, and fire.
- The GMA boundary includes a long segment along the province boundary with the Oregon Klamath Province, allowing for good connectivity with the South Oregon Klamath GMA. Spotted owl habitat is abundant on both sides of the boundary.
- Along the eastern edge of the GMA, forested areas on both sides of the boundary with the California Cascades Province may connect spotted owls across these two provinces (though there is little connectivity to the larger concentrations of spotted owl habitat in the California Cascades), and in turn to the Western Oregon Cascades Province. The adjacent habitat in the California Cascades Province is not within a GMA, but if spotted owls are present, site management could help to promote the exchange of spotted owls between these provinces. The nearby habitat within the Western Oregon Cascades is within the Cascade-Siskiyou Connectivity Area.

*Conditions:*

- We did not exclude all wilderness or roadless areas, where road and trail access may be lacking, nor did we try to exclude all high elevation areas without habitat, or areas where habitat has been lost to wildfire. These factors can be considered during development of the Focal Management Area boundaries.

*Other Considerations:*

- We excluded the Siskiyou Wilderness and most of the Siskiyou Roadless Area. We also excluded a large portion of the high-severity burned areas from the 2020 Slater Fire. Accessibility is low in these areas, little spotted owl habitat is available in these areas, and the excluded areas have burned and lost habitat to various fires including the 1987

Ten Bald Fire, 1994 Jack #1 Fire, 2008 Siskiyou Complex, 2017 Oak Fire, and others, as well as the 2020 Slater Fire. In some cases the GMA boundary follows land allocation boundaries, and in other cases is influenced by fire severity maps.

- Along the southeastern boundary of the GMA, we excluded the Scott Valley, which has little spotted owl habitat and consists largely of agricultural land.

*Focal Management Areas (FMAs) for the North California Klamath GMA*

In the North California Klamath GMA, we recommend developing FMAs large enough to support as many spotted owl pair sites as possible, up to 50 pair sites per FMA. Generally, larger block areas provide a smaller edge-to-area ratio. This may help reduce the influx of barred owls from outside the FMA in the future. However, where the landscape or forest conditions do not allow this, smaller or more sinuous FMAs, still encompassing multiple pair areas, may be appropriate. If smaller FMAs are developed due to funding limitations, design them such that they could be expanded in the future if funding becomes available.

When possible, include multiple FMAs, generally spaced no farther than 12 to 15 miles apart. Where smaller FMAs are developed due to topography, forest condition, access, funding limitations, or other reasons, we recommend these be closer together and multiple areas be designed with the intent of encouraging exchange of spotted owls between these smaller areas.

Including recently occupied sites in FMAs provides the starting point for development of spotted owl populations as barred owl populations are reduced. In areas where habitat connectivity is limited, site management may help to provide connectivity between smaller FMAs. Coordinate FMA locations with the spotted owl site management described above, with FMA locations in adjacent GMAs, and with any other barred owl management activity, whether or not it is conducted under this Strategy.

*Priorities:* The following are our recommended priorities for defining and selecting FMAs within the North California Klamath GMA. The following are in general priority order; however, local expertise will be important in applying these to specific FMA boundary designs.

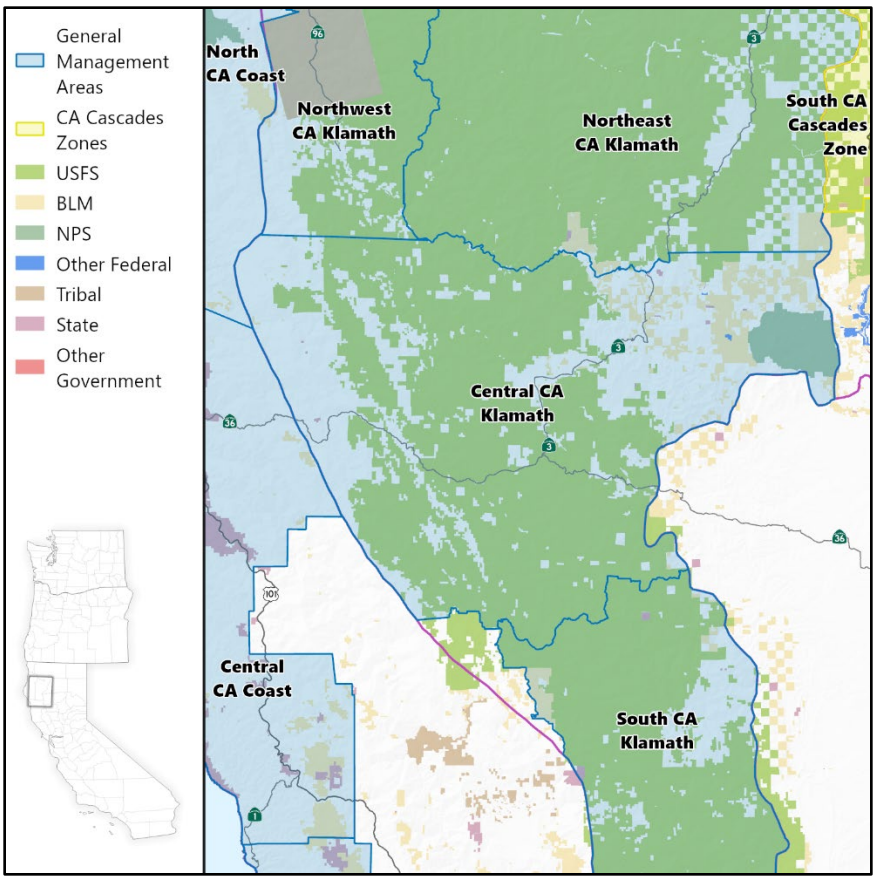
1. Build FMAs around current occupied spotted owl sites (sites with presence or occupancy of spotted owls within the last year). This provides a nucleus of spotted owls for the potential recolonization of sites in the FMA as barred owl numbers are reduced.

2. Focus on areas with reasonable access, in terms of road networks where available, and trail systems where roads do not exist. Avoid large areas without roads or trails. Closed roads may be used like a trail system if they can be safely walked.

3. Consider fire risk when mapping FMA boundaries. Avoid concentrating FMAs solely in areas identified as having the highest risk of habitat loss to fire; however, some areas with high fire risk may still be important to include in FMAs, particularly where spotted owls are currently present in these areas. Providing connectivity in FMAs from higher risk spotted owl habitat to areas identified as fire refugia and other areas with relatively lower risk will be important in the mixed-severity fire regime of the California Klamath Province. Placement of multiple FMAs in the GMA and inclusion of areas with relatively high resistance to uncharacteristic fire could reduce the risk of complete loss.

4. Place FMA blocks where the best spotted owl habitat remains, and areas which allow for the maximum number of spotted owls to be supported. Focus on designating FMAs in areas with the potential for at least 20 spotted owl pairs, though 50 pair sized areas are the target where possible.
5. Include lands of interested and willing landowners or land managers. A focus on areas where landowners have expressed interest in barred owl management can help expedite implementation of barred owl management and encourage involvement.
6. Include areas with high-quality historical spotted owl sites (sites with no confirmed occupancy in the last five years or more). Indicators may include, for example, especially good habitat amount, quality, and configuration; a history of good past demographic performance; or a history of long-term occupancy. These are areas that have been shown by past use to be attractive to spotted owls and therefore more likely to be reoccupied as populations recover.
7. Consider the potential for connection to other FMAs in the GMA, and to neighboring GMAs. Placement of FMAs in close proximity to other GMAs in the California and Oregon Klamath Provinces, and where there is forest that may provide connectivity to the California Cascades Province, can connect populations in these areas.
8. Consider the presence of areas already designated for spotted owl habitat management or compatible conservation purposes, such as Late Successional Reserves, Congressionally reserved areas, designated critical habitat, and areas identified as high priorities in the Northern Spotted Owl Recovery Plan. Including these areas provides support for spotted owls and limits impacts on other resources. As many of these have been managed for older forest over the last decades, these are the likely locations of higher value habitat.

*A4.10.B.2.c Central California Klamath GMA – Priority B*




The Central California Klamath GMA includes approximately 1,383,736 acres in total, of which 1,232,535 acres (89 percent) are forest lands and 381,367 acres (28 percent) provide spotted owl nesting and roosting habitat. It is located in the central extent of the province between Eureka and Redding. It is bounded to the west by the California Coast province and to the northeast by the California Cascades province. The majority of lands within the GMA fall within the Shasta-Trinity and Six Rivers National Forests. Whiskeytown National Recreation Area is in the northeastern portion of the GMA, along with lands managed by the Northern California District of the BLM. Sierra Pacific Industries lands are also present in the eastern extent. Forest lands in this GMA are 68 percent Federal lands (Forest Service, BLM, and National Park Service), with the remainder primarily in private ownership.

This GMA was mapped for the following reasons:

- Current spotted owl occupancy information is available, on both public and private lands.
- There are ongoing barred owl removal research efforts in portions of the GMA, which can be expanded. Green Diamond Resource Company and Sierra Pacific Industries are currently conducting barred owl removal research in portions of the GMA. The benefits to spotted owl populations from earlier Green Diamond removal experiments have been documented (Diller et al. 2016, entire; Wiens et al. 2021, entire).
- Barred owl removal research is also ongoing in adjacent portions of the North California Coast, Central California Coast, Northwest California Klamath, and Northeast California Klamath GMAs. Expanding these efforts farther into the Central California Klamath GMA would allow for the creation of a relatively large area of reduced barred owl density that includes portions of two provinces. This in turn would support recovery of spotted owls.
- Barred owl removal here, especially in the western portion of the GMA, could reduce southward movement of barred owls toward Marin and Sonoma Counties, where barred owl densities are relatively low and currently have little effect on spotted owl

populations. Reducing barred owl movement here could delay or prevent the need for future intensive barred owl management in Marin and Sonoma Counties.
- The GMA includes a portion of the Northwestern California Demography Study Area, with its historical and recent spotted owl data. The Northwest Forest Plan Effectiveness Monitoring program includes passive acoustic monitoring sampling 20 percent of the Northwestern California study area. Additionally, similar historical and recent spotted owl and barred owl data are available from the Green Diamond Demography Study Area. Green Diamond and Sierra Pacific Industries each have HCPs including annual monitoring components. These monitoring programs will provide additional future data on both spotted and barred owls, and allow for efficiencies in monitoring barred owl removal and its effects on spotted owls. These portions of the GMA are well known and accessible, allowing for quicker implementation.

This GMA is assigned Priority B. Spotted owl populations in this GMA have been affected not only by barred owl effects but also by habitat loss due to many large fires, including some areas that have been burned repeatedly and some recent high-severity fires leading to habitat loss over large areas. Barred owl removal, if implemented soon, would reduce further impacts from barred owl competition to spotted owls already stressed by fire-related habitat loss. This, in turn, could slow population declines and stabilize the population. Placing block management areas to encompass fire refugia (including areas identified as likely to burn at low severity) may be especially beneficial, in that it will allow spotted owls to access areas likely to maintain good habitat conditions over the long term. Site management around currently occupied sites within this GMA remains a Priority A action, but additional management outside of these sites is likely to increase the effectiveness of management and offer opportunities for spotted owls to recolonize high-value habitat within fire refugia, that in some cases barred owls currently prevent them from accessing. The landscape is relatively well-surveyed and accessible, and block management efforts could build from existing experimental barred owl removal, which will likely speed the beneficial effects to spotted owls. Due to the habitat condition, the recovery potential for spotted owls is lower in this GMA relative to the Northwest California Klamath GMA, but extirpation within the GMA is not imminent, so block management in this GMA best fits the definition associated with Priority B.

*Description of the elements considered in mapping:* In mapping the boundaries of the Central California Klamath GMA we used information on the following elements.

*Spotted Owl Data:*

- The GMA includes current, recent, and historical spotted owl sites.
- This GMA includes the major concentrations of spotted owl habitat in the central portion of the province. Habitat is patchy, with continuous high value areas predominantly situated near the western border of the GMA.
- The GMA boundary includes a long segment along the province boundary with the California Coast Province, allowing for good connectivity with the North and Central California Coast GMAs. Spotted owl habitat is present on both sides of the boundary.

*Conditions:*

- We excluded the North Fork Wilderness. Accessibility is low in this area, little spotted owl habitat is available in these areas, and previously existing habitat in this area, along with much of the nearby habitat within and outside of the GMA, was removed by the 2020 Hopkins Fire. In this area the GMA boundary follows land allocation and land ownership boundaries.
- We did not exclude all wilderness or roadless areas, where road and trail access may be lacking, nor did we try to exclude all high elevation areas without habitat, or areas where habitat has been lost to wildfire. These factors can be considered during development of the Focal Management Area boundaries.

*Other Considerations:*

- We considered the presence of ongoing barred owl removal research within this province and the neighboring California Coast Province.
- As discussed above, this GMA includes portions of two study areas, one of which encompasses an experimental barred owl removal area. Barred owl research is also conducted in a third area managed and monitored under an HCP. This allows for efficiencies in monitoring and opportunities for research. However, the GMA boundaries do not follow study area boundaries, and include relatively small portions of each study area.

*Focal Management Areas (FMAs) for the Central California Klamath GMA*

In the Central California Klamath GMA, we recommend developing FMAs large enough to support as many spotted owl pair sites as possible, up to 50 pair sites per FMA. Generally, larger blocky areas provide a smaller edge-to-area ratio. This may help reduce the influx of barred owls from outside an FMA in the future. However, where the landscape or forest conditions do not allow this, smaller or more sinuous FMAs, still encompassing multiple pair areas, may be appropriate. If smaller FMAs are developed due to funding limitations, design them such that they could be expanded in the future if funding becomes available.

When possible, include multiple FMAs, generally spaced no farther than 12 to 15 miles apart. Where smaller FMAs are developed due to topography, forest condition, access, funding limitations, or other reasons, we recommend these be closer together and multiple areas be designed with the intent of encouraging exchange of spotted owls between these smaller areas.

Because of the history of barred owl research and experimental management in parts of this area, additional information may be available regarding areas with higher and lower barred owl influxes, and implementers should refer to this information in FMA development.

Including recently occupied sites in FMAs provides the starting point for development of spotted owl populations as barred owl populations are reduced. In areas where habitat connectivity is limited, site management may help to provide connectivity between smaller FMAs. Coordinate FMA locations with the spotted owl site management described above, with FMA locations in adjacent GMAs, and with any other barred owl management activity, whether or not it is conducted under this Strategy.

*Priorities:* The following are our recommended priorities for defining and selecting FMAs within the Central California Klamath GMA. The following are in general priority order; however, local expertise will be important in applying these to specific FMA boundary designs.

1. Build FMAs around current occupied spotted owl sites (sites with presence or occupancy of spotted owls within the last year). This provides a nucleus of spotted owls for the potential recolonization of sites in the FMA as barred owl numbers are reduced.

2. Focus on areas with reasonable access, in terms of road networks where available, and trail systems where roads do not exist. Avoid large areas without roads or trails. Closed roads may be used like a trail system if they can be safely walked.

3. Consider fire risk when mapping FMA boundaries. Avoid concentrating FMAs solely in areas identified as having the highest risk of habitat loss to fire; however, some areas with high fire risk may still be important to include in FMAs, particularly where spotted owls are currently present in these areas. Providing connectivity in FMAs from higher risk spotted owl habitat to areas identified as fire refugia and other areas with relatively lower risk will be important in the mixed-severity fire regime of the California Klamath Province. Placement of multiple FMAs in the GMA and inclusion of areas with relatively high resistance to uncharacteristic fire could reduce the risk of complete loss.

4. Place FMA blocks where the best spotted owl habitat remains, and areas which allow for the maximum number of spotted owls to be supported. Focus on designating FMAs in areas with the potential for at least 20 spotted owl pairs, though 50 pair sized areas are the target where possible.

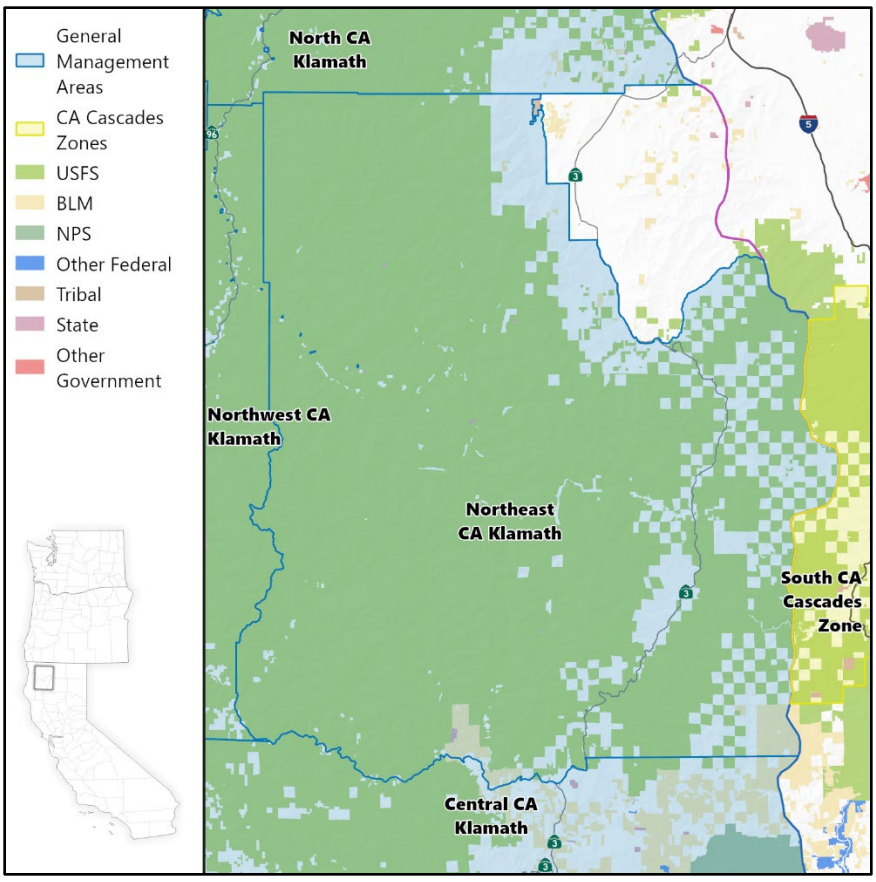
5. Include lands of interested and willing landowners or land managers. A focus on areas where landowners have expressed interest in barred owl management can help expedite implementation of barred owl management and encourage involvement.

6. Include areas with high-quality historical spotted owl sites (sites with no confirmed occupancy in the last five years or more). Indicators may include, for example, especially good habitat amount, quality, and configuration; a history of good past demographic performance; or a history of long-term occupancy. These are areas that have been shown by past use to be attractive to spotted owls and therefore more likely to be reoccupied as populations recover.

7. Consider the potential for connection to other FMAs in the GMA, and to neighboring GMAs. Placement of FMAs in close proximity to other GMAs in the California Klamath and California Coast Provinces, and other areas where there is forest that may provide connectivity to the California Coast Province, can connect populations in these areas.

8. Consider the presence of areas already designated for spotted owl habitat management or compatible conservation purposes, such as Late Successional Reserves, Congressionally reserved areas, designated critical habitat, and areas identified as high priorities in the Northern Spotted Owl Recovery Plan. Including these areas provides support for spotted owls and limits impacts on other resources. As many of these have been managed for older forest over the last decades, these are the likely locations of higher value habitat.

*A4.10.B.2.d Northeast California Klamath GMA – Priority C*




The Northeast California Klamath GMA includes approximately 1,607,456 acres in total, of which 1,500,431 acres (93 percent) are forest lands and 350,397 acres (22 percent) provide spotted owl nesting and roosting habitat. It is the largest GMA in the province, located in the north-central portion with the California Cascades Province to the east and the North, Northwest, and Central California Klamath GMAs on the other three sides. Most of the area is within the Klamath and Shasta-Trinity National Forests, as well as some small areas managed by the Northern California district of the BLM. Sierra Pacific Industries lands managed under an HCP are included in the eastern portion of the GMA. Forest lands within the GMA are 86 percent Federal lands (Forest Service and BLM), with the remainder primarily in private ownership.

This GMA was mapped for the following reasons:

- The majority of the lands are under Federal management (Forest Service and BLM).
- There are ongoing barred owl removal research efforts in portions of the GMA, which can be expanded. Sierra Pacific Industries is currently conducting barred owl removal research in portions of the GMA as a conservation measure associated with their HCP.
- Barred owl removal research is also ongoing in an adjacent portion of the Central California Klamath GMAs. Expanding these efforts farther into the Northeast California Klamath GMA would allow for the creation of a relatively large area of reduced barred owl density. This would create efficiencies in barred owl management and support recovery of spotted owls.
- Spotted owl habitat in this area is patchy, but well-distributed.
- The Northeast California Klamath GMA includes a small portion of the Northwestern California Demography Study Area, with its historical and recent spotted owl data. The Northwest Forest Plan Effectiveness Monitoring program includes passive acoustic monitoring sampling 20 percent of the Northwestern California study area. Additionally, Sierra Pacific Industries conducts monitoring as a component of their HCP. These monitoring programs will provide additional future data on both spotted and barred owls,

and allow for efficiencies in monitoring barred owl removal and its effects on spotted owls.
- This area includes the most likely area for population connections between northern spotted owls in the California Cascades Province and the rest of the northern spotted owl range.

This GMA is assigned Priority C. A high proportion of this GMA is within wilderness and roadless areas, and implementation of barred owl management will likely be difficult in these areas. Spotted owl populations in this GMA have been affected not only by barred owl effects but also by habitat loss due to many large fires, including some areas that have been burned repeatedly and some recent high-severity fires leading to habitat loss over large areas. Barred owl removal would reduce further impacts from barred owl competition to spotted owls already stressed by fire-related habitat loss. This, in turn, could slow population declines and stabilize the population. Placing block management areas to encompass fire refugia (including areas identified as likely to burn at low severity) may be especially beneficial, in that it will allow spotted owls to access areas likely to maintain good habitat conditions over the long term. Site management around currently and recently occupied sites within this GMA remain Priority A and B actions, respectively, but additional management outside of these sites is likely to increase the effectiveness of management and offer opportunities for spotted owls to recolonize high-value habitat within fire refugia, further stabilizing the population. Given the difficulties involved in accessing large portions of this GMA, combined with the patchy arrangement of habitat within the GMA, block management here is likely to be a less efficient use of barred owl management resources than in most other GMAs within the province. Therefore, block management here is relatively less urgent than block management in the Priority A and B GMAs, and fits the definition of a Priority C action.

*Description of the elements considered in mapping:* In mapping the boundaries of the Northeast California Klamath GMA we used information on the following elements.

*Spotted Owl Data:*

- The GMA includes current, recent, and historical spotted owl sites.
- Spotted owl habitat density is low, and although habitat is widely distributed, it is also patchy due to vegetation communities, past timber harvest, and fire.
- The GMA boundary includes a long segment along the province boundary with the California Cascades Province, and is adjacent to the South California Cascades Management Zone. This is the area of greatest habitat connectivity between the California Cascades Province and any other part of the northern spotted owl range, and provides the likeliest location for exchange of spotted owls between the California Cascades and Klamath Provinces.

*Conditions:*

- This GMA includes extensive wilderness and roadless areas. Many areas have burned repeatedly and some spotted owl habitat has been lost to large patches of high-severity fire. We did not attempt to exclude wilderness or roadless areas, where road and trail access may be lacking, nor did we try to exclude all high elevation areas without habitat,

or areas where habitat has been lost to wildfire. These factors can be considered during development of the Focal Management Area boundaries.

*Other Considerations:*

- As discussed above, this GMA includes a small portion of the Northwestern California study area, and barred owl research is carried out in an area managed and monitored under an HCP. This allows for efficiencies in monitoring and opportunities for research. However, the GMA boundaries do not follow the study area or HCP area boundaries, and include relatively small portions of each area.
- Along the northeastern boundary of the GMA, we excluded the Scott Valley, which has little spotted owl habitat and consists largely of agricultural land.

*Focal Management Areas (FMAs) for the Northeast California Klamath GMA*
In the Northeast California Klamath GMA, we recommend developing FMAs large enough to support as many spotted owl pair sites as possible, up to 50 pair sites per FMA. Generally, larger block areas provide a smaller edge-to-area ratio. This may help reduce the influx of barred owls from outside the FMA in the future. However, where the landscape or forest conditions do not allow this, smaller or more sinuous FMAs, still encompassing multiple pair areas, may be appropriate. If smaller FMAs are developed due to funding limitations, design them such that they could be expanded in the future if funding becomes available.

When possible, include multiple FMAs, generally spaced no farther than 12 to 15 miles apart. Where smaller FMAs are developed due to topography, forest condition, access, funding limitations, or other reasons, we recommend these be closer together and multiple areas be designed with the intent of encouraging exchange of spotted owls between these smaller areas.

Because of the history of barred owl research and experimental management in parts of this area, additional information may be available regarding areas with higher and lower barred owl influxes, and implementers should refer to this information in FMA development.

Including recently occupied sites in FMAs provides the starting point for development of spotted owl populations as barred owl populations are reduced. In areas where habitat connectivity is limited, site management may help to provide connectivity between smaller FMAs. Coordinate FMA locations with the spotted owl site management described above, with FMA locations in adjacent GMAs and Management Zones, and with any other barred owl management activity, whether or not it is conducted under this Strategy.

*Priorities:* The following are our recommended priorities for defining and selecting FMAs within the Northeast California Klamath GMA. The following are in general priority order; however, local expertise will be important in applying these to specific FMA boundary designs.

1. Build FMAs around current occupied spotted owl sites (sites with presence or occupancy of spotted owls within the last year). This provides a nucleus of spotted owls for the potential recolonization of sites in the FMA as barred owl numbers are reduced.

2. Focus on areas with reasonable access, in terms of road networks where available, and trail systems where roads do not exist. Avoid large areas without roads or trails. Closed roads may be used like a trail system if they can be safely walked.

3. Consider fire risk when mapping FMA boundaries. Avoid concentrating FMAs solely in areas identified as having the highest risk of habitat loss to fire; however, some areas with high fire risk may still be important to include in FMAs, particularly where spotted owls are currently present in these areas. Providing connectivity in FMAs from higher risk spotted owl habitat to areas identified as fire refugia and other areas with relatively lower risk will be important in the mixed-severity fire regime of the California Klamath Province. Placement of multiple FMAs in the GMA and inclusion of areas with relatively high resistance to uncharacteristic fire could reduce the risk of complete loss.

4. Place FMA blocks where the best spotted owl habitat remains, and areas which allow for the maximum number of spotted owls to be supported. Focus on designating FMAs in areas with the potential for at least 20 spotted owl pairs, though 50 pair sized areas are the target where possible.

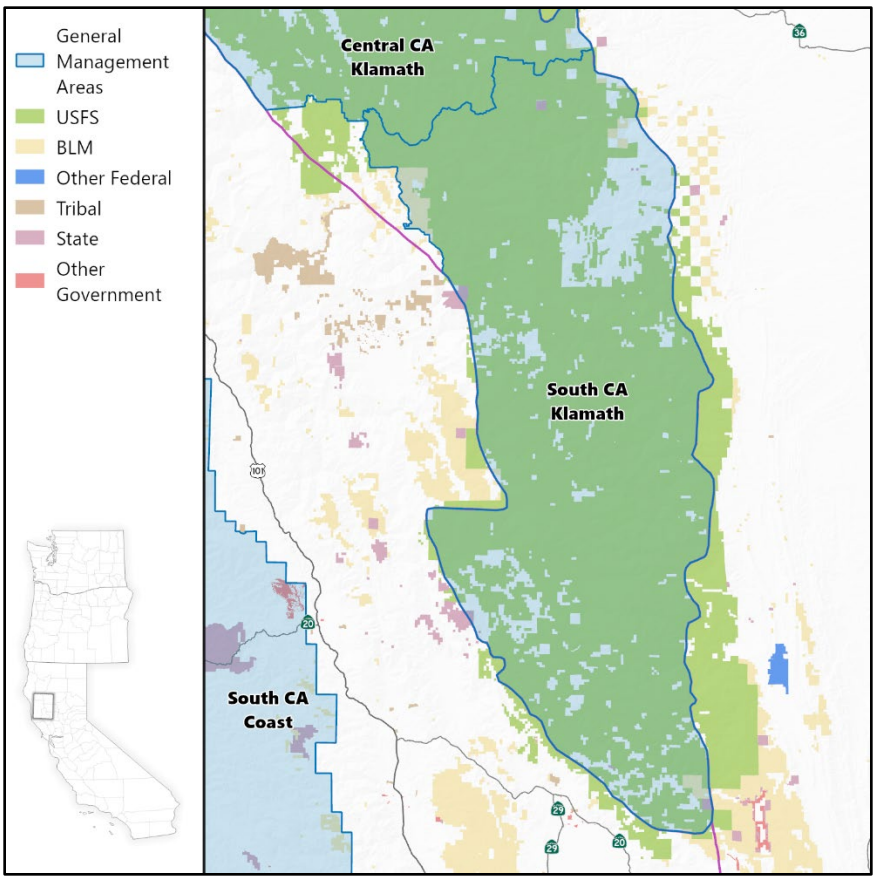
5. Include lands of interested and willing landowners or land managers. A focus on areas where landowners have expressed interest in barred owl management can help expedite implementation of barred owl management and encourage involvement.

6. Include areas with high-quality historical spotted owl sites (sites with no confirmed occupancy in the last five years or more). Indicators may include, for example, especially good habitat amount, quality, and configuration; a history of good past demographic performance; or a history of long-term occupancy. These are areas that have been shown by past use to be attractive to spotted owls and therefore more likely to be reoccupied as populations recover.

7. Consider the potential for connection to other FMAs in the GMA, and to neighboring GMAs. Placement of FMAs in close proximity to other GMAs in the California Klamath Province, to the South California Cascades Management Zone, and other areas where there is forest that may provide connectivity to the California Cascades, can connect populations in these areas.

*8.* Consider the presence of areas already designated for spotted owl habitat management or compatible conservation purposes, such as Late-Successional Reserves, Congressionally reserved areas, designated critical habitat, and areas identified as high priorities in the Northern Spotted Owl Recovery Plan. Including these areas provides support to spotted owls and limits impacts on other resources. As many of these have been managed for older forest over the last decades, these are the likely locations higher value habitat.

*A4.10.B.2.e South California Klamath GMA – Priority C*




The South California Klamath GMA includes approximately 987,327 acres in total, of which 866,632 acres (88 percent) are forest lands and 74,933 acres (8 percent) provide spotted owl nesting and roosting habitat. Another 81,923 acres (8 percent) provide marginal spotted owl habitat. The GMA occupies the full width of the southern extent of the California Klamath Province, and forms a narrow GMA with limited habitat connectivity to the west and none to the south or east. It consists mainly of Mendocino National Forest lands, and also includes some small areas managed by the Northern California and Central California Districts of the BLM. Forest lands in this GMA are 87 percent Federal lands (Forest Service and BLM), with the remainder in primarily in private ownership.

This GMA was mapped for the following reasons:

- It includes the southernmost area of spotted owl habitat and public land in the province.
- Barred owl removal here, especially in the western portion of the GMA, could reduce southward movement of barred owls toward Marin and Sonoma Counties, where barred owl densities are relatively low and currently have little effect on spotted owl populations. Reducing barred owl movement here could delay or prevent the need for future intensive barred owl management in Marin and Sonoma Counties.

This GMA is assigned Priority C. Relatively few barred owls have been detected in this GMA (see Map A4-1), though the detection rate reflects survey effort as well as barred owl presence. Spotted owl populations in this GMA have been greatly affected by habitat loss due to large fires burning through nearly the entire area. Most of the GMA has burned recently, either in the 2018 Ranch Fire or the 2020 August Complex, both of which included large areas of high-severity fire. Barred owl removal would reduce further impacts from barred owl competition to spotted owls already stressed by fire-related habitat loss. This, in turn, could slow population declines and stabilize the population, albeit likely with a very reduced population size. Site management around currently and recently occupied sites within this GMA remain Priority A and B actions,

respectively. Additional management outside of these sites could increase opportunities for spotted owls to recolonize remaining habitat, and may also reduce opportunities for barred owl movements from this GMA toward the southwest. Because barred owls may be present here at lower densities, identification of denser barred owl populations and management focused on these areas may be an effective addition to spotted owl site management, both for the benefit of spotted owls present in this GMA and to slow barred owl movements toward Sonoma and Marin Counties. Because both barred and spotted owl populations appear to be low in this GMA, block management here is relatively less urgent than block management in the Priority A and B GMAs, and fits the definition of a Priority C action.

*Description of the elements considered in mapping:* In mapping the boundaries of the South California Klamath GMA we used information on the following elements.

*Spotted Owl Data:*

- The GMA includes current, recent, and historical spotted owl sites, though many historical sites now lack habitat.
- Spotted owl habitat density is very low, due mainly to large, repeated fires throughout the GMA.
- Spotted owl habitat throughout the GMA is predominantly of equal quality, with few higher quality patches remaining due to wildfire impacts.

*Conditions:*

- Much of this GMA has burned repeatedly or at high severity, or both. This GMA also includes extensive wilderness and roadless areas. We did not attempt to exclude wilderness or roadless areas, where road and trail access may be lacking, nor did we try to exclude areas where spotted owl habitat has been lost to wildfire. These factors can be considered during development of the Focal Management Area boundaries.

*Other Considerations:*

- The GMA boundary mainly follows the provincial boundary line. In the north and northwest, the GMA includes the Yolla Bolly-Middle Eel Wilderness and the portion of the Cold Fork watershed that intersects the California Klamath Province, and the GMA boundary follows the boundary lines for these features.

*Focal Management Areas (FMAs) for the South California Klamath GMA*

In the South California Klamath GMA, we recommend developing FMAs large enough to support as many spotted owl pair sites as possible. The maximum practicable size of FMAs is likely to be much smaller than 50 pairs in this GMA, so management of small clusters of sites may be more feasible than block management. Generally, larger blocky areas provide a smaller edge-to-area ratio, and this may help reduce the influx of barred owls from outside an FMA in the future, so when large blocks are not practicable, smaller blocks are preferable to scattered sites. If smaller FMAs are developed due to funding limitations, rather than habitat configuration, design them such that they could be expanded in the future if funding becomes available.

When possible, include multiple FMAs, generally spaced no farther than 12 to 15 miles apart. Where smaller FMAs are developed due to topography, forest condition, access, funding limitations, or other reasons, we recommend these be closer together and multiple areas be designed with the intent of encouraging exchange of spotted owls between these smaller areas.

Including recently occupied sites in FMAs provides the starting point for development of spotted owl populations as barred owl populations are reduced. In areas where habitat connectivity is limited, site management may help to provide connectivity between smaller FMAs. Coordinate FMA locations with the spotted owl site management described above, with FMA locations in the Central California Klamath GMA, and with any other barred owl management activity, whether or not it is conducted under this Strategy.

*Priorities:* The following are our recommended priorities for defining and selecting FMAs within the South California Klamath GMA. The following are in general priority order; however, local expertise will be important in applying these to specific FMA boundary designs.

1. Build FMAs around current occupied spotted owl sites (sites with presence or occupancy of spotted owls within the last year). This provides a nucleus of spotted owls for the potential recolonization of sites in the FMA as barred owl numbers are reduced.

2. Focus on areas with reasonable access, in terms of road networks where available, and trail systems where roads do not exist. Avoid large areas without roads or trails. Closed roads may be used like a trail system if they can be safely walked.

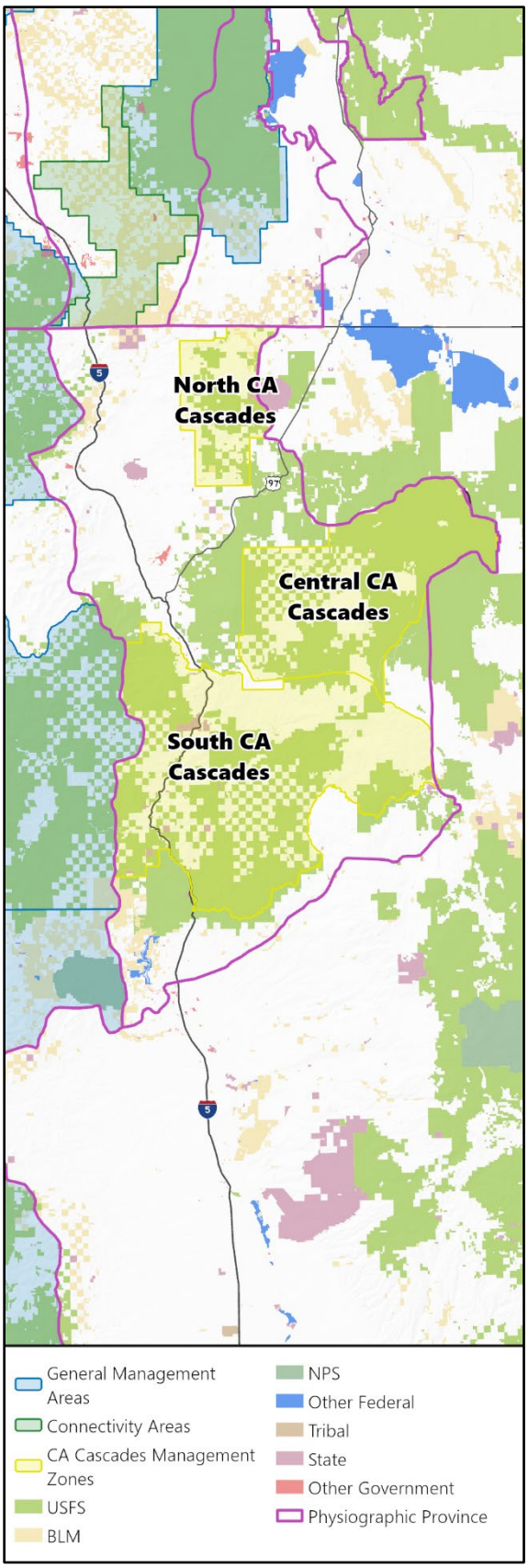
3. Consider fire risk when mapping FMA boundaries. Avoid concentrating FMAs solely in areas identified as having the highest risk of habitat loss to fire; however, some areas with high fire risk may still be important to include in FMAs, particularly where spotted owls are currently present in these areas. Providing connectivity in FMAs from higher risk spotted owl habitat to areas identified as fire refugia and other areas with relatively lower risk will be important in the mixed-severity fire regime of the California Klamath Province. Placement of multiple FMAs in the GMA and inclusion of areas with relatively high resistance to uncharacteristic fire could reduce the risk of complete loss.

4. Place FMA blocks where the best spotted owl habitat remains, and areas which allow for the maximum number of spotted owls to be supported. Focus on designating FMAs in areas with the potential for at least 20 spotted owl pairs, if possible. If 20 pair sized areas are not available, focus on a connected network of smaller blocks.

5. Include lands of interested and willing landowners or land managers. A focus on areas where landowners have expressed interest in barred owl management can help expedite implementation of barred owl management and encourage involvement.

6. Include areas with high-quality historical spotted owl sites (sites with no confirmed occupancy in the last five years or more). Indicators may include, for example, especially good habitat amount, quality, and configuration; a history of good past demographic performance; or a history of long-term occupancy. These are areas that have been shown by past use to be attractive to spotted owls and therefore more likely to be reoccupied as populations recover.

7. In the southern and western portions of the GMA, place barred owl management areas to limit barred owl population expansion, and especially southward and westward barred owl movements. This focus may be in addition to, or instead of, management focused on spotted owl population development.
8. Consider the potential for connection to other FMAs in the GMA, and to the neighboring GMA. Placement of FMAs in close proximity to the Central California Klamath GMAs, and where there is forest that may provide connectivity to the California Coast, can connect spotted owl populations in these areas and limit barred owl movements through these areas.
9. Consider the presence of areas already designated for spotted owl habitat management or compatible conservation purposes, such as Late Successional Reserves, Congressionally reserved areas, designated critical habitat, and areas identified as high priorities in the Northern Spotted Owl Recovery Plan. Including these areas provides support to spotted owls and limits impacts on other resources. As many of these have been managed for older forest over the last decades, these are the likely locations higher value habitat.




# A4.11 California Cascades Province

## A4.11.A Background

This physiographic province for the northern spotted owl encompasses approximately 2.5 million acres in total area. It is located at the eastern extent of the northern spotted owl range in California. It lies south of the Eastern and Western Oregon Cascades, and east of the California Klamath Province. Land management is a mix of Federal (Forest Service and BLM) and private industrial timberlands, resulting in a widespread checkerboard ownership pattern throughout the province. In addition, there are numerous small, private non-industrial timber land managers and private inholdings. Approximately 52 percent of the forest lands in the province are managed by the Forest Service and BLM. Approximately 1 percent of forest lands are managed by the State, with the remainder primarily in private lands.

The California Cascades Province has relatively gentle terrain, low annual precipitation, and dry forest types. The province is fragmented by large landscape features such as Mount Shasta, Shasta Valley, and the giant crater lava flows associated with the Medicine Lake Highlands. There are large expanses of volcanic and dry soils, and lower and drier elevation areas in the eastern portion of the province are dominated by ponderosa pine or western juniper (*Juniperus occidentalis*). In the western and southern portions of the province, as well as higher elevation areas in the eastern portion of the province, ponderosa pine/white fir (*Abies concolor*), mixed conifer, and red fir (*Abies magnifica*) forest types occur. As in other warmer, drier physiographic provinces (Eastern Washington and Oregon Cascades and the Oregon and California Klamath Provinces), fire was historically frequent and is an integral part of the internal dynamics of a typical stand. The east side of the province is characterized by a more fragmented landscape than what is observed in the southern and western areas, and by a checkerboard

of Federal and private ownerships where management regimes have exacerbated fragmentation.

### A4.11.A.1 Spotted Owl Condition in the California Cascades Province

The largest areas of spotted owl habitat, and higher quality habitat, are concentrated in the western and southern portions of the province, but habitat is also present in areas within the eastern portion of the province. In the eastern portion, habitat value for nesting, roosting, and foraging increases with elevation and water availability. The drier ponderosa pine and western juniper forests in the lower elevation areas in the east of the province do not typically support long-term spotted owl territories but likely provide for dispersal and may provide connectivity to the northern provinces. In the south, west, and higher elevations in the east, the ponderosa pine/white fir, mixed conifer, and red fir forest types are used by spotted owls in all stages of life. Dusky-footed woodrats are the primary prey consumed in this province, with flying squirrels as the secondary prey species, and smaller contributions from a variety of other species including brush rabbits and gophers (Farber and Whitaker 2005, p. 9).

Over the past 25 years, wildfires in the California Cascades Province were typically frequent, small, and suppressed fairly quickly due to the expansive road network. The recent exception is the 2021 Antelope Fire, which removed a significant portion of the spotted owl habitat in the northeastern part of the province, reducing even further its capability to support spotted owls. Based on the most recent assessment of habitat conditions after the 2023 wildfire season, there are approximately 169,999 acres of spotted owl nesting and roosting habitat and 279,230 acres of marginal spotted owl habitat in the California Cascades Province on Federal lands (Davis et al. 2024a).

There are no demography study areas for the northern spotted owl in the California Cascades Province. The closest study area in terms of distance, climate, vegetation, and habitat similarity is the South Cascades Study Area in southern Oregon. Prior to the 2021 Antelope Fire there were approximately 30 spotted owl territories on the Goosenest Ranger District of the Klamath National Forest in the northern extent of the province. There were approximately 30 to 40 territories on the Shasta-McCloud Management Unit of the Shasta-Trinity National Forest. Most of these territories are confirmed to be consistently occupied by single spotted owls or spotted owl pairs, from 1989 through 2020 (USFS 2024). Thus, the population appears to be relatively stable apart from some recent declines due to loss of habitat. There are two long-term occupied territories on the western edge of the province in and near the South Fork Sacramento watershed which function as connections between the California Cascades and California Klamath Provinces. In short, the sites occupied by spotted owls have remained consistently occupied, if not affected by high-severity fire.

The Pit River, generally referenced as the boundary between the northern and California subspecies ranges, flows through the southern portion of the province. The areas to the north and south of the Pit River form an introgression zone between the two subspecies, in which exchange of individuals, and their associated genetic information, takes place (Barrowclough et al. 2011, p. 583; Funk et al. 2008, p. 167; Miller et al. 2017, pp. 6873, 6877). The interchange between the two subspecies ranges provides for genetic richness and variation, which in turn supports the adaptive capacities of both subspecies.

### A4.11.A.2 Barred Owl Condition in the California Cascades Province

There are no barred owl population estimates available for the province, but barred owls have been detected in the province since the mid-1990s. Their numbers in the California provinces have steadily increased as their apparent southward and eastward migration from the California Coast Province has progressed (Franklin et al. 2021, pp. 11-17; Franklin et al. 2022, pp. 10, 12, 24, 29).

As of August 2022, barred owl density remains relatively low in the California Cascades Province, compared with the other two California provinces and the rest of the northern spotted owl range. However, this province is a key area to manage in order to reduce the movement and expansion of barred owls into the Sierra Nevada and the range of the California spotted owl. Annual surveys and monitoring on Forest Service, BLM, and private lands, as well as the large landscape Eastside Spotted Owl Resource Plan for private lands, may allow for faster implementation and focus of barred owl management actions. Map A4-1 shows known barred owl occurrence data for the province.

Sierra Pacific Industries is currently carrying out experimental barred owl removal in this province as a conservation measure included in their HCP.

## A4.11.B Management Strategy

### A4.11.B.1 Spotted Owl Site Management in the California Cascades Province

*A4.11.B.1.a Background*

Maintaining the existing northern spotted owl population to the maximum extent possible will provide for greater potential for recruitment and population expansion. Much, but not all, of the available habitat in this province has been surveyed in recent years. Where recent survey coverage is incomplete, we recommend surveys of areas with adequate habitat, especially historically active sites where the last spotted owl detections occurred between 5 and 10 years ago.

Although barred owls may be removed anywhere in the province as part of the strategy to reduce barred owl incursions into the California spotted owl range (see Section A4.11.A), designating areas for site management can help to prioritize those removals to maximize benefits to northern spotted owls as well. If barred owl monitoring and removal cannot be carried out in full, block management may be needed in Management Zones (see below), and managed sites may eventually be incorporated into block management areas. In some areas, site management of single sites or clusters of sites may be an appropriate long-term action, if larger blocks of habitat are not available for management due to landscape or ownership conditions, or in areas where site management promotes connectivity between block management areas.

- Managing barred owls in occupied northern spotted owl sites is intended to help retain the existing northern spotted owl population and increase the potential for recruitment of northern spotted owl young.
- Managing barred owls in occupied northern spotted owl sites may enable those sites to provide a source of young for recolonization of nearby management blocks, if block management is used.

- Maintaining northern spotted owl sites distributed across the California Cascades province, whether in block management areas or not, may reduce the risk of losing northern spotted owls in the province from catastrophic events, such as wildfire, by spreading sites across the area.
- Managing barred owls in northern spotted owl sites also provides an opportunity for maintaining northern spotted owls in areas where block management is not feasible nor recommended. This approach applies across the entire province, whether or not the northern spotted owl sites are in mapped Management Zone.
- Managing spotted owl sites in close proximity to other barred owl removal areas, whether those removal areas are part of this Strategy or other programs (e.g., scientific experiments), will create efficiencies by reinforcing and expanding zones of reduced barred owl density.
- These spotted owl sites may serve to increase connectivity between and within block management areas, and provide sites in the vicinity of block management areas that can interact at a demographic level. This is particularly important in the north and south California Cascades where demographic connectivity with the Eastern and Western Oregon Cascades and California Klamath Provinces may be possible.
- Spotted owl site management, due to its smaller size when compared to block management, also provides a wider range of options for landowner contribution to barred owl management, particularly for smaller landowners. The smaller size also makes site management suitable for areas where there are not large amounts of spotted owl habitat due to terrain, or extensive loss of habitat from wildfires, harvest, or other disturbances.

*Selection of Northern Spotted Owl Sites for Management*

Although the northern spotted owl population is reduced from historical numbers by both land management actions (timber harvest) and the 2021 Antelope Fire, the California Cascades province still contains a relatively stable number of long-term occupied northern spotted owl territories. As described above, the western and central extent of the province contains higher value spotted owl habitat and long-term sites; and sites in the northern extent do remain occupied but with a reduced distribution of nesting, roosting, foraging, and dispersal habitat because of the 2021 fire.

The focus of northern spotted owl site management in the California Cascades Province is primarily on currently active sites, to provide existing spotted owls relief from competitive pressure, and secondarily on recently active sites, where recolonization of sites after barred owl removal is more likely. This is reflected in the priorities for site management below.

*Spotted Owl Site Management Priorities*

| Priority | Spotted Owl Site Condition |
|---|---|
| A | Currently active sites, including all areas with any spotted owl detections within the last year |
| B | Recently active sites, including all areas where the most recent spotted owl detection was between 1 and 5 years ago |
| C | Historically occupied spotted owl sites (pair or single) with last detection between 5 and 10 years ago |
| D | Historically occupied spotted owl sites (pair or single) with last detection more than 10 years ago, and potential sites with adequate habitat but no known history of spotted owl occupancy, and without detections within the last 5 years |

*Other considerations for selection of spotted owl sites for management:*

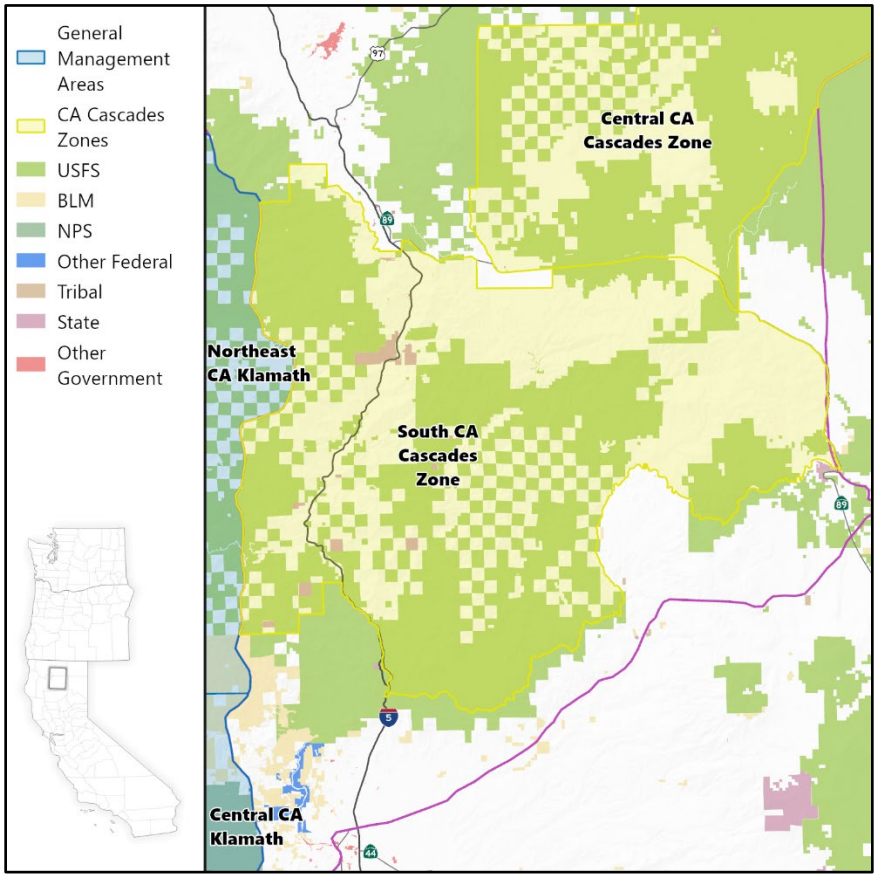
- We recommend consideration of the following factors when selecting among sites within a priority category. Focus first on spotted owl sites with recent occupancy by pairs, then singles, then detections.
- Consider past reproductive history of the spotted owl site. Select spotted owl sites with a history of reproduction on the site where surveys are available.
- Consider the condition of habitat in the area, particularly loss of habitat since the last surveys. All other things being equal, select sites with abundant high-quality habitat. Spotted owl sites that have lost substantial amounts of habitat to fire, harvest, insect damage, or other disturbances, may be lower priority.

*A4.11.B.1.b Management Recommendations*

Within each individual site, remove barred owls from an area between 7,645 and 13,592 acres. This represents the area in a circle of 1.5 and 2 home range radii (Table 2). This can be distributed in a circle around the activity center, or implementers can use local knowledge, topography, and habitat condition to design a non-circular area of the appropriate size that provides the best conditions for barred owl management. In areas where spotted owl sites are isolated, and particularly for sites in Priority A condition (see table above), we recommend a larger management area, up to 30,582 acres (3 home range radii). Where sites are not isolated, applying site management to clusters of two or more sites in close proximity is likely to provide more efficient management conditions and increased benefits for spotted owls present in those sites.

## A4.11.B.2 Special Designated Areas

*A4.11.B.2.a South California Cascades Management Zone – Priority A*




The South California Cascades Management Zone includes approximately 766,873 acres in total, of which 732,339 acres (95 percent) are forest lands and 199,138 acres (26 percent) provide spotted owl nesting and roosting habitat. Another 219,688 acres (29 percent) provide marginal spotted owl habitat. This Management Zone is located in the southern portion of the province extending from Highway 89 in the north, and south to the Pit River. Approximately 52 percent of forest lands in this Management Zone are under Federal land management by the Shasta-Trinity National Forest, with about 1 percent under State management, and the remainder primarily in private ownership.

This Management Zone was mapped for the following reasons:

- It includes the densest concentration of nesting, roosting, and foraging habitat in the California Cascades province.
- It provides connectivity to the west and the California Klamath Province.
- It encompasses the southeastern extent of the northern spotted owl range.
- It provides for connectivity to Sierra Nevada. This area is located in the center of the hybridization zone with the California spotted owl, making it important for genetic interchange. There are ongoing barred owl removal research efforts in portions of the Management Zone, which can be expanded. Sierra Pacific Industries is currently conducting barred owl removal research in portions of the Management Zone as a conservation measure associated with their HCP.

This Management Zone is assigned Priority A for northern spotted owls. Although the northern spotted owl population in this area is small, it appears to be relatively stable, and is located in a key location for genetic exchange with California spotted owls, as well as connectivity between the California Cascades and California Klamath Provinces. Given the existing barred owl

removal research efforts both within this Management Zone and in the adjacent Northeast California Klamath GMA, additional barred owl removal efforts within this Management Zone are likely to be effective in maintaining spotted owl population stability. Actions here are intended to create refugia to secure and improve spotted owl populations here, which may in turn serve as source populations for the rest of the province and other provinces. Monitoring and removal of all territorial barred owls within this area are also a Priority A or B actions (depending on the exact location) for the benefit of California spotted owls, to help prevent southward barred owl movement into the Sierra Nevada.

*Description of the elements considered in mapping:* In mapping the boundaries of the South California Cascades Management Zone we used information on the following elements.

*Spotted Owl Data:*

- We included current spotted owl detection and occupancy information from the Forest Service and private industrial timberland managers. In some areas this influenced placement of the boundary. This area includes current, recent, and historical sites, including a number of long-term occupied sites.
- High-quality spotted owl habitat is present in limited quantities and its distribution is patchy due to vegetation communities and past timber harvest. We mapped the Management Zone to encompass most high-quality habitat in between Highway 89 and the Pit River, and also included some large areas of marginal habitat with evidence of past or current spotted owl presence. Our mapping is inclusive rather than exclusive.

*Conditions:*

- We did not try to exclude wilderness or roadless areas, where road and trail access may be lacking, nor did we try to exclude all high elevation areas without spotted owl habitat, or areas where habitat has been lost to wildfire. If necessary, these factors can be considered during development of the Focal Management Area boundaries.

*Other Considerations:*

- We considered this area's location within the hybridization zone with the California spotted owl.
- As discussed above, barred owl research is currently being carried out in a portion of this area that is managed and monitored under an HCP. This allows for efficiencies in monitoring and opportunities for research. However, the Management Zone boundaries do not follow HCP area boundaries, and include a relatively small portion of the HCP area.

*Focal Management Areas (FMAs) for the South California Cascades Management Zone*
The Strategy for the Sierra Nevada population of California spotted owls identifies the California Cascades Province as an area where barred owls should be monitored, and all territorial barred owls removed, to prevent re-expansion of the barred owl population into the Sierra Nevada (see Section A4.12.A). If that component of the Strategy cannot be carried out in full, development of block management areas in the South California Cascades Management Zone will be beneficial

for the northern spotted owl population here. Depending on the density of barred owls at any given time and the available funding to carry out barred owl management, block management could include very large blocks covering all or most of the Management Zone. If barred owl densities are high or little funding is available, we recommend a FMA approach similar to that used in other portions of the northern spotted owl range.

We recommend developing FMAs large enough to support as many spotted owl pair sites as possible. The maximum practicable size of FMAs is likely to be much smaller than 50 pairs in this area, so management of small clusters of sites may be more feasible than block management. Generally, larger blocky areas provide a smaller edge-to-area ratio, and this may help reduce the influx of barred owls from outside the FMA in the future, so when large blocks are not practicable, smaller blocks are preferable to scattered sites. We recommend these small FMAs be located less than 12 miles apart and multiple areas be designed with the intent of encouraging exchange of spotted owls between these smaller areas. Where possible, when setting up smaller areas, design them such that they could be expanded in the future if funding becomes available.

Because of the history of barred owl research and experimental management in parts of this area, additional information may be available regarding areas with higher and lower barred owl influxes, and implementers should refer to this information in FMA development.

In areas where habitat connectivity is limited, site management may help to provide connectivity between smaller FMAs. Coordinate FMA locations with the spotted owl site management described above, with FMA locations in the adjacent Northeast California Klamath GMA and Central California Cascades Management Zone, and with any other barred owl management activity, whether or not it is conducted under this Strategy.

*Priorities:* The following are our recommended priorities for defining and selecting FMAs within the South California Cascades Management Zone, in case the entire area cannot be managed. The following are in general priority order; however, local expertise will be important in applying these to specific FMA boundary designs.

1. Build FMAs around current occupied spotted owl sites (sites with presence or occupancy of spotted owls within the last year).
2. Include areas with high-quality spotted owl sites, regardless of current occupancy status. Indicators may include, for example, especially good habitat amount, quality, and configuration; a history of good past demographic performance; or a history of long-term occupancy.
3. Place blocks to include spotted owl populations, or clusters of sites, with good current demographic parameters (e.g., higher survival, occupancy, reproductive output, etc.) relative to others in the Management Zone.
4. Place FMA blocks where the best spotted owl habitat remains, and areas which allow for the maximum number of spotted owls to be supported. Focus on designating FMAs in areas with the potential for at least 20 spotted owl pairs, if possible. If 20 pair sized areas are not available, focus on a connected network of smaller blocks.

5. Include lands of interested and willing landowners or land managers. A focus on areas where landowners have expressed interest in barred owl management can help expedite implementation of barred owl management and encourage involvement. Focus first on areas where funding is available.

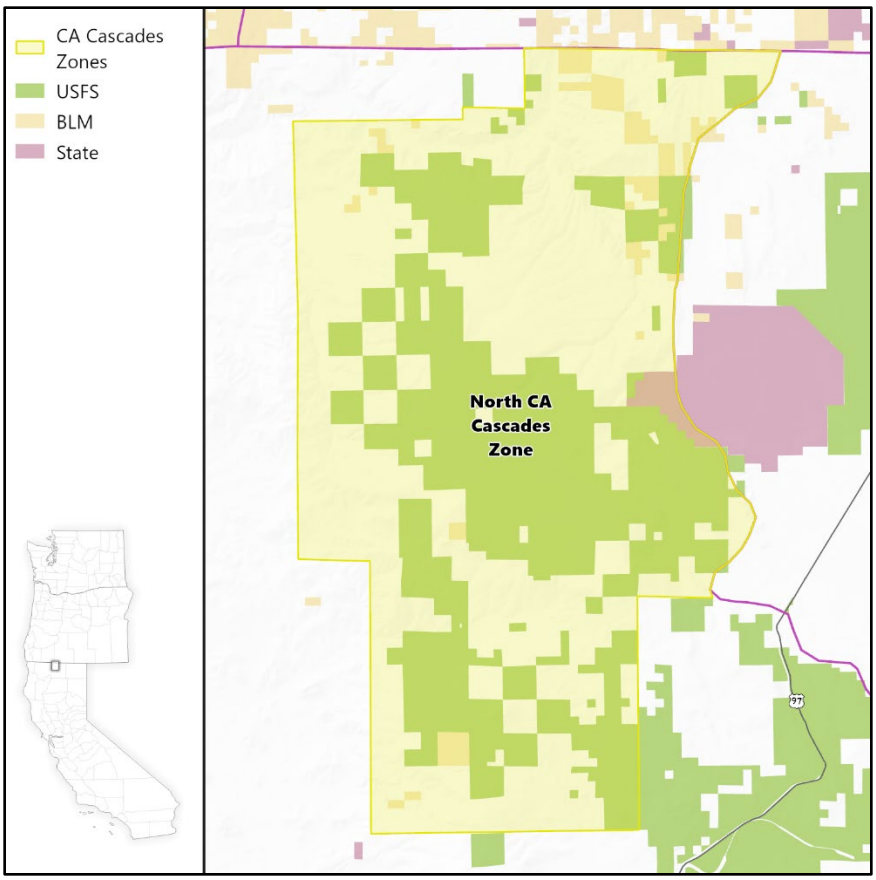
6. Consider fire risk when mapping FMA boundaries. Avoid concentrating FMAs solely in areas identified as having the highest risk of habitat loss to fire; however, some areas with high fire risk may still be important to include in FMAs, particularly where spotted owls are currently present in these areas. Providing connectivity in FMAs from higher risk spotted owl habitat to areas identified as fire refugia and other areas with relatively lower risk will be important in the fire-prone California Cascades Province. Placement of large blocks or multiple smaller FMAs in the Management Zone and inclusion of areas with relatively high resistance to uncharacteristic fire could reduce the risk of complete loss.

7. Select areas where drivable roads are available and accessible (including access rights and weather conditions) during the period when management is needed. Where roads are not available, trails may be used, but avoid areas lacking in roads and trails.

8. Consider the potential for connection to other barred owl removal areas in the Management Zone, and to neighboring GMAs and Management Zones. Placement of FMAs in close proximity to other GMAs in the California Klamath Province and to the Central California Cascades Management Zone can connect populations in those areas. Placement of FMAs in the area closest to the California spotted owl range can preserve connections between the two subspecies, and will be protective to California spotted owl populations as well.

9. Consider the presence of areas already designated for spotted owl habitat management or compatible conservation purposes, such as Late-Successional Reserves, Congressionally reserved areas, designated critical habitat, and areas identified as high priorities in the Northern Spotted Owl Recovery Plan. Including these areas provides support to spotted owls and limits impacts on other resources. As many of these have been managed for older forest over the last decades, these are the likely locations higher value habitat.

*A4.11.B.2.b North California Cascades – Priority C*




The North California Cascades Management Zone includes approximately 155,053 acres in total, of which 139,642 acres (90 percent) are forest lands and 14,852 acres (10 percent) provide spotted owl nesting and roosting habitat. Another 36,400 acres (23 percent) provide marginal spotted owl habitat. This Management Zone is located at the northern extent of the province, northeast of Highway 97. The Eastern Oregon Cascades Province is to the north. This Management Zone is centered on the Goosenest Late Successional Reserve on the Klamath National Forest, and also includes land managed by the Northern California District of the BLM. It also Includes a small area of the Butte Valley State Wildlife Area. Acer Klamath is the primary private landowner, and their lands are managed by FWS Forestry. Approximately 46 percent of the forest lands in this Management Zone are under Federal land management (Forest Service and BLM), with the remainder mainly under private ownership.

This Management Zone was mapped for the following reasons:

- This area has historically provided connectivity northwest to the Western Oregon Cascades and Oregon Klamath and north to the Eastern Oregon Cascades.
- This is an isolated area with limited extent of forest lands. Isolation may support successful barred owl removal and exclusion. Although it is a small and isolated patch of spotted owl habitat, spotted owls are present and occupancy appears to be stable.

This Management Zone is assigned Priority C for northern spotted owls. The spotted owl population within this area is small, but appears to be relatively stable. Site management around currently and recently occupied sites within this Management Zone remain Priority A and B actions, respectively, for the benefit of northern spotted owls. Monitoring and removal of all territorial barred owls within this area are also Priority B and Priority A actions, respectively, for the benefit of California spotted owls, to help prevent southward barred owl movement into the Sierra Nevada. If this element of the Strategy for California spotted owls cannot be completed in full, management within this area outside of current and recent spotted owl sites would help to

maintain spotted owl population stability by reducing barred owl reinvasion of spotted owl territories. Because both barred and spotted owl populations appear to be low in this area, block management here is relatively less urgent than block management in South California Cascades Management Zone, and fits the definition of a Priority C action.

*Description of the elements considered in mapping:* In mapping the boundaries of the North California Cascades Management Zone we used information on the following elements.

*Spotted Owl Data:*

- This area includes current, recent, and historical sites, including a number of long-term occupied sites.
- This area includes the Goosenest Late Successional Reserve, which contains most of the spotted owl habitat in the northern portion of the province.
- This area is key to maintaining linkages for spotted owls between the Oregon Cascades and Sierra Nevada (USFS 1996, p. 5-8).

*Conditions:*

- This area is largely accessible by road.

*Other Considerations:*

- The isolation of this patch of spotted owl habitat increases the potential for successful barred owl removal and exclusion.

*Focal Management Areas (FMAs) for the North California Cascades Management Zone*
The Strategy for the Sierra Nevada population of California spotted owls identifies the California Cascades Province as an area where barred owls should be monitored, and all territorial barred owls removed, to prevent re-expansion of the barred owl population into the Sierra Nevada (see Section A4.11.A). If that component of the Strategy cannot be carried out in full, development of block management areas in the North California Cascades Management Zone will be beneficial for the northern spotted owl population here. Depending on the density of barred owls at any given time and the available funding to carry out barred owl management, block management could include a block covering all or most of the Management Zone, which is relatively small in total area. If barred owl densities are high or little funding is available, we recommend a FMA approach similar to that used in other portions of the northern spotted owl range.

We recommend developing FMAs large enough to support as many spotted owl pair sites as possible. The entire Management Zone would support fewer than 50 pairs, even if all of the forested area consisted of spotted owl habitat, so if the entire area cannot be managed, management of small clusters of sites may be a feasible approach. Generally, larger blocky areas provide a smaller edge-to-area ratio, and this may help reduce the influx of barred owls from outside the FMA in the future, so when large blocks are not practicable, smaller blocks are preferable to scattered sites. We recommend these small FMAs be located close together and multiple areas be designed with the intent of encouraging exchange of spotted owls between

these smaller areas. Where possible, when setting up smaller areas, design them such that they could be expanded in the future if funding becomes available.

Coordinate block management locations with the spotted owl site management described above, and with any other nearby barred owl management activity, whether or not it is conducted under this Strategy.

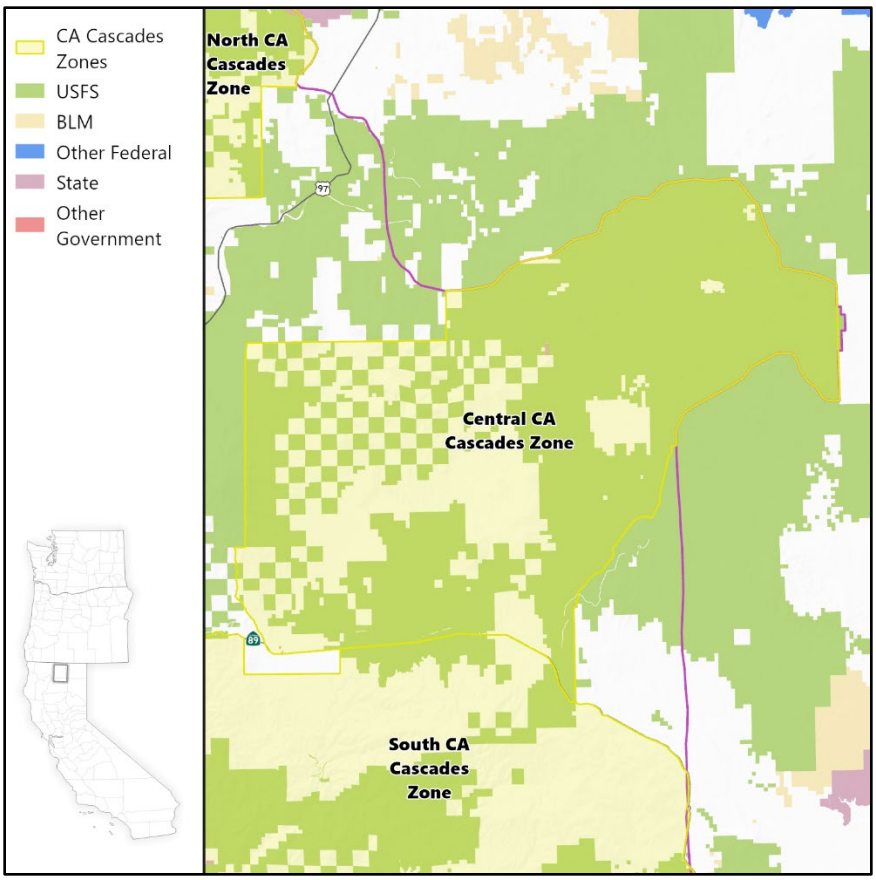
*Priorities:* The following are our recommended priorities for defining and selecting FMAs within the North California Cascades Management Zone, in case the entire area cannot be managed. The following are in general priority order; however, local expertise will be important in applying these to specific FMA boundary designs.

1. Build FMAs around current occupied spotted owl sites (sites with presence or occupancy of spotted owls within the last year).
2. Include areas with high-quality spotted owl sites, regardless of current occupancy status. Indicators may include, for example, especially good habitat amount, quality, and configuration; a history of good past demographic performance; or a history of long-term occupancy.
3. Place blocks to include spotted owl populations, or clusters of sites, with good current demographic parameters (e.g., higher survival, occupancy, reproductive output, etc.) relative to others in the Management Zone.
4. Place FMA blocks where the best spotted owl habitat remains, and areas which allow for the maximum number of spotted owls to be supported. Focus on designating an FMA with the potential for at least 20 northern spotted owl pairs, if possible. If a 20 pair sized area cannot be managed, focus on a connected network of smaller blocks.
5. Include lands of interested and willing landowners or land managers. A focus on areas where landowners have expressed interest in barred owl management can help expedite implementation of barred owl management and encourage involvement. Focus first on areas where funding is available.
6. Consider fire risk when mapping FMA boundaries. Avoid concentrating FMAs solely in areas identified as having the highest risk of habitat loss to fire; however, some areas with high fire risk may still be important to include in FMAs, particularly where spotted owls are currently present in these areas. Providing connectivity in FMAs from higher risk spotted owl habitat to areas identified as fire refugia and other areas with relatively lower risk will be important in the fire-prone California Cascades Province. Placement of large blocks or multiple smaller FMAs in the Management Zone and inclusion of areas with relatively high resistance to uncharacteristic fire could reduce the risk of complete loss.
7. Select areas where drivable roads are available and accessible (including access rights and weather conditions) during the period when management is needed. Where roads are not available, trails may be used, but avoid areas lacking in roads and trails.
8. Consider the presence of areas already designated for spotted owl habitat management or compatible conservation purposes, such as Late-Successional Reserves, designated critical habitat, and areas identified as high priorities in the Northern Spotted Owl Recovery Plan.

Including these areas provides support to spotted owls and limits impacts on other resources. As many of these have been managed for older forest over the last decades, these are the likely locations higher value habitat.

9. Consider the potential for connection to other barred owl removal areas in the Management Zone, and for dispersal to nearby GMAs and Management Zones. Placement of FMAs where there is forest that may provide connectivity to the Central California Cascades Management Zone, the Eastern Oregon Cascades, or the Western Oregon Cascades, may connect populations in those areas.

*A4.11.B.2.c Central California Cascades Management Zone – Priority C*




The Central California Cascades Management Zone includes approximately 429,198 acres in total, of which 409,840 acres (95 percent) are forest lands and 34,834 acres (8 percent) provide spotted owl nesting and roosting habitat. Another 128,791 acres (30 percent) provide marginal spotted owl habitat. This Management Zone is located in the northeastern part of the province south of Highway 97 and north of Highway 89. This Management Zone was the most impacted by the 2021 Antelope Fire, but still contains occupied sites as of 2023 and well-distributed nesting, roosting, foraging, and dispersal habitat. It includes portions of the Klamath, Shasta-Trinity, and Modoc National Forests. Approximately 71 percent of this Management Zone is under Federal land management (Forest Service), with the remainder in primarily in private ownership.

This Management Zone was mapped for the following reasons:

- While the amount and distribution of high-quality nesting and roosting habitat was impacted by the 2021 Antelope Fire, northern spotted owls in the California Cascades Province tend to nest in lower quality habitat. This area retains abundant intermixed higher quality and marginal nesting, roosting, and foraging habitat, as well as occupied spotted owl sites.
- This area provides connectivity between the northern and southern portions of the province.
- This area is within the hybridization zone with the California spotted owl, making it important for genetic interchange.
- There are ongoing barred owl removal research efforts in portions of the Management Zone, which can be expanded. Sierra Pacific Industries is currently conducting barred owl removal research in portions of the Management Zone as a conservation measure associated with their HCP.
- Extensive checkerboard ownership pattern with industrial timberland managers may help with barred owl management. The Management Zone includes the Eastside Spotted Owl

Resource Plan area, and lands managed by Sierra Pacific Industries, Hearst, Campbell-Global, and other private land managers.

This Management Zone is assigned Priority C. The spotted owl population within this area is small, but appears to be relatively stable, aside from recent fire effects. Site management around currently and recently occupied spotted owl sites within this Management Zone remain Priority A and B actions, respectively, for the benefit of northern spotted owls. Monitoring and removal of all territorial barred owls within this area are also Priority A or B actions (depending on the distance from the Pit River) for the benefit of California spotted owls, to help prevent southward barred owl movement into the Sierra Nevada. If this element of the Strategy for California spotted owls cannot be completed in full, management within this area outside of current and recent spotted owl sites would help to maintain spotted owl population stability by reducing barred owl reinvasion of spotted owl territories. Because both barred and spotted owl populations appear to be low in this area, block management here is relatively less urgent than block management in South California Cascades Management Zone, and fits the definition of a Priority C action.

*Description of the elements considered in mapping:* In mapping the boundaries of the Central California Cascades Management Zone we used information on the following elements.

*Spotted Owl Data:*

- This area includes current, recent, and historical sites, including a number of long-term occupied sites.
- This area includes most of the spotted owl habitat in the central portion of the province. The distribution of this habitat is sparse and patchy due to vegetation communities, past timber harvest, and fire. Much of this area contains very limited amounts of higher quality nesting and roosting habitat and larger amounts of marginal habitat.

*Conditions:*

- This area is largely accessible by road.
- We included a small portion of the Mt. Shasta Wilderness, which may include less-accessible areas and high elevation areas lacking in spotted owl habitat. We also included a portion of the Antelope Fire area where fire effects resulted in habitat loss. If necessary, these factors can be considered during development of the Focal Management Area boundaries.

*Other Considerations:*

- As discussed above, barred owl research is currently being carried out in a portion of this area that is managed and monitored under an HCP. This allows for efficiencies in monitoring and opportunities for research. However, the Management Zone boundaries do not follow HCP area boundaries, and include a relatively small portion of the HCP area.

*Focal Management Areas (FMAs) for the Central California Cascades Management Zone*
The Strategy for the Sierra Nevada population of California spotted owls identifies the California Cascades Province as an area where barred owls should be monitored, and all territorial barred owls removed, to prevent re-expansion of the barred owl population into the Sierra Nevada (see Section A4.11.A). If that component of the Strategy cannot be carried out in full, development of block management areas in the Central California Cascades Management Zone will be beneficial for the northern spotted owl population here. Depending on the density of barred owls at any given time and the available funding to carry out barred owl management, block management could include a block covering all or most of the Management Zone. If barred owl densities are high or little funding is available, we recommend a FMA approach similar to that used in other portions of the northern spotted owl range.

We recommend developing FMAs large enough to support as many spotted owl pair sites as possible. The entire Management Zone can likely support fewer than 50 pairs, given the current condition of spotted owl habitat, so if the entire area cannot be managed, management of small clusters of sites may be a feasible approach. Generally, larger blocky areas provide a smaller edge-to-area ratio, and this may help reduce the influx of barred owls from outside the FMA in the future, so when large blocks are not practicable, smaller blocks are preferable to scattered sites. We recommend these small FMAs be located close together and multiple areas be designed with the intent of encouraging exchange of spotted owls between these smaller areas. Where possible, when setting up smaller areas, design them such that they could be expanded in the future if funding becomes available.

Because of the history of barred owl research and experimental management in parts of this area, additional information may be available regarding areas with higher and lower barred owl influxes, and implementers should refer to this information in FMA development.

Coordinate block management locations with the spotted owl site management described above, and with any other nearby barred owl management activity, whether or not it is conducted under this Strategy.

*Priorities:* The following are our recommended priorities for defining and selecting FMAs within the Central California Cascades Management Zone, in case the entire area cannot be managed. The following are in general priority order; however, local expertise will be important in applying these to specific FMA boundary designs.

1. Build FMAs around current occupied spotted owl sites (sites with presence or occupancy of spotted owls within the last year).
2. Include areas with high-quality spotted owl sites, regardless of current occupancy status. Indicators may include, for example, especially good habitat amount, quality, and configuration; a history of good past demographic performance; or a history of long-term occupancy.
3. Place blocks to include spotted owl populations, or clusters of sites, with good current demographic parameters (e.g., higher survival, occupancy, reproductive output, etc.) relative to others in the Management Zone.

4. Place FMA blocks where the best spotted owl habitat remains, and areas which allow for the maximum number of spotted owls to be supported. Focus on designating FMAs in areas with the potential for at least 20 northern spotted owl pairs, if possible. If 20 pair sized areas are not available, focus on a connected network of smaller blocks.

5. Include lands of interested and willing landowners or land managers. A focus on areas where landowners have expressed interest in barred owl management can help expedite implementation of barred owl management and encourage involvement. Focus first on areas where funding is available.

6. Consider fire risk when mapping FMA boundaries. Avoid concentrating FMAs solely in areas identified as having the highest risk of habitat loss to fire; however, some areas with high fire risk may still be important to include in FMAs, particularly where spotted owls are currently present in these areas. Providing connectivity in FMAs from higher risk spotted owl habitat to areas identified as fire refugia and other areas with relatively lower risk will be important in the fire-prone California Cascades Province. Placement of large blocks or multiple smaller FMAs in the Management Zone and inclusion of areas with relatively high resistance to uncharacteristic fire could reduce the risk of complete loss.

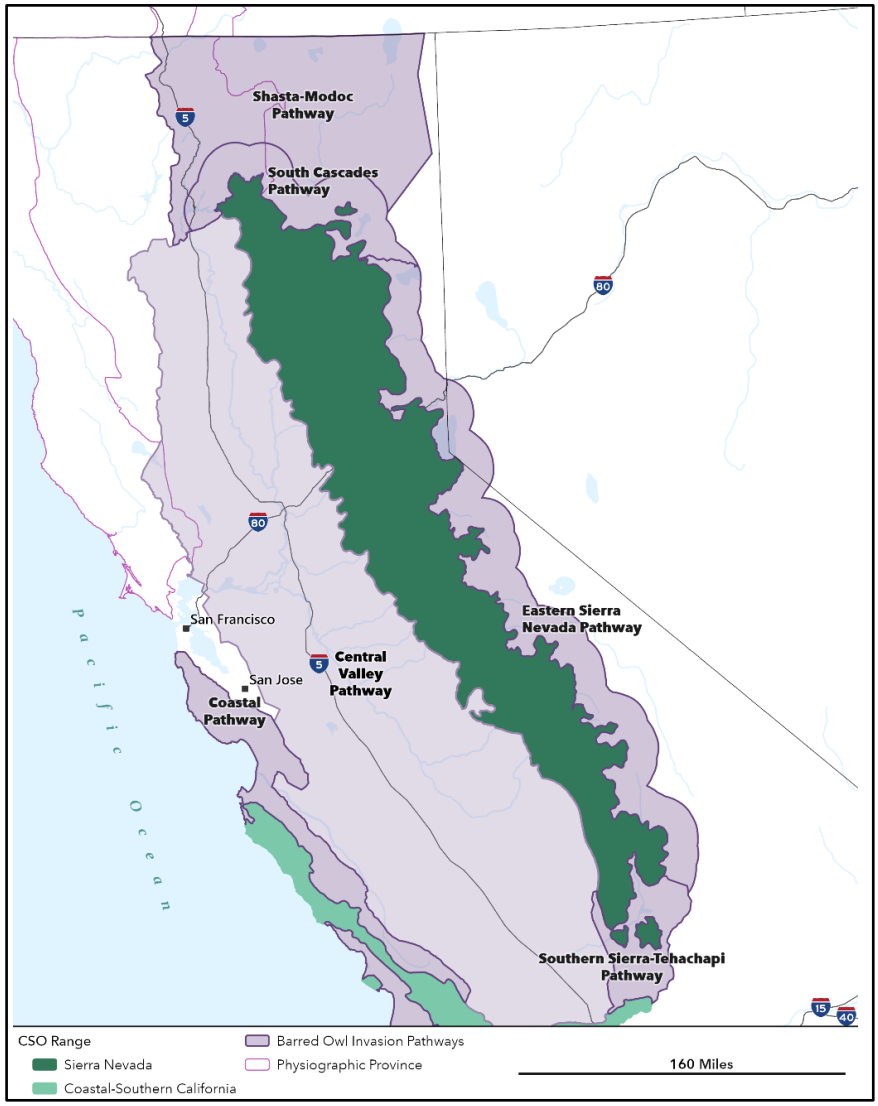
7. Select areas where drivable roads are available and accessible (including access rights and weather conditions) during the period when management is needed. Where roads are not available, trails may be used, but avoid areas lacking in roads and trails.

8. Consider the potential for connection to other barred owl removal areas in the Management Zone, to neighboring Management Zones, and to nearby GMAs and Management Zones. Placement of FMAs in close proximity to the South California Cascades Management Zone, and where there is forest that may provide connectivity to the North California Cascades Management Zone or the California Klamath Province, can connect populations in those areas.

9. Consider the presence of areas already designated for spotted owl habitat management or compatible conservation purposes, such as Late-Successional Reserves, Congressionally reserved areas, designated critical habitat, and areas identified as high priorities in the Northern Spotted Owl Recovery Plan. Including these areas provides support to spotted owls and limits impacts on other resources. As many of these have been managed for older forest over the last decades, these are the likely locations higher value habitat.

## A4.12 California Spotted Owl
### A4.12.A Sierra Nevada population

The Sierra Nevada population of California spotted owls is found in the Sierra Nevada Mountain Ranges and foothills in California and western Nevada.




Barred owls were first identified in the Sierra Nevada in 1989. By 2017, the cumulative number of barred and barred owl/spotted owl hybrid detections in the Sierra Nevada increased to approximately 145, with another 2.6-fold increase between 2017 and 2018 (Keane et al. 2018, p. 7; Wood et al. 2020, p. 4). This is a cumulative number, and not all of these sites remained active. A population of barred and hybrid owls developed in the northern Sierra Nevada, from which 65 owls were removed during an experiment between 2018 and 2020. Removal of detected barred owls continues as part of ongoing research in the Sierra Nevada at a rate of 10 to 15 barred owls per year (2020-2022).

At the current time, most barred owl detections appear to be dispersers that are detected one time and then are not detected on subsequent follow-up surveys. The primary dispersal corridor into the area occupied by the Sierra Nevada California spotted owl population is through the northern Sierra Nevada, with a secondary potential for movement across the Central Valley of California.

### A4.12.A.1 Specific Goals for Barred Owl Management:

1. Prevent colonization and population establishment of barred owl or hybrids across the Sierra Nevada, with the goal of maintaining barred owls at such low numbers they do not become a population-level threat to spotted owls in the Sierra Nevada population.
2. Focus specific attention on the key dispersal pathway in the northern Sierra Nevada from the Shasta-Trinity and Modoc National Forests and surrounding area.
3. Increase inventory and removal efforts if barred owl populations become established.

*Management Strategy:*
There are two primary components to the Strategy in the Sierra Nevada area: inventory and monitoring for the presence of invading barred owls, and removal of any barred owls located as soon as practicable from the lands of willing landowners or land managers. Experimental studies have demonstrated that an early warning system consisting of extensive systematic passive acoustic monitoring efforts, combined with follow-up surveys and lethal removal, are effective for reducing barred owl population expansion in the Sierra Nevada.

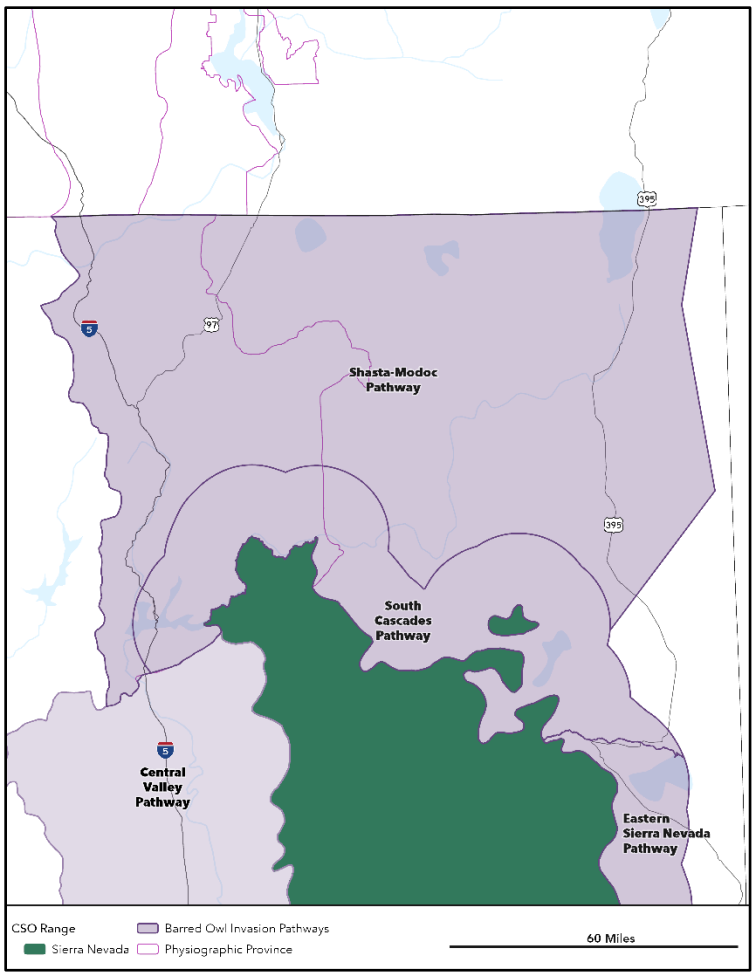
1. Inventory and monitoring for barred owls.

    a. Make use of all existing information sources for barred owl detections across the Sierra Nevada spotted owl population range and potential invasion pathways. Use existing broad-scale systematic sampling, such as the ongoing passive acoustic monitoring effort, to monitor for barred owl detections and occupancy at the scale of the Sierra Nevada California spotted owl population. Use focal monitoring at sentinel spotted owl research sites, such as demography study areas, on public and private lands to monitor for barred owl detection and effects at localized study scales. Collate barred owl detections recorded during short-term project-level surveys and anecdotal observations. **Priority A**

    b. Maintain and continue the established monitoring network for the detection of barred and spotted owls across the Sierra Nevada. **Priority A**

    c. Develop a sampling design to inventory and monitor barred owls in areas that function as dispersal pathways into the Sierra Nevada. Focused and long-term monitoring in these potential dispersal areas will create an early detection system along the northern border of the California spotted owl's range to allow for rapid removal of any detected barred owls. We recommend using passive acoustic monitoring, or other methods that become available. Initially these areas may not require annual surveys but could be visited on a five-year revolving window schedule to inventory and monitor for barred owls. If there is evidence of an increase in barred owl detections, increase the intensity and frequency of monitoring. Establish an extensive survey network:

        i. in the South Cascades Invasion Pathway, a 15-mile buffer surrounding the northern boundary of the California spotted owl range. This includes areas within the range of the northern spotted owl and southeast to the Susan River. Within the northern spotted owl range, coordinate survey and monitoring efforts with existing efforts, such as the Northwest Forest Plan Effectiveness Monitoring program, and with survey and monitoring associated with implementation of the




Strategy for the benefit of northern spotted owls. This area partially overlaps the South and Central California Cascades Management Zones for northern spotted owls within the California Cascades Province (see Section A4.11). **Priority A**

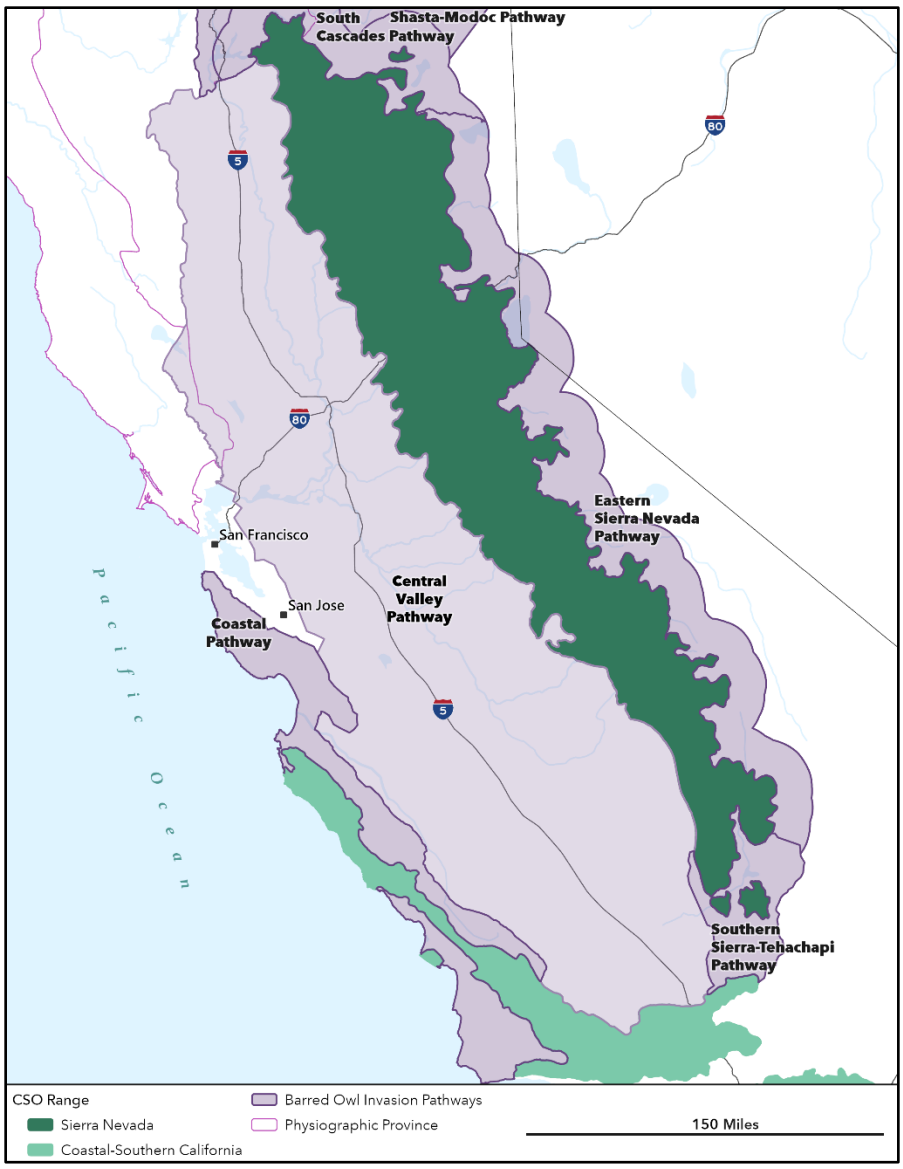
ii. in riparian corridors, forested areas, and woodland habitats that may support barred owls in Shasta-Modoc Invasion Pathway, which is the area outside of the 15-mile buffer across northeastern California. This includes the California Cascades Province north of the South Cascades Invasion Pathway, as well as portions of the Klamath, Shasta-Trinity, and Modoc National Forests to the east of the northern spotted owl range, and surrounding and intermixed BLM and non-Federal lands. Within the northern spotted owl range, coordinate survey and monitoring efforts with existing efforts, such as the Northwest Forest Plan Effectiveness Monitoring program, and with survey and monitoring associated with implementation of the Strategy for the benefit of northern spotted owls. This area includes the entire North California Cascades Management Zone and partially overlaps the Central and South California Cascades Management Zones for northern spotted owls (see Section A4.11). **Priority B**

d. Expand initial inventory and monitoring efforts to include lands not included in initial survey efforts.

i. In the northern Sierra Nevada – Develop an enhanced sampling design to monitor barred owl detections and occupancy. This is the area of highest risk of barred owl invasion, and has been a pathway in the past. **Priority A**

ii. In the central Sierra Nevada–- Develop an enhanced sampling design to monitor barred owl detections and occupancy. These areas are more removed from the potential invasion source and pathway, though barred owls may disperse long distances and reach these areas. **Priority B**

iii. In the southern Sierra Nevada–- Develop an enhanced sampling design to monitor barred owl detections and occupancy. These areas are more removed from the potential invasion source and pathway, though barred owls may disperse long distances and reach these areas. **Priority B**




iv. Make use of all sources of information on barred owl detections within the Central Valley, an alternative pathway for barred owl dispersal into the Sierra Nevada. Similarly, make use of all sources of information on barred owl detections within the Eastern Sierra Nevada Invasion Pathway, a 15-mile buffer along the east side of the California spotted owl range in the Sierra Nevada, focusing on riparian corridors, forested areas, and woodland habitats that may support barred owls. This is also a potential invasion pathway, though not currently of primary concern.

1. If barred owls are detected twice at a location, and the landowner or land manager is willing, schedule a follow-up survey. **Priority C**

2. If the number of barred owls reported in an area increases, establish additional monitoring to locate territorial barred owls. **Priority A**

e. Develop an interactive database and rapid-response system to collate all barred owl detections that are identified through ongoing demographic and research projects, project-level management surveys, and anecdotal observations within both the Sierra Nevada California spotted owl population and the key dispersal pathway areas. Develop an interagency database where records can be submitted that can facilitate a rapid-response follow-up to any detection. Develop a web-based portal where individuals outside of agencies may voluntarily provide data on locations of barred owls in this area, including educational and outreach material to encourage its use by the general public. **Priority A**

2. Lethal removal of detected barred owls.

a. Conduct lethal removal of all barred owls located on surveys or otherwise identified in the Sierra Nevada population range and potential invasion pathways described above as soon as practicable from the lands of willing landowners. This may include capture and euthanasia in areas where firearms may not be used. **Priority A**

b. Establish and maintain response team capacity to follow up on barred owl detections and conduct lethal removal of all barred owls. Support a rapid response capacity so that follow-up surveys and lethal removals can be conducted as soon as possible following reports of barred owl detections. **Priority A**

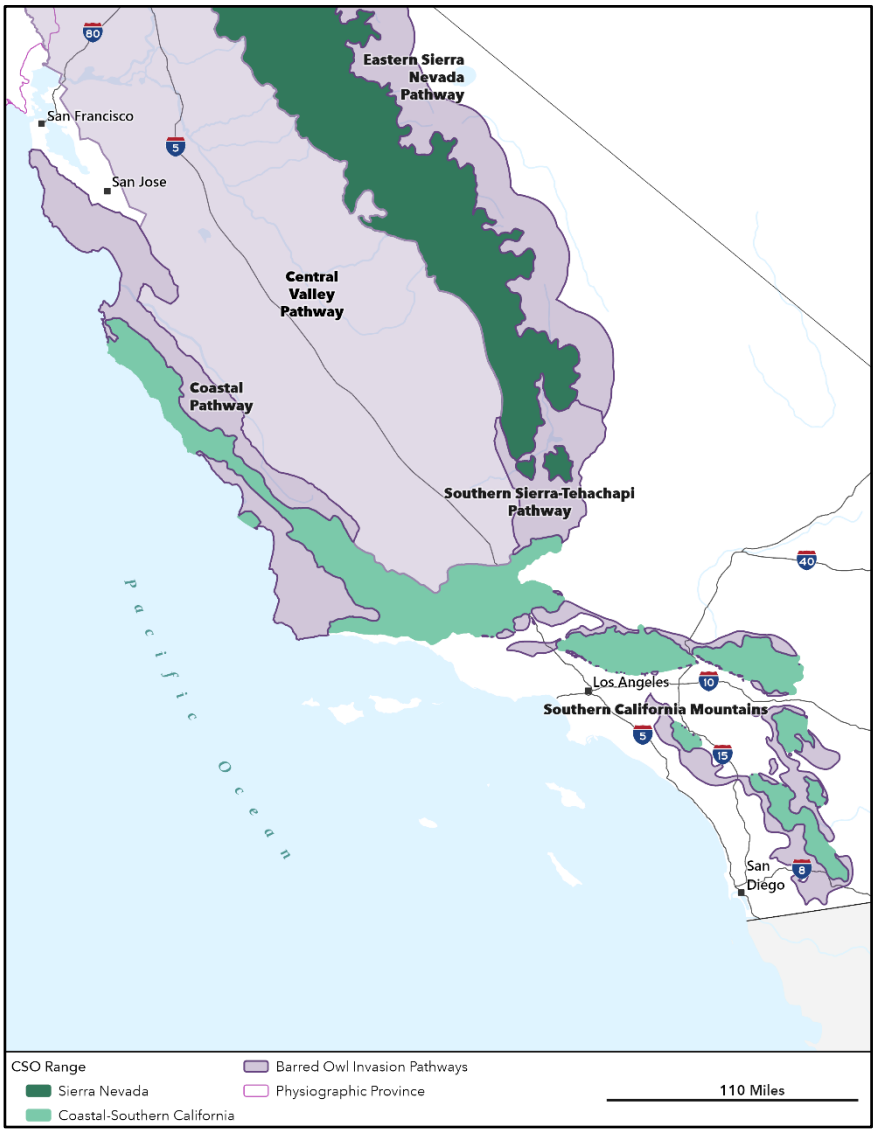
3. Response to the establishment of barred owl populations.

a. The goal in the Sierra Nevada is to prevent self-sustaining barred owl populations from becoming established and creating a source of additional barred owls to colonize within the California spotted owl range. However, it may not be possible to detect and remove all barred owls. Using current and future research results, establish a survey occupancy level that indicates barred owl populations are becoming self-sustaining and impacts to California spotted owls are imminent. Based on research in the northern Sierra Nevada, we recommend a starting threshold occupancy value of 0.10, though this should be modified if new information becomes available indicating that another occupancy value is a better indicator. Passive acoustic monitoring or other systematic regional monitoring results can be used to track the occupancy level. This should be evaluated at the scale of the Sierra Nevada population of California spotted owls, as well as at the zonal scales of the north, central and south zones within the Sierra Nevada. **Priority A**

b. If annual surveys or inventory in the Sierra Nevada indicate that barred owl occupancy has increased beyond the occupancy trigger threshold within the entire Sierra Nevada or the segments described above, then more intensive efforts should be implemented both within the Sierra Nevada California spotted owl population and in the surrounding dispersal pathways. **Priority A**

## A4.12.B. Coastal-Southern California population

The Coastal-Southern California population of California spotted owls is found in the Coast, Transverse and Peninsular Ranges of California.




Spotted owl habitat within the Coastal-Southern California range is naturally fragmented, with little dispersal occurring between subpopulations due to discontinuous mountain ranges. California spotted owl subpopulations in this area are further geographically isolated from each other by development and habitat loss in the greater Southern California area.

There are currently no known territorial barred owls in this area, and only a few confirmed detections in the central coast and the southern portion of the Sierra Nevada to the north. These represent potential invasion pathways for barred owls into the Coastal-Southern California spotted owl range. Detections of barred owls in coastal forests in the Santa Cruz Mountains in San Mateo County, California, suggest that the invasion may be on the horizon.

The Los Padres National Forest runs north-south along the southern portion of the California Coast Ranges. The Angeles and the northern part of the San Bernardino National Forests run east-west along the Transverse Ranges. The southern portion of the San Bernardino National Forest's San Jacinto Ranger District and the Cleveland National Forest run north-south along the Peninsular Range.

The BLM, California Desert District, manages public land, including designated wilderness, adjacent to the eastern and western boundaries of the San Bernardino and Cleveland National Forests in the Peninsular Range. The BLM and Forest Service co-manage the Sand to Snow

National Monument which spans the San Bernardino, Santa Rosa and San Jacinto Mountain Ranges, and the Santa Rosa and Santa Jacinto Mountains National Monument.

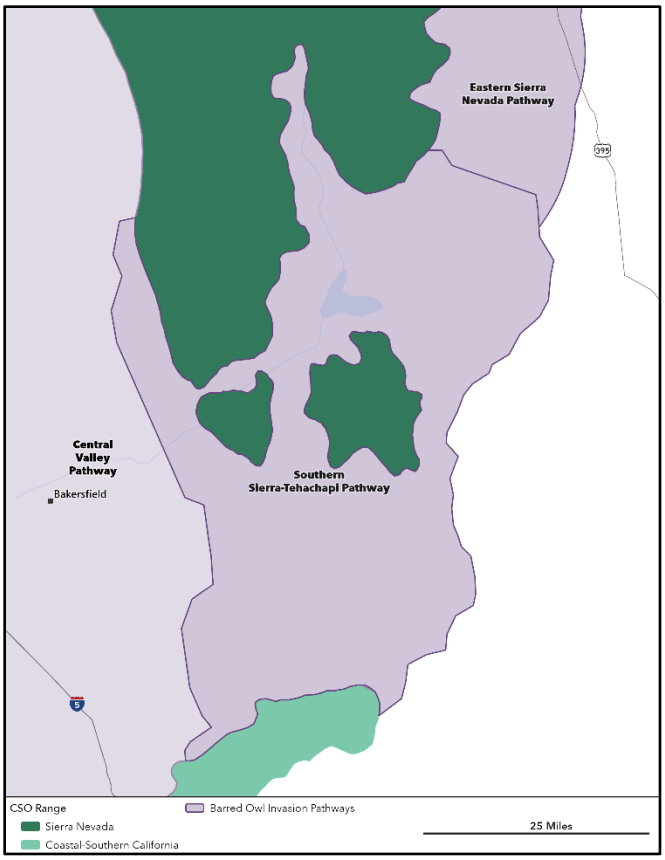
The Coastal-Southern California population of California spotted owls also occupies some State lands. The Santa Rosa Wildlife Area spans portions of the Santa Rosa and San Jacinto Mountains, Mount San Jacinto State Park and Magnesia Spring Ecological Reserve are located within the San Jacinto Mountains, and Peninsular Ranges Ecological Reserve and the Santa Rosa Mountains State Wilderness Area are located within the Santa Rosa Mountains all within the Peninsular Range. The Cuyamaca Rancho State Park and Cuyamaca Mountain State Wilderness are located within the Cuyamaca Mountains of the Peninsular Range.

### A4.12.B.1 Specific Provincial Goals for Barred Owl Management:

1. Prevent declines in California spotted owls from barred owl competition (short and long term).
2. Limit the invasion of barred owls into the Coastal-Southern California portion of the range of the subspecies (short term).
3. Respond quickly to reduce barred owl populations that may become established (long term).

*Management Strategy:*

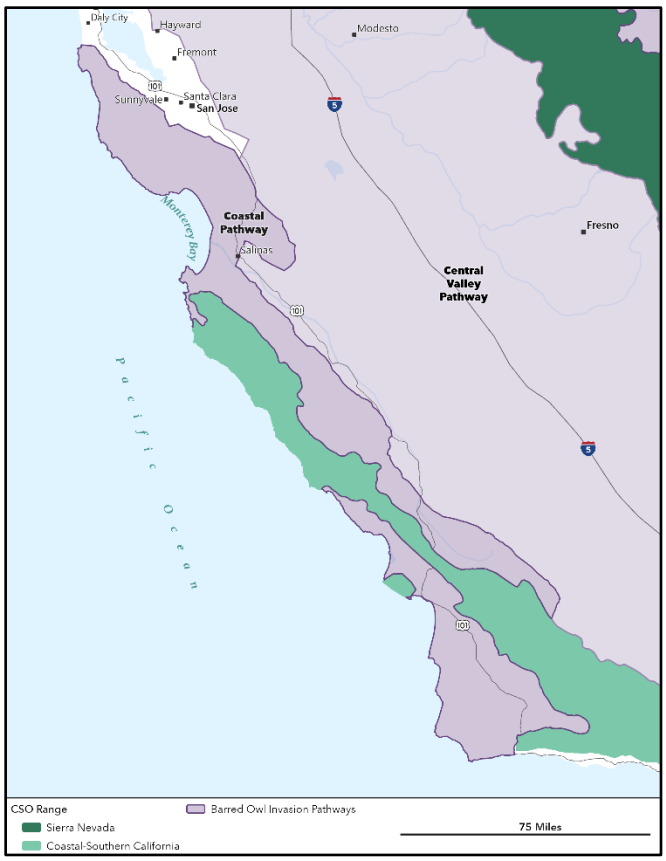
There are two primary components to the Strategy in the Coastal-Southern California area: inventory and monitoring for the presence of invading barred owls, and removal of any barred owls located as soon as practicable from the lands or willing landowners or land managers.

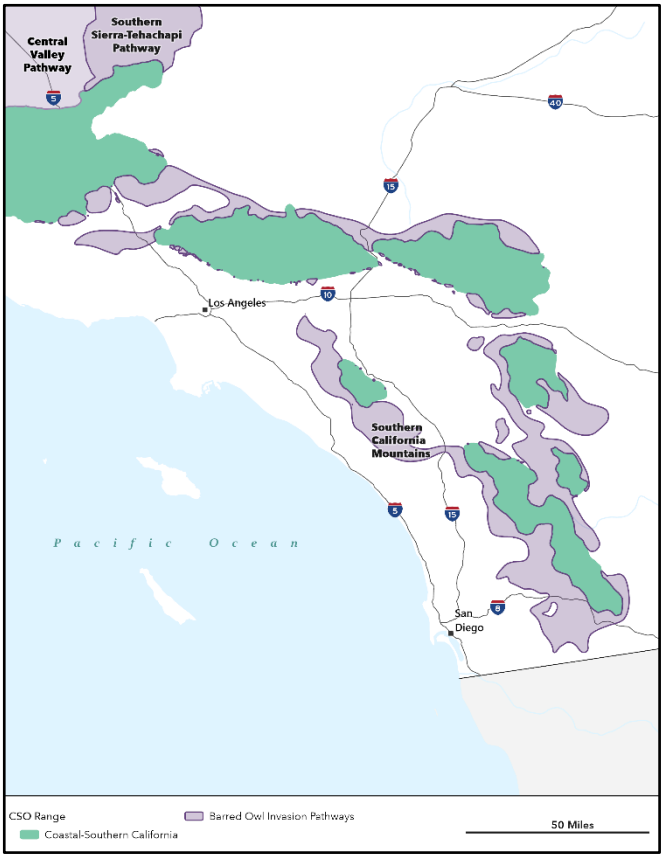



1. Inventory and monitoring for barred owls.

a. Make use of all existing information sources to monitor for barred owl detections across the Coastal-Southern California range, and within potential invasion pathways. Existing sources of information on barred owl detections include broad-scale systematic sampling, focal monitoring at sentinel spotted owl research sites, and barred owl detections recorded during short-term project-level surveys and anecdotal observations. **Priority A**

b. Conduct an extensive initial inventory of barred owl status and distribution in the




Coastal-Southern California population and likely invasion pathways, across all public lands and lands of willing private landowners and land managers, to establish baseline of current barred owl status and distribution across the area. The highest priority is to conduct extensive surveys within likely invasion pathways including the Southern Sierra-Tehachapi Invasion Pathway between the Coastal-Southern California and Sierra Nevada California spotted owl ranges as well as the Coastal Invasion Pathway south of San Francisco along the Coast Range. These pathways include riparian corridors, forest lands, and woodland habitats in San Mateo, Santa Clara, Santa Cruz, Monterey, San Benito, San Luis Obispo, and Santa Barbara Counties on the coast, as well as southern Kern County and northern Los Angeles County. **Priority A**

c. Extend initial inventory efforts to riparian corridors, forest lands, and woodland habitats that may support barred owls in the Southern California Mountains Invasion Pathway, for example, in lands immediately surrounding or falling between the disjunct islands of the Coastal-Southern California spotted owl range. **Priority B**

d. Develop an interactive database and rapid-response system to collate all barred owl detections that are identified through ongoing demographic and research projects, project-level management surveys, the inventory and monitoring efforts described above and below, and anecdotal observations. Provide opportunities for the public to provide locations. Develop an interagency database where records can be submitted that can facilitate a rapid-response follow-up to any detection. **Priority A**

e. Develop focused long-term monitoring, with particular emphasis on

early detection surveys (passive acoustic monitoring or other methods) within the Southern Sierra-Tehachapi Invasion Pathway and the Coastal Invasion Pathway. **Priority B**

This should be conducted National Forest, BLM, and surrounding State, local, and private lands within barred owl habitat. In the coastal range, surveys could start on the Los Padres National Forest's Monterey Ranger District (the closest district to the northern spotted owl range, within the Coastal Invasion Pathway) and Mt. Pinos Ranger District (the closest district to the Sierra Nevada California spotted owl range, within the Southern Sierra-Tehachapi Invasion Pathway). Within the Coastal-Southern California area, the northern edge of the Angeles National Forest (the northwestern edge of the Los Angeles Gateway Ranger District) is next closest to the area of Lake Isabella, Paiute Mountains/Tehachapi Range of Kern County, where a barred owl pair has been confirmed. In the Sierra Nevada Mountains within the Southern Sierra-Tehachapi Invasion Pathway, surveys are needed in barred owl habitat in lands managed by the BLM Bakersfield Field Office which has land surrounding Lake Isabella and south, and to the eastern portion of the Tehachapi range. We recommend that each willing landowner or land manger adjust survey intensity commensurate with location, available habitat, and barred owl threat. Focused surveys can move southward along the National Forests, BLM, State, local, and private lands as needed.

Focused and long-term monitoring will create an early detection system along the northern border of the area occupied by the Coastal-Southern California spotted owl population at key potential invasion corridors to allow for rapid removal of any detected barred owls before populations can become established. Adjusting survey intensity commensurate with potential barred owl colonization will allow investment of available funding where the barred owl threat is highest and reduce unneeded survey efforts elsewhere. Coordination with neighboring areas, as well as developing partnerships between public and private entities, will contribute to detection of barred owls in areas adjacent to Federal and State lands.

2. Lethal removal of detected barred owls.

   a. Conduct lethal removal of all barred owls located on surveys or otherwise identified in the Coastal-Southern California population range and potential invasion pathways described above as soon as practicable from the lands of willing landowners and land managers. This may include capture and euthanasia where firearms may not be used. **Priority A**

   b. Establish and maintain response team capacity to follow up on barred owl detections and conduct lethal removal of all barred owls. Support a rapid response capacity so that follow-up surveys and lethal removals can be conducted as soon as possible following reports of barred owl detections. **Priority B**

## Literature Cited


Acker, J. 2012. Recent Trends in Western Screech-Owl and Barred Owl Abundances on Bainbridge Island, Washington. Northwestern Naturalist 93:133-137.

Barrowclough, G.F., J.G. Groth, L.A. Mertz and R.J. Gutierrez. 2005. Genetic structure, introgression, and a narrow hybrid zone between northern and California spotted owls (*Strix occidentalis*). Molecular Ecology 13:1109-1120.

Barrowclough, G.F., R.J. Gutierrez, J.G. Groth, J.E. Lai and D.F. Rock. 2011. The hybrid zone between northern and California spotted owls in the Cascade-Sierran Suture Zone. The Condor 113:581-589

Barrows, C. 1980. Feeding ecology of the spotted owl in California. Journal of Raptor Research 14:4.

Barrows, C. 1985. Breeding success relative to fluctuations in diet for spotted owls in California. Pp. 50-54 in: Gutiérrez, R.J. and A.B. Carey, eds. Ecology and Management of the Spotted Owl in the Pacific Northwest. General Technical Report PNW-GTR-185. Pacific Northwest Forest and Range Experiment Station, U.S. Forest Service. Arcata, California. 120 pp.

Barrows, C.W. 1987. Diet shifts in breeding and nonbreeding spotted owls. Journal of Raptor Research 21:95-97.

Bevis, K.R., J.E. Richards, G. M. King and E. E. Hanson. 1997. Food habits of the northern spotted owl (*Strix occidentalis caurina*) at six nest sites in Washington's East Cascades. Pp. 68-73 *in*: Duncan, J.R., D.H. Johnson, and T.H. Nicholls, eds. Biology and conservation of owls in the northern hemisphere: second international symposium. February 5-9, 1997, Winnipeg, Manitoba, Canada. General Technical Report NC-190, North Central Forest Experiment Station, U.S. Forest Service. St. Paul, Minnesota.

Cutler, T.L. and D. W Hays. 1991. Food habits of Northern Spotted Owls in high elevation forests of Pelican Butte, southwestern Oregon. Northwestern Naturalist:66-69.

Davis, R.J., D.B. Lesmeister, Z. Yang, B. Hollen, B. Tuerler, J. Hobson, J. Guetterman, and A. Stratton. 2022. Northwest Forest Plan—the first 25 years (1994-2018): status and trends of northern spotted owl habitats. General Technical Report PNW-GTR-1003. Pacific Northwest Research Station, U.S. Forest Service. Portland, Oregon. 46 pp.

Davis, R.J., J.H. Guetterman, and A. Stratton. 2024. NSO_CTS_CLASS_2022: Classified nesting/roosting forest cover type suitability map. Unpublished geographic information system dataset. U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. Portland, Oregon.

Diller, L.V., K.A, Hamm, D.E. Early, D.W. Lamphear, K.M. Dugger, C.B. Yackulic, C.J. Schwarz, P.C. Carlson, and T.L. McDonald. 2016. Demographic response of northern spotted owls to barred owl removal. Journal of Wildlife Management 80:691-707.

Dugger, K., L.S. Andrews, L. Bright, S. Adams, K. Browning, E. Jaworski, J. Kurowski, J. Paque, and C. Pierce. 2023. Demographic characteristics and ecology of northern spotted owls (*Strix occidentalis caurina*) in the Southern Oregon Cascades. Annual research report

for fiscal year 2022. U.S. Geological Survey and Oregon Cooperative Fish and Wildlife Research Unit, Department of Fisheries, Wildlife, and Conservation Sciences, Oregon State University. Corvallis, Oregon. 39 pp.

Dugger, K.M., S. Ackers, M. Danilenko, R. Leach, R. Pechtimaldjian, D. Replinger, and L. Walderich. 2022. The demography of northern spotted owls (*Strix occidentalis caurina*) on the Willamette National Forest, Oregon. Annual report for fiscal year 2022. U.S. Geological Survey and Oregon Cooperative Fish and Wildlife Research Unit, Department of Fisheries, Wildlife, and Conservation Sciences, Oregon State University. Corvallis, Oregon. 67 pp.

Farber, S. and J. Whitaker. 2005. Diets of northern spotted owls (*Strix occidentalis caurina*) in the Southern Cascades and Klamath Provinces of interior northern California. Report prepared for the U.S. Fish and Wildlife Service for the review of the Spotted Owl Management Plan. Timber Products Company. Yreka, California. 42 pp.

Forsman, E.D., E.C. Meslow, and H.M. Wight. 1984. Distribution and biology of the spotted owl in Oregon. Wildlife Monographs:3-64.

Forsman, E.D., I.A. Otto, S.G. Sovern, and M.T. Taylor. 2001. Spatial and temporal variation in diets of spotted owls in Washington. Journal of Raptor Research 35:141-150.

Forsman, E.D., R.G. Anthony, E.C. Meslow, and C.J. Zabel. 2004. Diets and foraging behavior of northern spotted owls in Oregon. Journal of Raptor Research, 38:3.

Franklin, A.B. and R.J. Gutiérrez. 2002. Spotted Owls, forest fragmentation, and forest heterogeneity. Studies in Avian Biology 25:203–220.

Franklin, A.B., Dugger, K.M., Lesmeister, D.B., Davis, R.J., Wiens, J.D., White, G.C., Nichols, J.D., Hines, J.E., Yackulic, C.B., Schwarz, C.J., Ackers, S.H., Andrews, L.S., Bailey, L.L., Bown, R., Burgher, J., Burnham, K.P., Carlson, P.C., Chestnut, T., Conner, M.M., Dilione, K.E., Forsman, E.D., Glenn, E.M., Gremel, S.A., Hamm, K.A., Herter, D.R., Higley, J.M., Horn, R.B., Jenkins, J.M., Kendall, W.L., Lamphear, D.W., McCafferty, C., McDonald, T.L., Reid, J.A., Rockweit, J.T., Simon, D.C., Sovern, S.G., Swingle, J.K., Wise, H., 2021. Range-wide declines of northern spotted owl populations in the Pacific Northwest: A meta-analysis. Biological Conservation 259, 109168. https://doi.org/10.1016/j.biocon.2021.109168

Franklin A.B., P.C. Carlson, A. Rex, J.T. Rockweit, K. McGee, P. Teetsel, D. Brown, K. Lopez, S. Stewart, K.R. Wilson. 2022. Monitoring the population ecology of spotted owls (*Strix occidentalis caurina*) in northwestern California: annual results, 2021. Annual Progress Report (Contract# 17-CR-11052007-057) to Region 5, USDA Forest Service, Colorado State University. 1 April 2022. 36 pp.

Funk, W.C., E.D. Forsman, T.D. Mullins, and S.M. Haig. 2008. Introgression and dispersal among spotted owl *(Strix occidentalis*) subspecies. Evolutionary Applications 1:161-171.

Green Diamond Resource Company. 2019. Forest Habitat Conservation Plan on the California Timberlands of Green Diamond Resource Company. Final Habitat Conservation Plan prepared for the U.S. Fish and Wildlife Service. 828 pp.

Henke, A.L. 2005. Spotted owl (*(Strix occidentalis*) microsatellite variation in California. Master's Thesis. San Jose State University, San Jose, California. 52 pp.

Higley, J.M. 2022. Hoopa Valley Northern Spotted Owl Banding and Monitoring Comprehensive Project Report 2022. Hoopa Tribal Forestry. 26 pp.

Higley, J.M. 2023. Barred Owl Experimental Removal: Hoopa Study Area Report to U.S. Fish and Wildlife Service. Hoopa Tribal Forestry. 38 pp.

Irwin, L.L., T.L. Fleming, and J. Beebe. 2004. Are spotted owl populations sustainable in fire-prone forests? Journal of Sustainable Forestry 18:1-28.

Jenkins, J.M.A., D.B. Lesmeister, E.D. Forsman, K.M. Dugger, S.H. Ackers, L.S. Andrews, S.A. Gremel, B. Hollen, C.E. McCafferty, M.S. Pruett, J.A. Reid, S.G. Sovern and J.D. Wiens. 2021. Conspecific and congeneric interactions shape increasing rates of breeding dispersal of northern spotted owls. Ecological Applications 31(7): e02398.

Keane, J.J., R.A., Gerrard, C.V. Gallagher, P.A. Shaklee, T.E. Munton, and J.M. Hull. 2018. Range Expansion of the Barred Owl in the Sierra Nevada, California. PowerPoint Presentation for The Wildlife Society-Western Section Conference. Santa Rosa, CA

Lesmeister, D., J. Mowdy, E. Fliegel, K. Fukuda, A. Kupar, S. Langley, C. Larson, J. Riding, H. Wise. 2020. Demographic characteristics of northern spotted owls (*Strix occidentalis caurina*) in the Klamath Mountain Province of Oregon, 1990-2020. Northern spotted owl monitoring annual report for fiscal year 2020. Pacific Northwest Research Station, U.S. Forest Service. Corvallis, Oregon. 21 pp.

Lesmeister, D. B., J. M. A. Jenkins, Z. J. Ruff, R. J. Davis, C. L. Appel, A. D. Thomas, S. Gremel, D. Press, T. Chestnut, J. K. Swingle, T. Wilson, D. C. Culp, H. Lambert, C. McCafferty, K. Wert, B. Henson, L. Platt, D. Rhea-Fournier, and S. Mitchell. 2022a. Passive Acoustic Monitoring within the Northwest Forest Plan Area: 2021 Annual Report. USDA Forest Service Pacific Northwest Research Station and USDI National Park Service. Corvallis, OR. 30 p.

Lesmeister, D., A. Mikkelsen, and M. Nickols. 2022b. Demography of spotted owls on the east slope of the Cascade Range, Washington, 1989-2021. Cle Elum Spotted Owl Demography Study 2021 Annual Report. Pacific Northwest Research Station, U.S. Forest Service. Corvallis, Oregon. 22 pp.

Lesmeister, D. B, R. J. Davis, J.M.A. Jenkins, Z.J. Ruff, A.D. Thomas, T. Chestnut, S. Gremel, B. Henson, H. Lambert, C. McCafferty, S. Mitchell, T. Munger, N.M. Murphy, L. Platt, D. Press, S. Reffler, D. Rhea-Fournier, M. Ruggiero, J.K. Swingle, K. Wert, T. Wilson. 2023. Passive Acoustic Monitoring within the Northwest Forest Plan Area: 2022 Annual Report.

USDA Forest Service Pacific Northwest Research Station and USDI National Park Service. Corvallis, OR. 25 p.

Mangan, A.O., T. Chestnut, J. C. Vogeler, I. K. Breckheimer, W. M. King, K. E. Bagnall and K. M. Dugger. 2019. Barred Owls reduce occupancy and breeding propensity of Northern Spotted Owl in a Washington old-growth forest. The Condor, 121:p.duz031.

Miller, M.P., T.D. Mullins, E.D. Forsman and S.M. Haig. 2017. Genetic differentiation and inferred dynamics of a hybrid zone between northern spotted owls (*Strix occidentalis caurina*) and California spotted owls (*S. o. occidentalis*) in northern California. Ecology and Evolution 7:6871-6883.

Pearson, R.R. and K. B. Livezey. 2003. Distribution, numbers, and site characteristics of spotted owls and barred owls in the Cascade Mountains of Washington. Journal of Raptor Research 37:265-276.

Rosenberg, D.K., K. A. Swindle and R. G. Anthony. 2003. Influence of prey abundance on northern spotted owl reproductive success in western Oregon. Canadian Journal of Zoology 81:1715-1725.

Rossi, A. 2021. Rainier Spotted Owl Demography Study Area – 2021 Annual Report to Weyerhaeuser Company, Manulife Investment Management Timberland and Agriculture, Inc., National Park Service / Mt. Rainier National Park, U.S. Forest Service / Mt. Baker-Snoqualmie National Forest November 17, 2021. prepared by Raedeke Associates, Inc. 30 pp.

Schumaker, N.H., A. Brookes, J.R. Dunk, B. Woodbridge, J.A. Heinrichs, J.J. Lawler, C. Carroll, and D. LaPlante. 2014. Mapping sources, sinks, and connectivity using a simulation model of northern spotted owls. Landscape Ecology, 29:579-592.

Solis, D.M., 1983. Summer habitat ecology of spotted owls in northwestern California. Master's thesis. Humboldt State University, Arcata, California. 168 pp.

Taylor, A.H. and C.N. Skinner. 1998. Fire history and landscape dynamics in a late-successional reserve, Klamath Mountains, California, USA. Forest Ecology and Management 111:285-301.

Thomas, J.W., E.D. Forsman, J.B. Lint, E.C. Meslow, B.R. Noon, and J. Verner. 1990. A conservation strategy for the northern spotted owl. Interagency scientific committee to address the conservation of the northern spotted owl. U.S. Forest Service, U.S. Bureau of Land Management, U.S. Fish and Wildlife Service, and U.S. National Park Service, Portland, Oregon.

USDA (U.S. Department of Agriculture), and USDI (U.S. Department of the Interior). 1994. Record of decision for amendments to Forest Service and Bureau of Land Management planning documents within the range of the northern spotted owl: standards and guidelines for management of habitat for late-successional and old-growth forest related species within

the range of the northern spotted owl. U.S. Forest Service and U.S. Bureau of Land Management, Portland, Oregon.

USFS. 1996. Goosenest Adaptive Management Area Ecosystem Analysis. Goosenest Ranger District, Klamath National Forest, Pacific Southwest Region, Forest Service, U.S. Department of Agriculture. 187 pp.

USFS. 2024. Natural Resources Information System excerpt including northern spotted owl sites in northern California, 1989-2020. Unpublished geographic information system dataset. U.S. Forest Service, Region 5, Vallejo, California.

USFWS (U.S. Fish and Wildlife Service). 1992. Draft final recovery plan for the northern spotted owl. U.S. Fish and Wildlife Service, Portland, Oregon.

USFWS (U.S. Fish and Wildlife Service). 2011. Revised Recovery Plan for the Northern Spotted Owl (*Strix occidentalis caurina*). U.S. Fish and Wildlife Service, Portland, Oregon.

Ward, J.P., Jr., R. J. Gutiérrez, and B. R. Noon. 1998. Habitat selection by northern spotted owls: the consequences of prey selection and distribution. The Condor 100:79-92.

WDNR (Washington Department of Natural Resources). 2007. Northern spotted owl surveys on DNR-managed lands in southwest Washington. Final Report. Olympia. 31 pp.

White, K. 1996. Comparison of fledging success and sizes of prey consumed by spotted owls in northwestern California. Journal of Raptor Research 30:234-236.

Wiens, J.D. 2012. Competitive Interactions and Resource Partitioning Between Northern Spotted Owls and Barred Owls in Western Oregon. Ph.D. dissertation. Oregon State University, Corvallis, Oregon. 156 pp.

Wiens, J.D., K.M. Dugger, D.B. Lesmeister, K.E. Dilione, and D.C. Simon. 2019. Effects of barred owl (*Strix varia*) removal on population demography of northern spotted owls (*Strix occidentalis caurina*) in Washington and Oregon, 2015-2018. Open-File Report 2019-1074. U.S. Geological Survey. 27 pp.

Wiens, J.D., K.M. Dugger, D.B. Lesmeister, K.E. Dilione and D.C. Simon. 2020. Effects of barred owl (*Strix varia*) removal on population demography of northern spotted owls (*Strix occidentalis caurina*) in Washington and Oregon - 2019 annual report. U.S. Geological Survey.

Wiens, J. D., K. M. Dugger, J. M. Higley, D. B. Lesmeister, A. B. Franklin, K. A. Hamm, G. C. White, K. E. Dilione, D. C. Simon, R. R. Bown, P. C. Carlson, C. B. Yackulic, J. D. Nichols, J. E. Hines, R. J. Davis, D. W. Lamphear, C. McCafferty, and S. G. Sovern. 2021. Invader removal triggers competitive release in a threatened avian predator. Proceedings of the National Academy of Sciences 118(31): e2102859118.

Wood, C.M., R.J. Gutiérrez, J.J. Keane, and M.Z. Peery. 2020. Early detection of rapid Barred Owl population growth within the range of the California Spotted Owl advises the Precautionary Principle. The Condor 122:duz058. https://doi.org/10.1093/condor/duz058

Zabel, C.J., K. McKelvey, K, and J. P. Ward Jr. 1995. Influence of primary prey on home-range size and habitat-use patterns of northern spotted owls (*Strix occidentalis caurina*). Canadian Journal of Zoology 73: 433-439.

Personal Communications:

J. Allen, pers. comm., January 11, 2023.

J. Conner England, USFS, Forest Terrestrial Biologist, Gifford Pinchot National Forest, personal communication via email on January 9, 2023 to Vince Harke, USFWS, Supervisor, Westside Forests Zone Team, Washington Fish and Wildlife Office.

C. Yackulic, U.S. Geological Survey, Research Statistician, Southwest Region, personal communication via email on July 13, 2023, to Robin Bown, USFWS, Team Lead, Barred Owl Management Strategy, Oregon Fish and Wildlife Office.

# Appendix 5. Monitoring Plan for the Barred Owl Management Strategy

This section includes the **Implementation** and **Effectiveness Monitoring**. Implementation monitoring would be focused on documenting that actions taken under the Barred Owl Management Strategy (Strategy) are consistent with the described Strategy. Effectiveness monitoring would be focused on assessing the success of the management effort and providing information on the effectiveness of management under different conditions. For both types of monitoring, the Service, as the permit-holder, would be responsible for assembling the data contributed by designated implementers and conducting or securing Strategy-wide assessments and evaluations. In outlining this Monitoring Plan, we emphasize the information needed to document the implementation and effectiveness of the management efforts, rather than the particular methods used to gather the information.

## A5.1. Implementation Monitoring for the Barred Owl Management Strategy

The overall purpose of the Implementation Monitoring Plan would be to ensure that the management actions occurring under the  Strategy (Strategy) and Service's Migratory Bird Treaty Act (MBTA) permit, if issued, are consistent with the requirements of the barred owl removal protocol (Appendix 2) and the management plan outlined in the Strategy. Reporting the dates, locations, and numbers of barred owls taken, and their subsequent disposition would be a requirement for authorization under the MBTA.

We developed the implementation monitoring plan by reviewing the requirements in the removal protocol and information required to document those requirements, as well as the information required for the annual reporting forms associated with Special Purpose MBTA permits.

### A5.1.1 Annual report information required during implementation of barred owl removal.

Each group or individual designated to operate under the Service's MBTA permit shall submit annual reports including the information described below in Section A5.1.1.1 and A5.1.1.2.

#### A5.1.1.1 Barred owl removal results: For each attempt to remove a barred or hybrid owl, summarize the following information:

- Date and time.
- Location, preferably in Universal Transverse Mercator coordinates, and also listing state and county.
- Species targeted (barred owl or identified hybrid)
- Name of removal specialist and any other persons assisting or observing
- For each carcass collected, provide the following information, recorded prior to burying or transmitting the carcass:

- Body mass
- Foot-pad length
- Sex (if known)
- A photograph of each of the following:
    - front of the bird, including head, chest, and tail, with a good view of the lower abdomen,
    - underside of the tail, flared out, and
    - underside of the spread wings.
- Disposition of the carcass (not found, located but could not be safely accessed, buried on site, or retained and transmitted to an interested entity with the appropriate permits). Note that all owls identified as hybrids (whether the identification occurred before removal, after the carcass was in hand, or both) should be retained until released by USFWS. For carcasses retained and transmitted to other permitted entities, identify the entity to whom the carcass was transmitted.
- For each carcass that could not be found, an incident report describing the situation, including any information regarding the likelihood that the shot may have missed, or that the bird was injured and escaped.

#### A5.1.1.2 For any injury or mortality of non-target species

If any non-target species is injured or killed during an attempt to remove a barred owl, the protocol requires that this be reported immediately to the designated Service contact, that any injured animal other than a barred owl be transported to a licensed rehabilitation facility, and that a written incident report be submitted to the Service within 3 days. A copy of this report should also be appended to the annual report and should include:

- Species identity of the animal injured or killed.
- Nature of the injury (including death).
- Circumstances surrounding the unintended injury or death, including pictures if available.
- If the animal was injured but not killed, the name and contact information of the rehabilitation facility to which it was transported.

If non-target threatened or endangered species is injured or killed during an attempt to remove a barred owl, the protocol requires that this be reported immediately to the designated Service contact, that any injured animal be transported to a veterinarian or licensed rehabilitation facility, no further removal activities may be conducted until the Service reviews the incident report and authorizes such activities to resume.

#### A5.1.1.3 Summary of changes from previous annual report

Include a list of all removal specialists authorized, and summary of any ongoing requests for changes in removal specialists. Include any changes in boundary or personnel completed or requested since the previous annual report (A2.1.1 and A2.1.2).

## A5.2 Effectiveness Monitoring for the Barred Owl Management Strategy

The overall purpose of the Effectiveness Monitoring Plan is to assess status and trends in populations of spotted owls and barred owls in areas managed under the Strategy. Monitoring data would be used to assess the success of the management effort and provide information on the effectiveness of management under different conditions across the range of the northern and California spotted owl.

A key component of the monitoring plan is integration with monitoring of northern spotted owl populations and old forests on Federal lands under the Northwest Forest Plan Effectiveness Monitoring Plan, where feasible (Davis et al. 2022, entire; Lint et al. 1999, entire; Lesmeister et al. 2021, entire; Lesmeister et al. 2022, entire; Lesmeister and Jenkins 2022, entire). Use of this passive acoustic monitoring (PAM) network as a platform for evaluating the effectiveness of the Strategy would be anticipated to reduce cost and effort associated with monitoring requirements on Federal lands. However, integration with Northwest Forest Plan Effectiveness Monitoring would not be feasible in all areas where barred owls may be managed. Additionally, some potentially willing landowners or land managers may not wish to integrate monitoring on their lands with Northwest Forest Plan Effectiveness Monitoring. In these cases, we would accept monitoring data obtained by other means or by similar means not integrated with the Northwest Forest Plan Effectiveness Monitoring, as long as it provided the necessary information. In this way, we would avoid creating barriers for potential participants who would be able and willing to provide the necessary monitoring information, but not able or willing to integrate with Northwest Forest Plan Effectiveness Monitoring.

The development of the effectiveness monitoring plan was based on the following five steps (adapted from Lint et al. 1999, p. 1):

1. Specify monitoring goals, questions, and objectives.
2. Identify and evaluate population indicators that best represent changes to the status and trend of spotted owls (and barred owls) in managed areas.
    - informed by long-term demographic studies (Franklin et al. 2021, entire), barred owl removal experiments (Diller et al. 2014, entire; Diller et al. 2016, entire; Hofstader et al. 2022, entire; Wiens et al. 2021, entire), and existing monitoring of spotted owls (Kelly et al. 2023, entire; Lesmeister and Jenkins 2022, entire).
3. Based on steps 1 and 2, recommend a monitoring approach to measure population status and trend of both species in areas identified for management (e.g., Focal Management Areas).
4. Recommend a framework to manage monitoring data and periodically analyze results.
5. Ensure feedback between monitoring data, data analyses, and future management decision-making.

## A5.2.1 Monitoring Goal, Questions, and Objectives

The goal of the monitoring plan is to provide data that can be used to: 1) evaluate management actions in areas selected for management of barred owls; and 2) periodically evaluate the success of the Strategy in meeting the purpose and need to:

1. stop or slow northern spotted owl population declines caused by barred owls in selected treatment areas in the short term;
2. increase northern spotted owl populations over the longer term;
3. provide spotted owl habitat that is free of, or with reduced competition from, invasive barred owls;
4. limit the invasion of barred owls into the range of the California spotted owl by preventing the establishment of barred owl breeding populations;

*Monitoring questions:*
The monitoring plan is designed to address *population-level* questions specific to the status of spotted owls and barred owls **in managed areas specified** under the Strategy under block management areas (e.g., areas capable of supporting at least 30 pairs of spotted owls). Key questions for each species include:

Spotted owls:

- Has the Strategy implementation met the goal of slowing or stopping population declines (or increasing the annual population growth rate) of northern spotted owls relative to population status in the same area prior to management, or in comparable areas without management?
- What is the status and trend in abundance, site occupancy/site use, or local (site or territory) colonization/extinction rates of spotted owls in managed areas relative to conditions prior to management or in comparable areas without management?

Barred owls:

- Has the Strategy implementation reduced the abundance of, or site use by, barred owls, thereby providing habitat for northern spotted owls with reduced competition from barred owls?
- Has the Strategy implementation limited the colonization and establishment of barred owls into the range of California spotted owls?
- What is the status and trend in abundance, site occupancy/site use, or colonization rates of barred owls in managed areas?

*Monitoring objectives:*
The following objectives were specified to achieve the above monitoring goals and address key questions associated with management decision-making.

- Assess annual occurrence of spotted owls and barred owls at sites or areas selected for barred owl management.
- Assess changes in the population status or trend of spotted owls in managed areas.

    - e.g., annual change in the proportion of survey sites with one or more detections of spotted owls (Lesmeister and Jenkins 2022).
    - for spotted owls, occupancy surveys completed prior to management implementation can expedite estimation of management effectiveness and population status and trend. In some cases, these monitoring data may already exist.
- Assess changes in barred owl populations to quantify effectiveness of management in limiting their re-establishment (northern spotted owl) or establishment (California spotted owl) in managed areas.
    - for barred owls, occupancy surveys completed prior to implementation can expedite estimation of effectiveness of management. In some cases, these monitoring data may already exist.

## A5.3 Potential Population Indicators

Desired indicators of management effectiveness reflect ecologically quantifiable progress towards achievement of monitoring objectives. Desired population-level indicators should (modified from Lint et al. 1999, p. 5)

- Be based on methods with high detectability of focal owl species.
- Reflect the state of managed owl populations.
- Be quantifiable, cost-effective, and easily repeated over time.
- Show sufficient power in detecting changes in managed populations.
- Be readily distinguishable from background variation not related to barred owl management, such as habitat loss.

We narrowed the range of possible population indicators for each owl species based on the following considerations:

- Current availability of monitoring data on spotted owls and barred owls (e.g., detection/non-detection data used to estimate probability of site use from PAM; (Appel et al. 2023, entire; Duchac et al. 2020, entire).
- Indicators for spotted owls must be measurable population characteristics of spotted owls known to be sensitive to competition from barred owls: adult survival (Franklin et al. 2021, entire; Wiens et al. 2021, entire), site occupancy, colonization, and local extinction (Franklin et al. 2021), breeding dispersal and pair status (Jenkins et al. 2019, entire; Jenkins et al. 2021, entire; Wiens et al. 2021).
- For barred owls, removal data collected during management activities may be used to directly measure population changes over time without additional surveys (e.g., see methods described by Link et al. 2018; Udell et al. 2022). Quantitative methods for this approach for barred owls are currently under development (D. Wiens pers. comm.)

**Population indicators applicable to spotted owls and barred owls**
We recommend using non-invasive (passive) survey methods to monitor and track changes in population status of spotted owls and barred owls simultaneously in areas targeted for management. These methods provide the information needed to monitor implementation of the

Strategy while avoiding injury to spotted owls. In using passive monitoring, we recommend focusing on the following population vital rates:

Territory occupancy (detection/non-detection data)

- For northern spotted owls, territories are approximated by provincial core use areas and home ranges, or defined by polygons depicting historical use areas (e.g., demographic monitoring by Franklin et al. 2021, entire).
- For California spotted owls, territories are approximated by Protected Activity Centers.
- Historically, territory occupancy has been determined through call-broadcast surveys or mark-resight studies. Focused use of PAM within known high-use portions of a territory can also provide data regarding territory occupancy.

Site use (detection/non-detection data)

- Where survey sites are randomly placed (e.g., in hexagon survey plots used for existing PAM programs), site use is distinct from territory occupancy in that it provides information on spotted owl presence and absence, but not necessarily on-site fidelity or pair status
    - For northern spotted owls, sites have been defined as 5-$km^2$ survey hexagons (e.g., PAM by Lesmeister and Jenkins 2022, entire)
    - For California spotted owls, sites have been defined as 4-$km^2$ survey hexagons.

Population size/abundance (numbers of territorial individuals)

- This is not typically estimated in spotted owl demographic studies or monitoring programs, but see Davis et al. (2022, pp. 18-19) for example of habitat-based estimates of number of occupied territories. Note that habitat-based estimates of occupancy also rely on existing information regarding occupancy rate (see above).
- This can be estimated using count-based models (e.g., *N*-mixture abundance estimation; Duarte et al. 2018, entire; Royle 2004, entire; see Wiens et al. 2017, pp. 13–14 for application with barred owls), or multistate occupancy models for estimation of relative abundance and population trends (Steen et al. 2023, entire).
- For barred owls, abundance can be estimated directly from lethal removal activities (e.g., number detected vs. number removed per visit to each sample site; see Rodriguez de Rivera and McCrea2021, pp. 18–19)

*Population indicators specific to spotted owl demographic studies:*
Previous demographic monitoring of spotted owl populations was based on call-broadcast survey methods to detect the presence of territorial owls, followed by capture-mark-resight methods to mark individuals and track their survival and reproduction over time (Franklin et al. 1996, entire; Franklin et al. 2021, entire). While these demographic monitoring methods have been largely discontinued and replaced with non-invasive surveys, some groups may opt to conduct demographic studies for a variety of reasons, and may wish to use this information to evaluate the effectiveness of barred owl management. In such cases, we recommend focusing on the following population vital rates:

Adult survival (i.e., apparent survival; Franklin et al. 2021 entire)

- Adult survival is typically estimated with mark-resight data (but see Rossman et al. 2016, entire).
- Estimates of adult survival are typically focused on breeding/territorial birds.
- Barred owls are known to disproportionately impact adult survival of spotted owls (Wiens et al. 2021:6-7).
- Adult survival has a disproportionate contribution to changes in population growth rate relative to other population vital rates (Diller et al. 2016; Dugger et al. 2016; Franklin et al. 2021; Noon and Biles 1990; Wiens et al. 2021).

Reproductive rate/number of young fledged (NYF)

- One measure is the proportion of sites monitored with ≤1 fledgling (e.g., reproductive rate defined by Rockweit et al. 2023).
    - This measure can be estimated without capture-mark-resight data based on the proportion of monitored sites where at least 1 fledging was detected.
- A more precise measure is fecundity (number of female fledglings produced per territorial female; Franklin et al. 2021).
    - This measure requires capture-mark-resight data from territorial birds.
    - Reproduction is known to be sensitive to fluctuations in local weather and regional climate (Glenn et al. 2011a; Glenn et al. 2011b, entire), and less responsive to barred owl presence relative to other population characteristics like adult survival and territory occupancy (Diller et al. 2016, pp. 11–12; Wiens et al. 2021, pp. 4–5).

## A5.4 Management Scales and Data Needs

Species-specific monitoring is important across multiple spatial scales of management action identified in the Strategy. Below we describe each scale and identify corresponding minimum data requirements needed to determine effectiveness of management actions.

Individual site (territory) scale

At this scale, management may occur at individual territories recently or historically used by spotted owls. The primary indicators of management effectiveness at this scale are territory occupancy or site use, based on detection/non-detection data collected within the provincial home-range radius of the site for both owl species. Counts of individual spotted owls or barred owls detected on each survey occasion are desirable if using survey methods that provide such information. For Passive acoustic monitoring (PAM) survey methods (see below), we recommend reporting the number of repeated sampling occasions with positive vocal detections to help differentiate territory occupancy from infrequent use of the site (see Watson et al. 2023, entire). Note that methods to estimate numbers of individuals or territorial pairs using PAM are under development (Kelly et al. 2023, entire; D. Lesmeister pers. comm.)

Small block scale (e.g., 30 pair size areas or larger)

At this scale, management occurs across areas capable of supporting multiple (at least 30) territorial pairs of spotted owls. Indicators of population status at this scale include site

occupancy/use (i.e., proportion of historical territories or PAM sites surveyed with positive detections), reproductive rate, or population size/abundance. PAM sites may include hexagons (i.e., groups of 3-4 autonomous recording units [ARUs] within a hexagon), or ARU stations within hexagons. Note that some management areas may be larger than a single site but smaller than a 30-pair area, and these would be monitored using the same methods used for individual sites.

Large block or provincial scale: Includes larger General Management Areas (particularly those that overlap study areas used for Northwest Forest Plan monitoring) or entire provinces (i.e., a collection of sites and/or multiple Focal Management Areas). Indicators at this scale include site occupancy/use, reproductive rate, population size/abundance. This scale includes areas with and without barred owl management, providing monitoring data that can be compared with data from managed areas to increase understanding of management effectiveness.

Range-wide scale
Includes all provinces and populations, respectively, within the northern and California spotted owl geographic ranges. This facilitates testing of Strategy effectiveness using all managed areas combined within range-wide meta-analysis, similar to that completed by Wiens et al. (2021). Indicators include site use or occupancy; reproductive rate; population size/abundance.

## A5.5 Recommended Monitoring Approach

Established and standardized monitoring protocols are recommended initially for the focal owl species (spotted and barred owls), but the monitoring plan can accommodate future changes associated with the development of existing or new methods. Below we provide descriptions of recommended monitoring methods that each group or individual designated implementer can employ to satisfy permitting requirements while providing information on management effectiveness at one or more of the spatial scales identified above.

Passive Acoustic Monitoring (applicable across all management scales)
Over the past several years, population monitoring of northern spotted owls and California spotted owls on Federal lands has transitioned from traditional call-playback and mark-resight demographic studies to a broad-scale PAM sampling design **(**Figure 1; Lesmeister et al. 2021, entire; Lesmeister and Jenkins 2022, entire). The monitoring design uses ARUs to measure owl use at recording stations (~250-m radius around ARUs) and sample sites in which three or four ARUs are placed (5-$km^2$ hexagons for northern spotted owls, 4-$km^2$ for California spotted owls). Sample hexagons are monitored over a six-week period during the breeding season, and colonization and extinction rates of those sites are estimated using occupancy modeling to track changes in populations of spotted owls and barred owls and estimate population trend. Now fully implemented as of 2023, the PAM sampling network (used for effectiveness monitoring of northern spotted owls under the Northwest Forest Plan) includes 20 percent coverage of Federal forest lands (i.e., forested lands of all age classes, including recently burned, harvested, or otherwise disturbed areas) in seven historical spotted owl demography study areas, and 2 percent coverage of Federal forest lands across the entire northern spotted owl range within the United States (Figure 1; Lesmeister and Jenkins 2022, entire).

The PAM sampling design for northern spotted owls (Lesmeister et al. 2021, entire) has been shown to be effective for detecting the presence of spotted owls and barred owls while accounting for uncertainties associated with the sampling design (e.g., effects of background noise levels on detectability; Duchac et al. 2020). More recently, data from the PAM network was used to estimate spotted owl sex (Dale et al. 2022, entire) and the probability of pair vocalizations at sample sites (Appel et al. 2023, entire). Further, these data can be integrated with traditional call-broadcast survey methods to estimate population trends for spotted owls (see Weldy et al. 2023, entire) or barred owls.

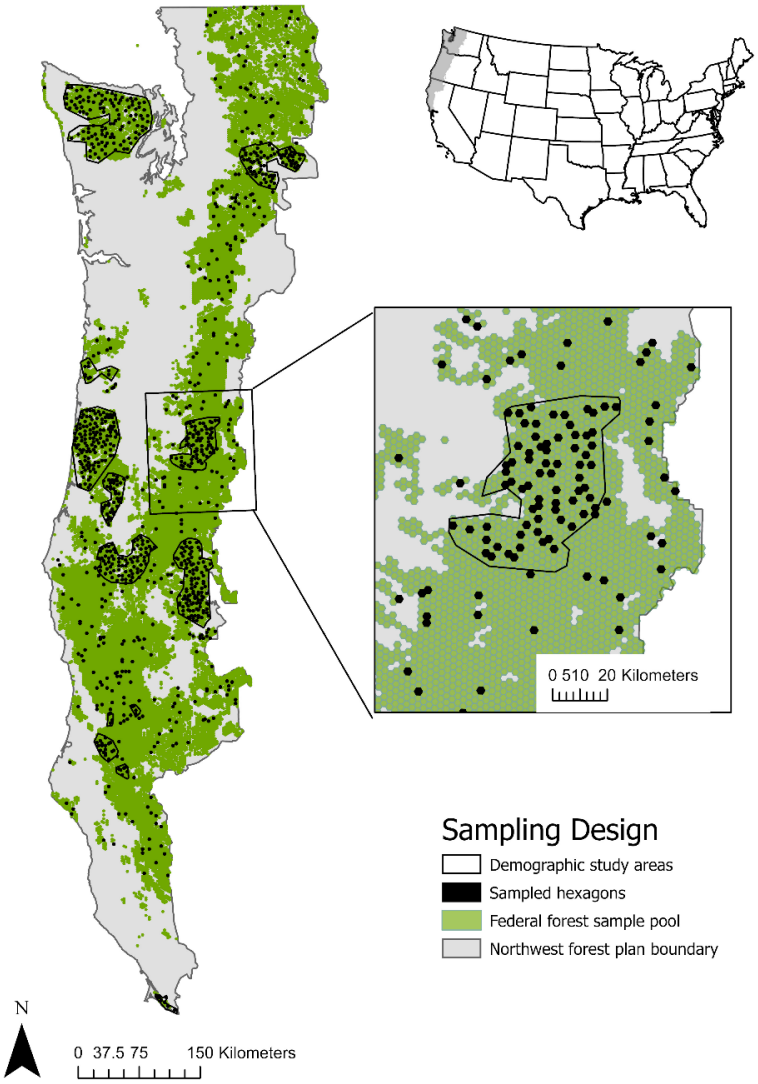



*Figure 1* (*from Lesmeister and Jenkins 2022*). Map of the planned passive acoustic monitoring network for northern spotted owls, barred owls, and other species in the Northwest Forest Plan area. Green area is the pool of 5-km$^2$ hexagons that are at least 50 percent forest cover and at least 25 percent under Federal land management. Black outlines are historical study areas for northern spotted owl demographic and territory occupancy monitoring. Black 5-km$^2$ hexagons are randomly selected from pool of green hexagons. Within historical study areas, 20 percent of hexagons were randomly selected, and outside those study areas 2 percent of hexagons were randomly selected. The full network design will be implemented in 2023-24.

The PAM network would serve as a primary basis for effectiveness monitoring of both spotted owls and barred owls on Federal lands (Fig. 1). Monitoring data from areas managed under the Strategy (e.g., Focal Management Areas) can be coupled with PAM data collected outside of these areas to gauge the status of managed relative to unmanaged populations of spotted and barred owls. Such comparisons may expedite assessments of management effectiveness.

*Use of PAM in the range of the California Spotted Owl:*
The existing PAM network in the Sierra Nevada can be used to monitor for barred owls. Specific recommendations concerning monitoring in the California spotted owl range are to:

1. Maintain and continue established monitoring network for the detection of barred and spotted owls. Monitor all sources of information on barred owl detections, including broad-scale systematic sampling and focal monitoring at sentinel spotted owl research sites.
2. Initiate inventory and monitoring network within potential barred owl dispersal pathways into the Sierra Nevada from the northern spotted owl range in the northern Sierra Nevada area.

*Use of PAM on non-Federal lands:*
The Northwest Forest Plan PAM network uses established protocols to survey and monitor northern spotted owl and barred owls on Federal lands only. These protocols rely on a hexagon grid that includes both Federal and non-Federal lands in the range of the northern spotted owl (e.g., Fig. 1), though only Federal lands are monitored for the Northwest Forest Plan effectiveness monitoring. If non-Federal implementers choose to do so, they can initiate PAM monitoring that can be integrated into the broader network using established sampling and monitoring protocols.

Call-playback surveys (applicable at site- and block-management scales)
This method is also used for locating barred owls for removal activities (see barred owl removal protocol). This permits estimation of site occupancy and use by spotted owls and barred owls, but requires species-specific surveys to maximize detectability (Wiens et al. 2011). It is recommended that call-playback surveys also use the PAM hexagon grid, so that monitoring data may be integrated with broader PAM sampling to increase the scope of inference using integrated occupancy modeling (e.g., Doser et al. 2022, entire).

Mark-resight surveys (applicable at site and block scales)
Currently this is the only method that can reliably estimate adult apparent survival of spotted owls, a key indicator of management effectiveness. However, apparent survival can be estimated without mark-recapture methods (e.g., Rossman et al. 2016, entire), though such methods fail to account for territory turnover. Mark-resight methods permit estimation of survival, recruitment, and finite rate of annual population change (e.g., Franklin et al. 2021; Wiens et al. 2021). These methods have been discontinued in most areas, but remain an option for monitoring of non-Federal barred owl management if the landowner or land manager choses to do so. In addition, the method is currently limited to spotted owls only.

*Sampling considerations:*
For site-level management, we recommend full coverage of managed provincial home range radius centered on last known activity center, using either PAM or call-broadcast survey methods.

For block-level management, we recommend a minimum of 20 percent coverage of a managed block area using the randomized hexagon grid design outlined by Lesmeister et al. (2021). In this case sampling sufficiency is based on expected landscape occupancy of spotted owls, with greater sampling effort required in areas with a lower occupancy rate in order to detect changes. Thus, in cases where spotted owl site occupancy (proportion of survey sites with detections) is known to be low (less than 20 percent), greater levels of coverage would be required to adequately detect changes in focal owl populations relative to areas where occupancy is expected to be higher (greater than 20 percent).

To determine how monitoring resources should be allocated within a given management area, three pieces of information are required: 1) the level of acceptable precision of the occupancy estimate; 2) the expected probability of occupancy and detection; and 3) the maximum number of surveys that could be conducted (MacKenzie et al. 2006, p. 165). Once this information is obtained, it is recommended to follow guidelines outlined for a standard occupancy study design in MacKenzie et al. (2006, pp. 167–173 and Table 6.1) or Bailey et al. (2007, entire). In general, as the detection probability decreases, the optimal number of sites and surveys per site increases.

For the provincial and range-wide scales, the range-wide PAM network would be used for inferences on overall population status of northern spotted owls and barred owls. These areas may also be useful for comparisons of populations between managed and unmanaged areas. Sites designated for PAM were randomly selected from a grid of hexagons. For spotted owls, which are expected to be rare in many areas, a randomly selected survey site would have a low probability of occupancy, thus requiring larger numbers of sites, and site-visits, to obtain precise estimates of occupancy (i.e., coefficient of variation less than 20 percent).

## A5.6 Recommended Data Analysis and Reporting

*Periodic assessments of monitoring data for barred owls and spotted owls*

- Annual assessments: The Service will evaluate the data collected under the Monitoring Plan will be evaluated on an annual basis to update estimates of selected population indicators for each owl species. Annual reports will be submitted to Service will include basic results of annual monitoring efforts completed within established management areas (e.g., numbers of detections per sample site for each owl species; numbers of barred owls removed).
- Five-year assessments: The Service will ensure that formal analyses and reporting of monitoring data and results will occur at regular, five-year intervals coincident with meta-analyses of northern spotted owl population trends under the Northwest Forest Plan Effectiveness Monitoring Plan. The forthcoming meta-analysis in 2024 is anticipated to provide baseline monitoring data on site-use of spotted owls and barred owls from the

range-wide PAM network, first implemented in 2023 (Fig. 1). These data will provide information on site use by spotted owls and barred owls in areas with and without management of barred owls, allowing for formal analyses of the effectiveness in meeting Strategy goals as management is implemented. We recommend that five-year assessments include the analyses specified below. In the northern spotted owl range, monitoring data collected outside of the Northwest Forest Plan PAM framework may still be incorporated into northern spotted owl population meta-analyses, if the designated entity agrees, and if methods are available to incorporate the data.

*Two-species occupancy modeling (applicable to spotted and barred owls):*
A two-species occupancy model (MacKenzie et al. 2017, entire) is the primary recommended modeling framework for determining population status and trend of northern spotted owls and barred owls, and for assessing the strength of evidence of management effects (see examples in Dugger et al. 2016; Franklin et al. 2021; and Yackulic et al. 2014). This approach also serves as the recommended primary modeling approach for decision analyses.

Site occupancy data collected under PAM or call-broadcast survey protocols are used (or integrated) under this approach to provide estimates of site-occupancy, colonization, and extinction rate of spotted owls and barred owls while accounting for imperfect detection and other uncertainties associated with the sampling design. The model has been used extensively to estimate the co-occurrence dynamics of spotted owls and barred owls (Diller et al. 2014; Franklin et al. 2021; Yackulic et al. 2014). Data for this approach are based on site-specific detection histories that use repeated survey detections (1) and nondetections (0) for both spotted owls and barred owls within and between years at survey sites (e.g., 5-$km^2$ sample hexagons or historical spotted owl territories). Parameters of initial site occupancy/use, colonization, extinction, and detection probabilities for both species may be evaluated as potential functions of management effort or intensity (see below). The model can include spatial covariates representing relevant site-specific changes in local habitat conditions (e.g., Yackulic et al. 2019), thereby providing a unified framework for inferences on management effectiveness for spotted owls and barred owls while accounting for underlying variation in habitat conditions.

*Barred owl removal model (applicable to barred owls only):*
For barred owls in block management areas, we recommend the use of an open-population removal model that uses barred owl removal data (e.g., numbers detected vs. removed per visit per site) to track change over time in abundance and distribution of managed populations and the success of management goals for barred owls. This method requires no additional survey cost for barred owls beyond that already required for barred owl removal. This method may be used in combination with the two-species occupancy analysis outlined above to provide detailed information on the effectiveness of management in limiting barred owls within and among different management areas.

Removal models specific to barred owls are currently under development and expected to be available in 2024 (D. Wiens pers. comm). For recent examples of removal models that may be applicable to removal data for barred owls see Udell et al. (2022), Davis et al. (2022), and Link et al. (2018).

*Reproductive success/number of young fledged (spotted and barred owls):*

- See examples in Dugger et al. (2016), Franklin et al. (2021), and Rockweit et al. (2023)
- Used in combination with two-species occupancy modeling and barred owl removal modeling to supplement assessments of management effectiveness.

*Estimation of annual rate of population growth ($\lambda_t$) for spotted owls and barred owls:*
Estimation of annual population growth rate may be based on site occupancy data (Lesmeister et al. 2021, entire; Steen et al. 2023, entire) collected under established PAM or call-broadcast survey protocols. Mark-resight data for estimation of population growth is also desirable as this would provide estimates of apparent survival and recruitment. However, it is recognized that these methods have been discontinued for monitoring spotted owls in most areas.

## A5.7 Additional Considerations Beyond the Scope of the Monitoring Plan

*Data management plan:*
Organization and management of raw monitoring data and associated metadata used to track effectiveness of the Strategy management actions would be overseen by the Service. Landowners, land managers, or other entities designated to act under the Service permit would be required to submit an annual report detailing all management and monitoring activities, along with relevant raw data in a standardized database format that can be queried for relevant data summaries.

*Use of unmanaged areas (controls) as a baseline reference:*
The extent to which controls (unmanaged) areas are included as references in analyses of management effectiveness would be addressed on a case-by-case basis. For valid comparisons, managed and unmanaged areas should be as similar as possible in terms of landscape conditions and status of owl populations prior to management action.

*Before-After-Control-Impact vs. Before-After-Impact analyses:*
We recommend a full Before-After-Control-Impact design for strong inference and applicability to the adaptive management framework, but recognize that pre-existing data may not always be available for selected management areas.

*Duration of management actions:*
We assume a minimum of five years of implementation would be used to determine local effectiveness of Strategy implementation. The specific length of time required to detect changes in populations of spotted owls barred owls, however, would depend on the relative density of barred owls and spotted owls in managed areas, landscape conditions in surrounding landscapes, and other environmental factors. In general, population-level response time of spotted owls to barred owl management is expected to decrease as the ratio of spotted owls to barred owls increases (see discussions by Hofstadter et al. 2022; Wiens et al. 2021).

## Literature Cited


Appel, C. L., D. B. Lesmeister, A. Duarte, R. J. Davis, M. J. Weldy and T. Levi. 2023. Using passive acoustic monitoring to estimate northern spotted owl landscape use and pair occupancy. Ecosphere 14(2): e4421. DOI: 10.1002/ecs2.4421

Bailey, L.L., Hines, J.E., Nichols, J.D. and MacKenzie, D.I. 2007. Sampling design trade-offs in occupancy studies with imperfect detection: examples and software. Ecological Applications, 17(1), pp.281-290.

Dale, S. S., J. M. A. Jenkins, Z. J. Ruff, L. S. Duchac, C. E. McCafferty and D. B. Lesmeister. 2022. Distinguishing sex of northern spotted owls with passive acoustic monitoring. Journal of Raptor Research 56(3):287–299. DOI: 10.3356/JRR-21-33

Davis, R.J., D.B. Lesmeister, Z. Yang, B. Hollen, B. Tuerler, J. Hobson, J. Guetterman and A. Stratton. 2022. Northwest Forest Plan—the first 25 years (1994-2018): status and trends of northern spotted owl habitats. General Technical Report PNW-GTR-1003. Pacific Northwest Research Station, U.S. Forest Service. Portland, Oregon. 46 pp.

Diller, L. V., J. P. Dumbacher, R. P. Bosch, R. R. Bown and R. J. Gutiérrez. 2014. Removing Barred Owls from local areas: Techniques and feasibility. Wildlife Society Bulletin 38:211–216.

Diller, L.V., K.A, Hamm, D.E. Early, D.W. Lamphear, K.M. Dugger, C.B. Yackulic, C.J. Schwarz, P.C. Carlson and T.L. McDonald. 2016. Demographic response of northern spotted owls to barred owl removal. Journal of Wildlife Management 80:691-707.

Doser, J. W., Finley A. O., Kéry, M., & Zipkin E. F. 2022. spOccupancy: An R package for single-species, multi-species, and integrated spatial occupancy models Methods in Ecology and Evolution, 13, 1670-1678. https://doi.org/10.1111/2041-210X.13897

Duarte, A., Adams, M., and Peterson, J. 2018. Fitting N-mixture models to count data with unmodeled heterogeneity: Bias, diagnostics, and alternative approaches. Ecological Modelling. 374. 51–59. 10.1016/j.ecolmodel.2018.02.007.

Duchac, L. S., D. B. Lesmeister, K. M. Dugger, Z. J. Ruff and R. J. Davis. 2020. Passive acoustic monitoring effectively detects Northern Spotted Owls and Barred Owls over a range of forest conditions. The Condor 122:1-22.

Dugger, K.M., E.D. Forsman, A.B. Franklin, R.J. Davis, G.C. White, C.J. Schwarz, K.P. Burnham, J.D. Nichols, J.E. Hines, C.B. Yackulic, P.F. Doherty, Jr., L. Bailey, D.A. Clark, S.H. Ackers, L.S. Andrews, B. Augustine, B.L. Biswell, J. Blakesley, P.C. Carlson, M.J. Clement, L.V. Diller, E.M. Glenn, A. Green, S.A. Gremel, D.R. Herter, J.M. Higley, J. Hobson, R.B. Horn, K.P. Huyvaert, C. McCafferty, T. McDonald, K. McDonnell, G.S. Olson, J.A. Reid, J. Rockweit, V.Ruiz, J. Saenz and S.G. Sovern. 2016. The effects of habitat, climate, and Barred Owls on long-term demography of Northern Spotted Owls. Condor: Ornithological Applications 118:57-116.

Franklin, A.B., D.R. Anderson, E.D. Forsman, K.P. Burnham and F.W. Wagner. 1996. Methods for collecting and analyzing demographic data on the northern spotted owl. Studies in Avian Biology 17:12-20.

Franklin, A.B., K.M. Dugger, D.B. Lesmeister, R.J. Davis, J.D. Wiens, G.C. White, J.D. Nichols, J.E. Hines, C.B. Yackulic, C.J. Schwarz, S.H. Ackers, L.S. Andrews, L.L. Bailey, R. Bown, J. Burgher, K.P. Burnham, P.C. Carlson, T. Chestnut, M.M. Conner, K.E. Dilione, E.D. Forsman, E.M. Glenn, S.A. Gremel, K.A. Hamm, D.R. Herter, J.M. Higley, R.B. Horn, J.M. Jenkins, W.L. Kendall, D.W. Lamphear, C. McCafferty, T.L. McDonald, J.A. Reid, J.T. Rockweit, D.C. Simon, S.G. Sovern, J.K. Swingle and H. Wise. 2021. Range-wide declines of northern spotted owl populations in the Pacific Northwest: a meta-analysis. Biological Conservation 259:109168. Available online: https://reader.elsevier.com/reader/sd/pii/S0006320721002202?token=1EF6BDA1171ECDA10DB345F89A9B1F8B022C7F7B7F6CE9F9D8ADCE78901D5F37B76ADE7C16B0C6230E8FA7F4D5FC7E84&originRegion=us-east-1&originCreation=20210812021224, Accessed August 11, 2021.

Glenn, E.M., R.G. Anthony, E.D. Forsman and G.S. Olson. 2011a. Local weather, regional climate, and annual survival of the Northern Spotted Owl. Condor 113:159-176.

Glenn, E.M., R.G. Anthony, E.D. Forsman and G.S. Olson. 2011b. Reproduction of Northern Spotted Owls: The role of local weather and regional climate. Journal of Wildlife Management 75:1279-1294.

Hofstadter, D.F., N.F. Kryshak, C.M. Wood, B.P. Dotters, K.N. Roberts, K.G. Kelly, J.J. Keane, S.C. Sawyer, P.A. Shaklee, H.A. Kramer, R.J. Gutiérrez and M.Z. Peery. 2022. Arresting the spread of invasive species in continental systems. Frontiers in Ecol & Environ 1–7. https://doi.org/10.1002/fee.2458

Jenkins, J. M. A., D. B. Lesmeister, E. D. Forsman, K. M. Dugger, S. H. Ackers, L. S. Andrews, C. E. McCafferty, M. S. Pruett, J. A. Reid, S. G. Sovern, R. B. Horn, S. A. Gremel, J. D. Wiens and Z. Yang. 2019. Social status, forest disturbance, and Barred Owls shape long-term trends in breeding dispersal distance of Northern Spotted Owls. The Condor 121(4): duz055.

Jenkins, J. M. A., D. B. Lesmeister, E. D. Forsman, K. M. Dugger, S. H. Ackers, L. S. Andrews, S. A. Gremel, B. Hollen, C. E. McCafferty, M. S. Pruett, J. A. Reid, S. G. Sovern and J. D. Wiens. 2021. Conspecific and congeneric interactions shape increasing rates of breeding dispersal of northern spotted owls. Ecological Applications 31(7): e02398.

Kelly, K.G., Wood, C.M., McGinn, K., Kramer, H.A., Sawyer, S.C., Whitmore, S., Reid, D., Kahl, S., Reiss, A., Eiseman, J. and Berigan, W. 2023. Estimating population size for California spotted owls and barred owls across the Sierra Nevada ecosystem with bioacoustics. Ecological Indicators, 154, p.110851.

Lesmeister, D. B., C. L. Appel, R. J. Davis, C. B. Yackulic and Z. J. Ruff. 2021. Simulating the effort necessary to detect changes in northern spotted owl (*Strix occidentalis caurina*)

populations using passive acoustic monitoring. Res. Pap. PNW-RP-618. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 55 p

Lesmeister, D. B. and J. M. A. Jenkins. 2022. Integrating new technologies to broaden the scope of northern spotted owl monitoring and linkage with USDA forest inventory data. Frontiers in Forests and Global Change 5: 966978. DOI: 10.3389/ffgc.2022.966978

Lesmeister, D. B., J. M. A. Jenkins, Z. J. Ruff, R. J. Davis, C. L. Appel, A. D. Thomas, S. Gremel, D. Press, T. Chestnut, J. K. Swingle, T. Wilson, D. C. Culp, H. Lambert, C. McCafferty, K. Wert, B. Henson, L. Platt, D. Rhea-Fournier and S. Mitchell. 2022. Passive Acoustic Monitoring within the Northwest Forest Plan Area: 2021 Annual Report. USDA Forest Service Pacific Northwest Research Station and USDI National Park Service. Corvallis, OR. 30 p.

Link, W.A., Schofield, M.R., Barker, R.J., Sauer, J.R., 2018. On the robustness of N- mixture models. Ecology 99 (7), 1547–1551.

Lint, J., B. Noon, R. Anthony, E. Forsman, M. Raphael, M. Collopy and E. Starkey. 1999. Northern spotted owl effectiveness monitoring plan for the Northwest Forest Plan. General Technical Report PNW-GTR-440, Pacific Northwest Research Station, U.S. Department of Agriculture, Forest Service, Portland, Oregon. 43 pp.

Mackenzie, D.I. 2006. Modeling the probability of resource use: the effect of, and dealing with, detecting a species imperfectly. J. Wildl. Manag. 70 (2), 367–374.

MacKenzie, D.I., Nichols, J.D., Royle, J.A., Pollock, K.H., Bailey, L.L., Hines, J.E., 2017. Occupancy Estimation and Modeling: Inferring Patterns and Dynamics of Species Occurrence. Elsevier.

Noon, B.R. and C.M. Biles. 1990. Mathematical Demography of Spotted Owls in the Pacific Northwest. Journal of Wildlife Management 54(1):18-27.

Rockweit, J. T., J. M. Jenkins, J. E. Hines, J. D. Nichols, K. M. Dugger, A. B. Franklin, P. C. Carlson, W. L. Kendall, D. B. Lesmeister, C. McCafferty, S. H. Ackers, L. S. Andrews, L. L. Bailey, J. Burgher, K. P. Burnham, T. Chestnut, M. M. Conner, R. J. Davis, K. E. Dilione, E. D. Forsman, E. M. Glenn, S. A. Gremel, K. A. Hammn, D. R. Herter, J. M. Higley, R. B. Horn, D. W. Lamphear, T. L. McDonald, J. A. Reid, C. J. Schwarz, D. C. Simon, S. G. Sovern, J. K. Swingle, J. D. Wiens, H. Wise and C. B. Yackulic. 2023. Range-wide sources of variation in reproductive rates of northern spotted owls. Ecological Applications 33(1): e2726. DOI: 10.1002/eap.2726

Rodriguez de Rivera, O. and R. McCrea R. 2021. Removal modelling in ecology: A systematic review. PLoS ONE 16(3): e0229965. https://doi.org/10.1371/journal.pone.0229965

Rossman, S., C.B. Yackulic and S.P.Saunders, S.P. [et al.]. 2016. Dynamic N-occupancy models: estimating demographic rates and local abundance from detection non-detection data. Ecology. 97(12): 3300–3307. https://doi:10.1002/ecy.1598.

Royle, J.A., 2004. N-mixture models for estimating population size from spatially replicated counts. Biometrics 60 (1), 108–115.

Steen, V.A., A. Duarte and J.T. Peterson. 2023 An evaluation of multistate occupancy models for estimating relative abundance and population trends, Ecological Modelling, 478 (110303) ISSN 0304-3800, https://doi.org/10.1016/j.ecolmodel.2023.110303.

Udell B, Martin J, Romagosa C, Waddle H, Johnson F, Falk B, Yackel Adams A, Funck S, Ketterlin J, Suarez E, Mazzotti F. 2022. Open removal models with temporary emigration and population dynamics to inform invasive animal management. Ecol Evol. 2022 Aug 17;12(8):e9173. doi: 10.1002/ece3.9173. Erratum in: Ecol Evol. 2022 Sep 12;12(9):e9315. PMID: 35991280; PMCID: PMC9382647.

Watson, W.A., C.M. Wood, K.G. Kelly, D.F. Hofstadter, N.F. Kryshak, C.J. Zulla, S.A. Whitmore, V. O'Rourke, J.J. Keane and M.Z. Peery, Passive acoustic monitoring indicates Barred Owls are established in northern coastal California and management intervention is warranted, Ornithological Applications, Volume 125, Issue 3, 7 August 2023, duad017, https://doi.org/10.1093/ornithapp/duad017

Weldy, M. J., D. B. Lesmeister, C. B. Yackulic, C. L. Appel, C. McCafferty and J. D. Wiens. 2023. Long-term monitoring in transition: Resolving spatial mismatch and integrating multistate occupancy data. Ecological Indicators 146: 109815. DOI: 10.1016/j.ecolind.2022.109815

Wiens, J.D., R.G. Anthony and E.D. Forsman. 2011. Barred Owl Occupancy Surveys within the Range of the Northern Spotted Owl. Journal of Wildlife Management 75(3):531-538.

Wiens, J.D., Dugger, K.M., Lewicki, K.E. and Simon, D.C., 2017, Effects of experimental removal of barred owls on population demography of northern spotted owls in Washington and Oregon—2016 progress report: U.S. Geological Survey Open-File Report 2017-1040, 23 p., https://doi.org/10.3133/ofr20171040.

Wiens, J. D., K. M. Dugger, J. M. Higley, D. B. Lesmeister, A. B. Franklin, K. A. Hamm, G. C. White, K. E. Dilione, D. C. Simon, R. R. Bown, P. C. Carlson, C. B. Yackulic, J. D. Nichols, J. E. Hines, R. J. Davis, D. W. Lamphear, C. McCafferty and S. G. Sovern. 2021. Invader removal triggers competitive release in a threatened avian predator. Proceedings of the National Academy of Sciences 118(31): e2102859118.

Yackulic, C. B., J. A. Reid, J. D. Nichols, J. E. Hines, R. J. Davis, E. D. Forsman. 2014. The roles of competition and habitat in the dynamics of populations and species distributions ecology. Ecology 95(2): 265–279.

Yackulic, C.B., L.L. Bailey, K.M. Dugger, R.J. Davis, A.B. Franklin, E.D. Forsman, S.H. Ackers, L.S. Andrews, L.L. Diller, S.A. Gremel, K.A. Hamm, D.R. Herter, J.M. Higley, R.B. Horn, C. McCafferty, J.A. Reid, J.T. Rockweit and S.G. Sovern. 2019. The past and future roles of competition and habitat in the range-wide occupancy dynamics of northern spotted owls. Ecological Applications 29:e01861.

Personal Communications:

D. Lesmeister personal communication 2023.

D. Wiens personal communication 2023.