



Draft Environmental Impact Statement for the Barred Owl Management Strategy

**U.S. Fish and Wildlife Service
November 2023**

COVER SHEET

Title of Proposed Action: Implementation of the Proposed Barred Owl Management Strategy in Washington, Oregon, and California

Subject: Draft Environmental Impact Statement

Lead Agency: U.S. Fish and Wildlife Service

Cooperating Agencies: Bureau of Land Management (Oregon), Bureau of Land Management (California), National Park Service, United States Forest Service, Washington Department of Fish and Wildlife, Washington Department of Natural Resources, Oregon Department of Fish and Wildlife, Oregon Department of Forestry, California Department of Fish and Wildlife, California Department of Forestry and Fire Protection.

County/State: Oregon, Washington, California

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Abstract: The U.S. Fish and Wildlife Service has developed a proposed Barred Owl Management Strategy to address the threat of the non-native, invasive barred owl to the native northern and California spotted owls. This action is necessary to support the survival of the threatened northern spotted owl and avoid substantial impacts to the California spotted owl populations from barred owl competition. This Draft Environmental Impact Statement (Draft EIS) was prepared pursuant to the National Environmental Policy Act (NEPA). This Draft EIS evaluates the impacts of six alternatives, including a no action alternative, on the human environment, including spotted owls, barred owls, other wildlife species, recreation and visitor use, wilderness areas, socioeconomics, and climate change.

For Information, Contact:

Robin Bown, Wildlife Biologist
U.S. Fish and Wildlife Service
U.S. Department of Interior
2600 SE 98th Ave, Ste 100
Portland, OR 97266
(503) 231-6179
Robin_Bown@fws.gov

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Executive Summary

We, the U.S. Fish and Wildlife Service (Service), have developed a proposed Barred Owl Management Strategy (Strategy) to address the threat of the non-native, invasive barred owl (*Strix varia*) to the native northern and California spotted owls (*Strix occidentalis*). This action is necessary to support the survival of the threatened northern spotted owl (*Strix occidentalis caurina*) and avoid substantial impacts to the California spotted owl (*Strix occidentalis occidentalis*) populations from barred owl competition. This Draft Environmental Impact Statement (Draft EIS) was prepared pursuant to the National Environmental Policy Act and describes and evaluates the impacts of the proposed action and alternatives to the human environment, including spotted owls, barred owls, other wildlife species, recreation and visitor use, wilderness areas, socioeconomics, and climate change.

ES 1 Background

Spotted owls are native to western North America. Competition from the non-native invasive barred owls has been identified as a primary threat to the northern spotted owl and a significant and increasing threat to the California spotted owl. Additional primary threats include the loss of habitat to timber harvest on non-Federal lands and to wildfires on Federal lands. Barred owls, native to eastern North America, 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. These slightly larger and more aggressive owls quickly displaced spotted owls from their historical territories.

Based on a recent demographic meta-analysis, extirpation of northern spotted owls from major portions of their historical range is likely in the near future without management of barred owls (Franklin et al. 2021). In recent years, barred owls have penetrated into the range of the California spotted owl in the Sierra Nevada Mountains, although the barred owl population generally remains low and scattered in most of the California spotted owl range at this time. While barred owls have not substantially impacted California spotted owl populations to date, the establishment of a small barred owl population in the northern Sierra Nevada, and the history of the invasion and impacts on northern spotted owls following such expansion, indicates that barred owls are a significant threat to the persistence of California spotted owls.

ES 1.1 Purpose and Need for the Proposed Action

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 invasive 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). 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 provide 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 expect 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.

ES 1.2 Description of the Proposed Action and Decision to be Made

The Service, in coordination with Federal, State, and Tribal partners across the range of the northern and California spotted owls, developed a proposed Barred Owl Management Strategy (Strategy) to address the threat to northern and California spotted owls from the invasive barred owl. 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 management strategy would require authorization of the take of barred owls under the MBTA. The proposed action includes the issuance of a Special Purpose permit under MBTA (50 CFR 21.95) and implementation of the Strategy.

ES 1.3 Public Involvement

The Service initiated public scoping with the publication of the Notice of Intent (NOI) to prepare an EIS in the Federal Register on July 22, 2022. The NOI requested comments from all interested parties on the scope of issues and alternatives to consider in preparing the EIS. The public comment period was open through August 22, 2022. We hosted a virtual public meeting on July 28, 2022. Chapter 5, Summary of Submitted Alternatives, Information, and Analyses and Appendix 5, Scoping Comment Summary, provide a summary of the comments received during the scoping period, which we considered when developing this EIS.

This Barred Owl Management Strategy and this Draft EIS are being released for public review and comment. Comments received will be reviewed and considered during the development of a Final EIS. A virtual public meeting will be held during the comment period.

ES 2 Alternatives

The draft EIS evaluates the effects of a no action alternative (Alternative 1), and five action alternatives, including the proposed action (Alternative 2). All action alternatives include management to reduce barred owl populations in areas within the northern spotted owl range and to prevent establishment of barred owl populations within the California spotted owl range. Each of the action alternatives would authorize lethal removal of barred owls. The locations and relative priorities for removal would vary by alternative. The Service also considered but eliminated from detailed analyses several other alternatives and management approaches.

ES 2.1. Alternative 1 – No Action

Under the no action alternative, no systematic management strategy would be finalized or implemented, and the Service would not issue an MBTA permit for comprehensive management of barred owls. Ongoing barred owl removal as part of research efforts in California, and future research efforts that may be proposed anywhere in the range of the spotted owl would still occur.

ES 2.2. Elements Common to All Action Alternatives

The proposed action and each action alternative would provide different management frameworks for entities (Federal, State or Tribal government agencies, or private companies or individuals) to implement barred owl management. None of the alternatives would require any entity to implement barred owl management; rather they outline various combinations of management approaches, geographic areas, and other components that would allow for and guide management actions and the ability to prioritize areas of greatest need.

All action alternatives would include the issuance of a Migratory Bird Special Purpose permit (50 CFR 21.95) to the Service for the take of barred owls associated with the actions described in the alternatives. The Service would designate interested governmental and non-governmental entities to act under the permit.

Actions in areas where barred owl populations are well established focus on control and management of this invasive species. Actions in the California spotted owl range, and where barred owl populations are not yet established, focus on early detection and rapid response to invading barred owls. In either case, management of barred owls would be implemented over the long-term.

Analysis of effects of any of the action alternatives includes projecting future implementation actions by multiple entities. It is not possible to forecast the duration of the management activities themselves. The MBTA Special Purpose permit can be issued for up to three years, but can be renewed. For the purposes of the analysis of the action in this EIS, we chose a temporal

scale of analysis of 30 years. This 30-year period allows sufficient time to predict and analyze discernable differences in effects to resources across alternatives.

Under all action alternatives, management of barred owl populations would be accomplished by lethally removing barred owls under the protocol in Appendix 2. This protocol was developed based on time-tested field methods proven to be effective, efficient, and as humane as possible. All removal efforts would be monitored at the spotted owl site (territory), management block, province or area, and range-wide (northern and California spotted owls) scale. Designees under the MBTA permit would provide annual data from removal implementation areas. Information would be summarized in annual reports, and population trend analyses would be conducted approximately every five years.

ES 2.3. Alternative 2 – Proposed Action – Strategy Implementation

Under this alternative, within the northern spotted owl range, we would apply three approaches to barred owl management – 1) northern spotted owl site management (site management), 2) General Management Areas (GMAs) with their associated Focal Management Areas (FMAs), and 3) Special Designated Areas (Maps 2-2, 2-3, 2-4, and 2-5).

Site management would involve removing barred owls from within and around spotted owl sites, with priority given to recently occupied sites. The intent is to conserve remaining northern spotted owls while larger block management efforts (such as FMAs) are developed and implemented, allowing these spotted owls to recolonize larger blocks as barred owl populations decrease.

GMAs are large, mapped areas within which barred owl management would occur on smaller FMAs. These GMAs were developed, mapped, and prioritized with the assistance of an interagency, intergovernmental team at the physiographic province scale, in keeping with the Recovery Plan's focus on maintaining viable northern spotted owl subpopulations within each province. FMAs would be established at the time of removal implementation, by the implementing agency/entity or a group of agencies/entities, based on general direction and prioritization provided in the alternative. FMAs would be limited to 50 percent of the GMA at any one time. We recommend FMAs are of a size to 50 northern spotted owl pairs, where possible, to provide for development of a functional populations over time.

Special Designated Areas are intended to support specific identified needs, such as connectivity between larger GMAs, future contribution for spotted owl management efforts in Canada, a buffer zone to reduce invasion of barred owls into the California spotted owl range, Washington State's Spotted Owl Special Emphasis Areas, and management of early invasions in Sonoma and Marin counties. Each has a specific description of barred owl management to meet the purpose of the area.

In the California spotted owl range, where we are focused on early detection and rapid response at the invasion front, Alternative 2 would focus on surveys, inventory, and monitoring to detect invading barred owls and rapid removal of any barred owls detected. This applies throughout the range of the California spotted owl.

ES 2.4. Alternative 3 – Management Across the Range

Alternative 3 would allow for barred owl management to be implemented anywhere within the range of the northern or California spotted owls or within 15 miles of the range of the subspecies on up to 50 percent of the area (Map 2-6). There would be no specific requirements for size or location of management areas under this alternative.

ES 2.5. Alternative 4 – Limited Management by Province/Population

Within the northern spotted owl range, Alternative 4 would focus barred owl management on a single large GMA within each province (Map 2-7). This approach would support a single, but larger, spotted owl population in each province. In the California spotted owl range, barred owl management would be delayed until detections reached 10 percent of surveys in areas within the Sierra Nevada portion of the population, or 5 percent within the Coastal-Southern California portion of the province. This would allow barred owl populations to be established, but removed before they can substantially impact spotted owls.

ES 2.6. Alternative 5 – Management Focused on Highest Risk Areas

In the northern spotted owl range, Alternative 5 would focus barred owl management in the northern provinces, where the subspecies is at greatest risk of extirpation from barred owl competition (Map 2-8). Management could be conducted on 100 percent of two GMAs in the Eastern Washington Cascades, Western Washington Cascades, Eastern Oregon Cascades, Western Oregon Cascades, and Oregon Coast Ranges Physiographic Provinces and one GMA in the Olympic Peninsula Physiographic Province. In the California spotted owl range, under this alternative, barred owl management would be limited to the northern Sierra Nevada portion of the subspecies range. This is the area where the barred owl invasion initially occurred and represents the most likely pathway for larger numbers of barred owls to invade the California spotted owl range.

ES 2.7. Alternative 6 – Management Focused on Best Conditions

In the northern spotted owl range, Alternative 6 would focus barred owl management in the southern portion of the northern spotted owl range, where spotted owl populations have not decreased to the degree they have in the north (Map 2-9). Management could occur on up to 75 percent of each GMA in the Oregon Klamath, California Coast, California Klamath, and California Cascades Physiographic Provinces. In the California spotted owl range, under this alternative, barred owl management would be focused on areas with the best remaining habitat and areas with higher fire resiliency, including 50 percent of the Sierra Nevada portion of the range and 75 percent of the Coastal-Southern California portion of the range.

ES 3 Environmental Consequences

In this draft EIS, we conducted an analysis of the potential effects of each alternative to barred owls, spotted owls, other wildlife species, recreation and visitor use, wilderness, socioeconomics, climate change, as well as cumulative effects. Effects to other resources were considered but dismissed from detailed analysis because there are not likely to be significant effects from the proposed action or alternatives. These resources include public health and safety, cultural resources, Tribes, ethical considerations, environmental justice, or geology, soils, water, vegetation, or air quality.

ES 3.1 Effects to Barred Owls

Alternative 1, the no action alternative, would have no significant effect on barred owl populations. All the action alternatives would have some level of adverse effect on barred owls through the removal of barred owls from management areas.

In the northern spotted owl range, Alternative 3 would have the greatest adverse impact on barred owl populations due to the large area under removal activities. Alternative 6 would have the lowest adverse effect because barred owl removal would be focused in the southern portion of the northern spotted owl range which has the lowest density of barred owls at this time, resulting in fewer barred owls being removed per area. However, this alternative would not result in removal of barred owls in the northern two thirds of the northern spotted owl range and would have no significant effect on barred owls in those areas. Both Alternatives 5 and 6 would leave large areas of the northern spotted owl range without barred owl management.

In the California spotted owl range, Alternative 4 would result in the most barred owls removed, but would also allow for the establishment of barred owl populations. The increase in barred owls would result in more barred owls being removed once management intervention began. Other than the No Action Alternative, Alternative 5 would result in the fewest barred owls removed due to the limitation of removal to a portion of the northern Sierra Nevada area. However, outside of this area, barred owls would potentially establish populations, and could offset the effect of removals in the north.

ES 3.2 Effects to Spotted Owl

Alternative 1, the no action alternative, would have the greatest adverse effect on spotted owls and would result in the greatest decline in northern and California spotted owl populations f.

Alternative 2 would result in the greatest increase in northern spotted owl populations, in part due to the focus on managing recently occupied sites in addition to management areas, and would also have a beneficial effect on California spotted owls. Alternative 3 has the greatest area of barred owl removal, but somewhat lower benefits to northern spotted owl populations due to the lack of focus on high priority areas. The added monitoring and removal in buffer areas would result in an increased beneficial effect on California spotted owls. Alternative 4 would have a smaller but positive effect on northern spotted owls due to the restriction of management with

each province, and an adverse effect on California spotted owls by allowing barred owls to establish populations before removal effort are initiated.

Alternatives 5 and 6 do not include barred owl management in portions of the northern spotted owl range, leading to adverse effects in these areas; beneficial effects would occur in areas where barred owls are removed. Alternative 5 would have an adverse effect on a large portion of the California spotted owl population because barred owl removal is limited to the northern Sierra Nevada. Alternative 6 would have an overall adverse effect because not all areas are included, leaving room for barred owl populations to be established.

ES 3.3 Effects to Other Wildlife Species

Barred owls are a generalist non-native predator that exert pressure on species not adapted to this new source of predation, leading to negative effects on potential prey species and competitors for the prey. Barred owl removal in the northern spotted owl range would have a beneficial effect on potential prey species by reducing this novel source of predation and on potential competitors by reducing competitive pressure. Barred owl removal in the California spotted owl range would prevent negative effects of barred owl predation and competition by preventing the establishment of barred owl populations in the areas described in the alternatives. The specific species affected would vary by location of management.

The act of removing barred owls involves discharge of shotguns. If barred owls are removed very near nesting murrelets during critical periods of the nesting cycle, these activities would have a small, but adverse effect on marbled murrelets through disturbance. The potential degree of this impact at the population level depends on the area of removal activity that overlaps the range of the murrelet. This would be lowest under Alternative 6 and limited to the southern portion of the murrelet's range. The potential impact would be greatest under Alternative 3 due to the large overlap with marble murrelet habitat in Washington, Oregon, and California.

ES 3.4 Effects to Recreation and Visitor Use

Alternative 1, the no action alternative, would have no effect on recreation and visitor use. The primary adverse effect of the action alternatives on recreation and visitor use would be the potential disturbance to users from the sound of gunshots, resulting in changes to the soundscape. On areas where hunting or target shooting are allowed, we anticipate no significant disturbance from the sound of gunshots, particularly during hunting seasons, as these are part of the background soundscape. On areas where hunting and target shooting are not allowed, the sound of gunshots would adversely affect some users. These areas include most National and State Parks. The primary difference between alternatives would be the number and location of closed areas where barred owl removal would occur, including the National Park units.

ES 3.5 Effects to Wilderness

Alternative 1, the no action alternative, would have no effect on most aspects of wilderness character, but an adverse effect on the natural quality of wilderness because native northern and California spotted owl populations would continue to decline or be locally extirpated

while barred owls persist or increase in wilderness. Action alternatives would have a negative effect on several aspects of wilderness character as a result of manipulation of wildlife populations, presence of crews, and presence of unnatural soundscapes (gunfire). The placement of Automated Recording Units within the wilderness would have a small but negative effect on undeveloped quality. All action alternatives would also have a positive effect on natural quality of wilderness because native northern and California spotted owl populations would stabilize and potentially increase. The extent, location, and intensity of these effects would vary by alternative, depending on the area included in management.

ES 3.6 Effects to Socioeconomics

Barred owl management would allow spotted owl populations to stabilize and increase, recolonizing management areas where they have been previously excluded by barred owls. This would be unlikely to have any effect on most aspects of the diverse economy of the West Coast (Washington, Oregon, and California), with the possible exception of timber harvest and associated revenues, income, and employment. Therefore, our analysis is focused on impacts to timber harvest.

The projected increases in spotted owl site occupancy would likely be slow and small in most areas, apart from areas of northern California with low barred owl populations. Increases would also likely occur where high quality habitat is available, which is concentrated on Federal lands in most provinces, and often within reserve areas on these lands.

We anticipate there would be little, if any, impact on regional timber harvest on Federal lands, based on the history and underlying designations of Federal land management. Over time, as northern spotted owl subpopulations rebound inside managed areas and the resiliency of these individuals and subpopulations increases, we expect Federal agencies may have more flexibility in where and how land is managed, including the potential to expand timber harvest. On State lands, existing land management plans and HCPs would greatly reduce the potential for conflict between timber production and reoccupied spotted owl sites.

In Washington State, the projected limited increase in occupied spotted owl sites and extensive Federal lands currently reserved from commercial timber harvest would result in a very low to negligible potential for impacts to timber harvest across all action alternatives. In Oregon, the potential for impacts on timber harvest levels would be generally low due to the low level of increase in spotted owl occupied sites and the high percentage of spotted owl habitat on Federal lands, including large areas of reserved lands. The potential for some spotted owl sites to impact private land timber harvest is slightly higher in Alternatives 2 and 4 in the Oregon Coast Ranges province and Alternatives 2 and 6 in the Oregon Klamath province. The limited requirements for management around spotted owl sites under Oregon Forest Practices Rules would reduce the potential impact to a very low level.

In northern California, a substantially higher percentage of spotted owl habitat is found on private lands. Where these lands are covered by HCPs covering spotted owls, and where barred owls have recently displaced spotted owls from known sites that are still being managed as occupied under California regulations, we would anticipate no change in timber harvest levels as

a result of barred owl management. Barred owl management would not occur in northern California under Alternative 5, limiting spotted owl population increases. Potential impacts to private land timber harvest would be greatest in Alternative 2 in the California Coast province, given the larger increase in occupied/reoccupied spotted owl sites and spotted owl habitat on private lands.

ES 3.7 Effects to Climate Change

Given the nature of the proposed action and alternatives analyzed in this EIS, the negligible contribution of additional greenhouse gas (GHG) emissions associated with any of the alternatives, and the data available, the Service determined that a quantitative analysis of GHG emissions was not appropriate. Alternative 1, the No Action alternative, would have no effect on climate change, as no management actions would be conducted that could contribute GHG emissions. Under all action alternatives, the primary potential effect on climate change is GHG emissions associated with the use of motorized vehicles for the survey and removal of barred owls. Under all action alternatives these actions would be conducted as part of ongoing forest or land management activities, which already involve the use of vehicles as needed, and the addition of barred owl management is not anticipated to significantly increase the vehicle use. Thus, additional emissions would be extremely low. Overall, any effects on regional GHG emissions or global climate change resulting from the proposed alternatives would be negligible. Thus, the Service has not attempted to conduct an in-depth or quantitative analysis of effects of the action alternatives on global climate change.

Chapter 1 - Introduction and Purpose and Need for the Action

We, the U.S. Fish and Wildlife Service (Service), have developed a proposed Barred Owl Management Strategy (Strategy) to address the threat of the non-native, invasive barred owl (*Strix varia*) to the native northern and California spotted owls (*Strix occidentalis*). Implementation of the management strategy would require the take of barred owls and the issuance of a permit under the Migratory Bird Treaty Act (MBTA). This action is necessary to support the survival of the threatened northern spotted owl (*Strix occidentalis caurina*) and avoid substantial impacts to the California spotted owl (*Strix occidentalis occidentalis*) populations from barred owl competition. This environmental impact statement (EIS) was prepared in accordance with the National Environmental Policy Act (NEPA) (42 United States Code [USC] 4321 et seq.) to analyze the environmental impacts of the Strategy and the associated MBTA take authorization, as well as alternatives to the Strategy, including a no action alternative. We developed this EIS in accordance with NEPA as amended by the Fiscal Responsibility Act of 2023, and in accordance with implementing regulations in effect in 2023 (i.e., Council on Environmental Quality regulations at 40 CFR Parts 1500-1508 as amended April 20, 2022, 87 FR 23453, and the Department of Interior NEPA regulations at 43 CFR Part 46). We also considered the regulatory changes proposed by CEQ on July 31, 2023 (88 FR 49924); this EIS would be consistent with those regulatory changes, if adopted.

1.1 Background

Spotted owls are native to western North America. Of the three identified subspecies, two are the subject of this action, the northern spotted owl and the California spotted owl (Map 1-1). Both subspecies select structurally diverse forests with larger trees and moderate to dense canopy closure for nesting, with more variable habitat acceptable for foraging.

Northern spotted owls were historically found in the western forests of southwest British Columbia through Washington and Oregon to northwestern California south to Marin County. Northern spotted owls still occupy most of this range, though in very low densities in some areas. 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, with a distinct geographic



Map 1: Range of the northern and California spotted owl.

separation between the Sierra Nevada and Coastal-Southern California populations (Verner et al. 1992).

The Service listed the northern spotted owl as a threatened species under the Endangered Species Act (ESA) on June 26, 1990 ([55 FR 26114](#)). The primary reason for listing the northern spotted owl was the widespread loss of subspecies' habitat across its range and the inadequacy of existing regulatory mechanisms to conserve the northern spotted owl. 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 was 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, 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 non-native northern barred owl (*Strix varia varia*) (barred owl), which is currently the stressor with the largest negative impact on northern spotted owls (88 FR 41578). The spotted owl is also protected by the MBTA.

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

Barred owls are native to eastern North America. 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 Pacific Northwest in the early 1970s, establishing populations in northern Washington in the early 1980s. They continued to spread southward in the Cascades and coastal mountains, building dense populations behind the invasion front (See Appendix 1 for more details).

While barred owls prefer the same older, structurally diverse forest type selected by spotted owls, barred owls utilize a wider range of forested habitat types than spotted owls, including wooded urban areas and large tracts of second-growth forests. In addition, barred owls are generalist predators, eating a much wider variety of prey items than the specialist spotted owls. 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, Wood et al. 2020 entire). They also consume numerous other species, including other mammals, amphibians, insects, crayfish, and mollusks. Because of their larger size, adaptability to a wide variety of forested habitats, and ability to eat a wide variety of prey, barred owls often occur in denser populations, outcompeting and excluding spotted owls from the latter's preferred habitats.

The Service has concluded that the barred owl in western North America meets the definition of an invasive species under Executive Order 13112 for the following reasons (a full description of this analysis is contained in Appendix 1):

- The barred owl is an alien species, not native to the range of the northern and California spotted owls.
- Barred owls were introduced unintentionally through dissemination across the previous barrier to the 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 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.
- Barred owls are also likely harming other species and may 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).

By 2004, the Service had identified competition from the invasive barred owl as a primary threat to northern spotted owl populations (USFWS 2004). Since then, the effects of barred owls have become more apparent. Based on a recent demographic meta-analysis, northern spotted owl populations in the northern half of the subspecies' range have dropped by over 75 percent in two decades and continue to decline at greater than 5 percent per year, primarily due to barred owls (Franklin et al. 2021). Without management of barred owls and the maintenance of suitable habitat, extirpation of northern spotted owls from major portions of their historical range is likely in the near future (Franklin et al. 2021).

In recent years, barred owls have penetrated into the range of the California spotted owl in the Sierra Nevada Mountains, although the barred owl population generally remains low and scattered in most of the California spotted owl range at this time. A small but rapidly expanding population of barred owls was established in the northern Sierra Nevada by 2017 (Wood et al 2020, p. 4). The bulk of those barred owls and associated spotted/barred owl hybrids were removed during a research study between 2018 and 2020 (Hofstadter et al 2022, p. 5). While barred owls have not substantially impacted California spotted owl populations to date, the establishment of a small but 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 are managed, barred owls will continue to invade southward until barred owls impact California spotted owl populations.

The Revised Recovery Plan for the Northern Spotted Owl (USFWS 2011, entire) (Recovery Plan) identifies 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.). Recovery Criterion 1 of the Recovery Plan is focused on reaching a stable population trend for

northern spotted owls, specifically targeting a stable or increasing overall population trend of northern spotted owls throughout their range over 10 years, as measured by a statistically reliable monitoring effort (USFWS 2011, p. II-1). Recovery Action 30 is to implement the results of research to adaptively manage the effects of barred owls to meet Recovery Criterion 1, informed by the results of Recovery Action 29: a large-scale barred owl control experiment (USFWS 2011, pp. III-65—III-66). 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).

In 2013, the Service initiated the Barred Owl Removal Experiment (Removal Experiment), implementing Recovery Action 29 for the northern spotted owl (USFWS 2011, p. III-65) to investigate the effect of barred owl removal on northern spotted owl population dynamics. The Removal Experiment, conducted in four study areas in Washington, Oregon, and northern California, used paired treatment areas (barred owl removal) and control areas (no barred owl removal), to test whether barred owl removal could reverse declining northern spotted owl population trends in study areas with differing environmental conditions. The removal of barred owls had a strong, positive effect on survival of northern spotted owls and a weaker, though still positive, effect on northern spotted owl dispersal and recruitment (Wiens et al. 2021). In the treatment areas where barred owls were removed, northern spotted owl populations stabilized after three to six years of removal. In paired control areas without barred owl removal, northern spotted owl populations continued to decline at 12 percent per year over the same time period. The Removal Experiment demonstrated that barred owl removal can be an effective method contributing to the conservation of northern spotted owls. Additional barred owl removal studies conducted in California showed similar results (Hofstadter et al. 2022).

1.2 Purpose and Need for the Proposed Action

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 invasive 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). 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 provide 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 expect 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.

1.3 Proposed Federal Action and Decision to Be Made

Using information from the Removal Experiment and other applicable studies and research findings, the Service, in coordination with Federal, State, and Tribal partners across the range of the northern and California spotted owls, developed a proposed Barred Owl Management Strategy (Strategy). The Strategy is limited to addressing the threat from the barred owl. Other threats, such as habitat loss, are being addressed through other processes.

The barred owl is protected under the Migratory Bird Treaty Act (MBTA; 16 U.S.C. 793 et seq.) see 50 CFR 10.13 (list of MBTA species). The MBTA 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.

The proposed action is the issuance of a Migratory Bird Special Purpose (hereafter referred to as “Special Purpose”) permit under MBTA (50 CFR 21.95) and implementation of the Strategy. To issue a Special Purpose permit, the Service must determine whether the application is complete (as defined in 50 CFR 13.12) and the activity meets the general permit issuance criteria and requirements (50 CFR 13.21), as well as the specific requirements for a special purpose permit (50 CFR 21.95). Permits are issued for up to three years but may be renewed after each three-year period as long as general permit requirements are met.

The Service’s Regional Director of the Pacific Region will decide whether to authorize take of barred owls under the MBTA and implement a comprehensive management strategy as described in the proposed action or an alternative, or to select the no action alternative and not issue the MBTA take authorization or implement a management strategy. The Service would also complete intra-Service consultation under Section 7 of the ESA prior to a final NEPA decision or permit issuance, addressing the potential effects to northern spotted owls and any other ESA-listed that may be affected by the proposed action.

The proposed action is considered a Federal action under NEPA. This EIS was prepared to evaluate the effects on the human environment related to the proposed action, as well as a reasonable range of alternatives, including a no action alternative. In assessing the appropriate level of NEPA review, we chose to develop an EIS in part due to the large scale of the affected area across three States and potential impacts to ESA listed species. The Service is the lead Federal agency responsible for preparing the EIS, and there are 10 cooperating agencies:

1. Bureau of Land Management - Oregon
2. Bureau of Land Management - California
3. National Park Service
4. United States Forest Service
5. Washington Department of Fish and Wildlife
6. Washington Department of Natural Resources
7. Oregon Department of Fish and Wildlife
8. Oregon Department of Forestry
9. California Department of Fish and Wildlife
10. California Department of Forestry and Fire Protection

Designation as a cooperating agency does not imply that the agency supports the proposed action or other alternatives that may be developed, and participation as a cooperating agency does not diminish or otherwise modify the agency's independent statutory obligations and responsibilities under applicable Federal laws. Further, participation as a cooperating agency does not imply any future commitment of resources based on the final decision and is not an agreement to carry out any specific actions in the future.

1.4 Public Involvement

On July 22, 2022, the Service published a Notice of Intent (NOI) to prepare an EIS to consider a range of alternatives for managing the threat of the non-native, invasive barred owl to the native northern and California spotted owls through the development and implementation of the Strategy (87 FR 43886).

The NOI requested comments from all interested parties on the scope of issues and alternatives to consider in preparing the EIS. The public comment period was open through August 22, 2022. We provided information at a virtual public meeting on July 28, 2022. We received 37 written comments from 22 different organizations (including Tribes and governmental entities, environmental, conservation, animal welfare, and industry groups, professional societies, and zoological parks) and 15 individuals. Chapter 5 and Appendix 5 include summaries of submitted alternatives, information, and analyses received during the scoping period, which the Service considered when developing this EIS.

This Draft EIS is being released for public review and comment. Comments received will be reviewed and considered during the development of a Final EIS. A virtual public meeting will be held during the comment period. The Final EIS will be released for at least 30 days prior to a decision on the proposed action.

1.5 Other Permits and Determinations

In addition to compliance with the ESA and MBTA discussed above, compliance with Section 106 of the National Historic Preservation Act (as amended) is required for all Federal undertakings. In this case, the undertaking is the Service's proposed issuance of an MBTA permit and implementation of the Strategy.

Depending on the location and landowners involved in implementation of the Strategy, barred owl management could require additional Federal and State permits. This EIS could serve as the NEPA documentation for issuance of other Federal permits as needed, where this EIS addresses the relevant effects and meets the needs of the permitting agencies. Use of this EIS for such issuance would be at the discretion of the responsible agency. We anticipate the potential need to acquire permits from the States of Washington, Oregon, and California to carry out the proposed barred owl removal actions under the Strategy. The Service will apply for any necessary State permits.

Chapter 2 - Alternatives

This chapter describes the alternatives analyzed in detail in this EIS and the alternatives considered but eliminated from detailed analysis.

The Service developed these alternatives in coordination with the interagency, intergovernmental team assisting with development of the Strategy (including representatives from Federal, State, and Tribal governments in Washington, Oregon, and California) and the cooperating agencies under NEPA described above, informed by the comments we received during the scoping process.

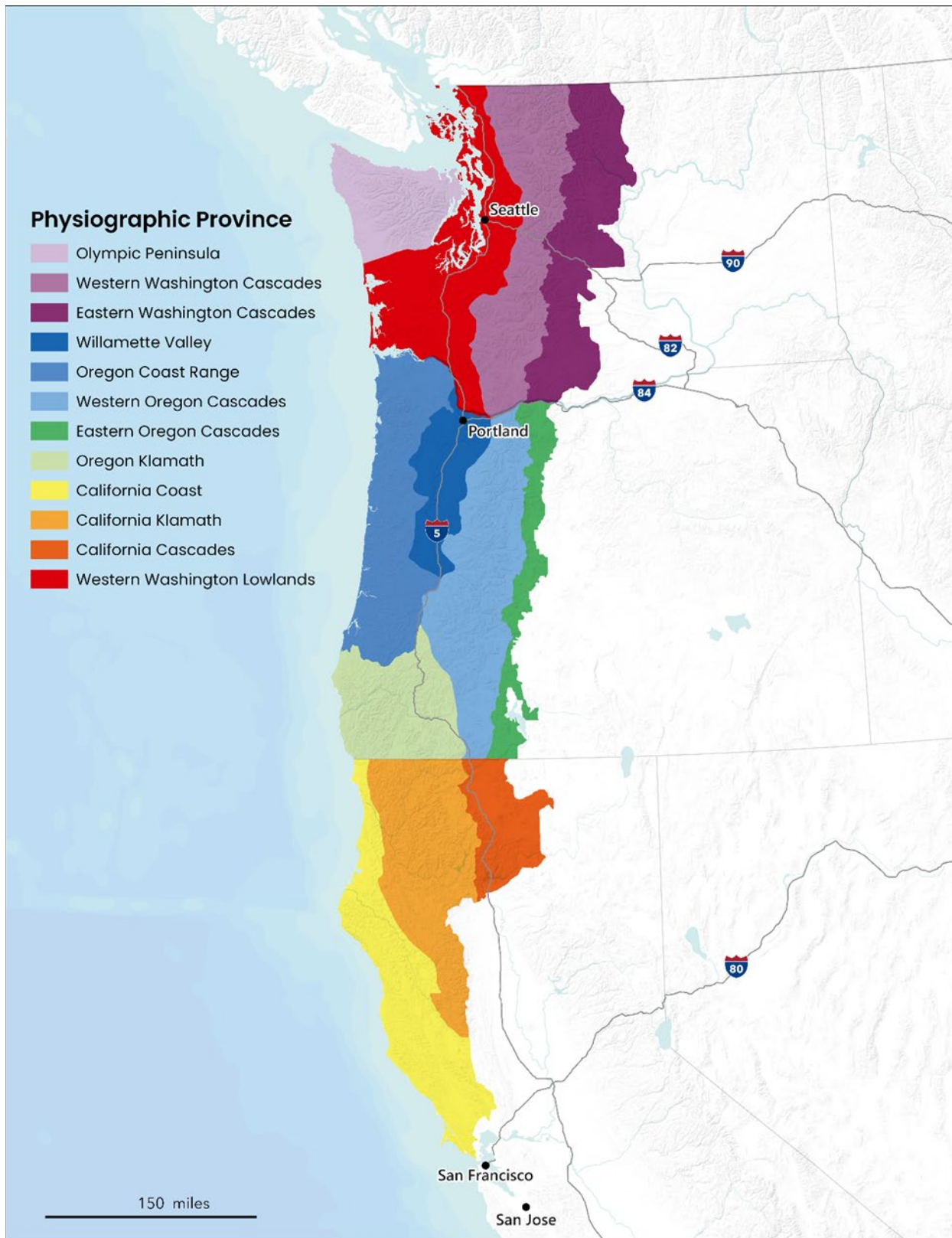
2.1 Considerations Used in Developing the Alternatives

We developed five action alternatives, based on an array of considerations. These considerations included suggested alternatives and other concepts we received during the scoping process (see Chapter 5), our own internal analyses, and input from cooperating agencies. These action alternatives span a reasonable range of alternatives that are technically and economically feasible and meet the Purpose and Need described in Section 1.2.

Given the differences in conditions and specifically the status of barred owls between the northern and California spotted owl ranges, as described in the Purpose and Need, each alternative contains specific elements for each subspecies. For the northern spotted owl range, management alternatives are described at the physiographic province level (Map 2-1) to ensure consideration across the range of the subspecies. In the California spotted owl range, alternatives are described at the population level, including the Sierra Nevada and Coastal-Southern California populations.

We analyzed the no action alternative and five action alternatives, including the proposed action (Alternative 2). All action alternatives analyzed in detail would include management to reduce barred owl populations in areas within the northern spotted owl range and to prevent establishment of barred owl populations within the California spotted owl range. Each of the action alternatives would authorize lethal removal of barred owls. The locations and relative priorities for removal would vary by alternative.

- Alternative 1: No Action
- Alternative 2: Proposed Action – Strategy Implementation
- Alternative 3: Management Across the Range
- Alternative 4: Limited Management by Province/Population
- Alternative 5: Management Focused on Highest Risk Areas
- Alternative 6: Management Focused on Best Conditions



Map 2-1. – Physiographic provinces in the northern spotted owl range

2.2 Alternative 1 – No Action

NEPA requires that the Federal agency consider impacts of a no action alternative, which serves as a baseline with which to compare impacts of the proposed action and any action alternatives. We also include an analysis of negative environmental impacts of not implementing the proposed agency action. Under the no action alternative, no systematic management strategy would be finalized or implemented, and the Service would not issue an MBTA permit for management of barred owls. Ongoing barred owl removal on research efforts in California and future research efforts that may be proposed anywhere in the range of the spotted owl would still occur.

2.3 Elements Common to All Action Alternatives

The proposed action and each action alternative would provide different management frameworks for entities (Federal, State and Tribal government agencies, or private companies and individuals) to implement barred owl management. None of the alternatives would require any entity to implement barred owl management; rather they outline various combinations of management approaches, geographic areas, and other components that would allow for and guide management actions and the ability to prioritize areas of greatest need.

Management of barred owls described in the action alternatives would only be conducted on lands of willing landowners or land managers, including Federal, State, Tribal, and local governmental agencies, and private landowners. Presence of an area within the mapped confines or description of the proposed action or any action alternative would not convey any additional rights or requirements to the implementing entities.

The alternatives could be applied across all ownerships, but are not a replacement for, and would not result in any change in, land management as included in current land use plans or agreements, and would not make any changes to existing plans or agreements. The actions described can generally be applied in concert with existing land management.

All action alternatives would include the issuance of a Migratory Bird Special Purpose permit (50 CFR 21.95) to the Service for the take of barred owls associated with the actions described in the alternatives and for the number of barred owls described in Section 3.3 Barred Owl. Special Purpose permits are issued for three years and can be renewed. The Service would designate interested governmental and non-governmental entities to act under the permit, in accordance with the Record of Decision.

Under 50 CFR 21.95, a Special Purpose permit may be issued to an applicant who submits a written application containing the required information and makes a sufficient showing of benefit to the migratory bird resource, important research reasons, reasons of human concern for individual birds, or other compelling justification. Upon receipt of a properly executed application for a permit, the Service is required to make a decision. The Service must ensure that its permit decision is consistent with the MBTA, its underlying treaties, and implementing regulations, and that it complies with all other applicable Federal laws and regulations. The permit type may change in the future based on regulatory updates. The MBTA gives the

Service broad authority to protect birds, but also to regulate their taking as long as their conservation is assured; in issuing the permit, the Service must ensure that authorized take would not potentially threaten wildlife or plant populations (50 CFR 13.21(b)(4)).

2.3.1 Barred Owl Population Management

In managing invasive species, there are two general approaches depending on the progression of the invasion. At the advancing front where few individuals are present, management is focused on early detection and rapid response to remove the invaders. Once invasive species are established, the focus is on control and management. In the California spotted owl range, and the very southern tip of the northern spotted owl range in Marin and Sonoma Counties, barred owls are at the early stages of invasion and as described in the Purpose and Need (Section 1.2), an early detection and rapid response mode is appropriate. In the remainder of the northern spotted owl range, barred owls are well established, and a control and management approach is needed. In each action alternative, we describe a control and management approach on specific defined areas.

Under all action alternatives, management of barred owl populations would be accomplished by lethally removing barred owls, thereby reducing or eliminating barred owl populations. Removal will focus on territorial barred owls that defend their territories from other barred or spotted owls. Management would include removal of spotted/barred owl hybrids, though the removal protocol for hybrids would be more restrictive to further reduce risk of accidentally injuring or killing a spotted owl. Hybrids represent the same impact to spotted owls by displacing them from their territories.

Removal methods are designed to:

- Reduce the number of territorial barred owls on the management area to a minimum. While the intention would be to remove all barred owls from a management area, we know that accessibility, weather, and other limitations, and well as an influx of barred owls from outside of the management area, would likely prevent this from happening. We do anticipate that removal would reduce and maintain barred owl populations at levels lower than would occur without management.
- Be as quick and humane as possible within the confines of the method.
- Pose little to no risk of removal or injury to nontarget species, including the spotted owl.

We considered potential approaches for reducing barred owl populations or their effect on northern spotted owls. To meet the purpose and need, methods for managing barred owl should result in 1) the rapid removal of territorial barred owls from management areas in the short term within the northern spotted owl range, and 2) limit the invasion of barred owls into the California spotted owl range. Lethal removal of barred owls is the only population reduction method that has been proven to work in reducing barred owl populations, thereby improving spotted owl population response (Diller et al. 2016, Wiens et al. 2021, Hofstadter et al. 2022). Other, nonlethal methods were considered, but not included because they would not meet the

purpose and need (See Section 2.4.). Therefore, all action alternatives include the lethal removal of barred owls.

Lethal removal would be accomplished by broadcasting recorded barred owl territorial calls, which attract territorial barred owls, and shooting birds that respond and approach closely. The proposed protocol would be identical under the proposed action and all action alternatives (Appendix 2). This protocol is based on the experience gathered from several previous barred owl removal studies, and is designed to ensure a quick kill, minimize the potential for non-fatal injury to barred owls, and strongly reduce the potential for injury or death of non-target species. For use in areas where firearm use would be inadvisable due to safety concerns, local regulations, or the density of human habitation, the protocol includes an option to capture and euthanize barred owls. Basic documentation and information would be required for all removals to ensure application of the protocol and to provide information for future modifications to this protocol.

All removal conducted under any of the action alternatives would utilize the methods that conform to the removal protocol found in Appendix 2, or future revisions to this protocol approved by the Service. Removal would be conducted by implementing entities, including Federal and non-Federal entities or their designees covered under the permit described above.

Under any action alternative, we would continue to pursue new information and modify the protocol as needed to ensure removal would be as humane as possible. Implementing entities would need to meet the requirements of training for removal specialists described in Appendix 2, abide by the protocol for removal, and provide all required reports.

2.3.2 Monitoring

All action alternatives include required monitoring of both barred and spotted owl responses to the management, as a requirement for the issuance of the Special Purpose permit. Appendix 4 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 designated implementing entities.

Implementation monitoring would be focused on documenting that actions are consistent with those described in the final decision. Implementation monitoring requirements include information on the qualifications of the removal specialists, the location of management activities, and the barred or hybrid owls removed on an annual basis (see Appendix 4 for additional details).

Effectiveness monitoring would be focused on assessing the success of the 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 future modifications of the approaches and would allow us to determine when barred owl management was no longer required.

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 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?

For barred owls, the questions include:

- Has the Strategy implementation reduced the abundance of, or site use by, barred owls, thereby providing habitats 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?

The monitoring plan recommends integration with monitoring of northern spotted owl populations and old forests on Federal under the Northwest Forest Plan Effectiveness Monitoring Program 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 managers may not wish to integrate monitoring on their lands with the shared Federal system. 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 Program, as long as it provided the necessary information for evaluation.

Monitoring for the effect on barred owls would occur at multiple scales, including the individual northern spotted owl site (territory), management block, physiographic province or area, and range-wide (northern and California spotted owls). Individual site and management block monitoring would be part of the management action. Information would be summarized in annual reports. Periodic assessments of monitoring data for barred owls and spotted owls would 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 Program, 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) (See Appendix 4 for additional details).

2.3.3 Prioritization

To further focus barred owl management efforts, we developed a set of priority ratings for management areas or components. This includes a different set of priorities for northern and California spotted owls based on the differences in the conditions within their respective ranges. The priorities were used to determine level of management in Alternative 2, and to select the GMAs included in Alternatives 4 and 5.

Northern spotted owl range

Actions and management areas would be prioritized within each physiographic province or area to provide focus and recommendations to implementing entities, though it would be non-binding and any action described in the proposed action would be allowed at any time in any province or area described in the Strategy. Within the northern spotted owl range, the Strategy includes a five-level prioritization system (A to E, in which A is the highest priority), applied at the province level. See USFWS 2023a, Appendix 3 for more details.

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

California spotted owl range

Actions and management areas would be prioritized within the California spotted owl range, within each DPS. We developed a three-level prioritization system (A to C, with A being the highest priority), applied at the population level. See Appendix 5 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.

2.3.4 Management Areas

In the range of the northern spotted owl, most of the action alternatives would include management focused on mapped General Management Areas (GMAs) and associated smaller Focal Management Areas (FMAs) within the boundaries of the GMAs. GMAs represent geographic areas where control efforts would be focused. Within GMAs, FMAs would be smaller areas established by implementing agencies or entities, where control efforts would be intended to reduce barred owl populations sufficiently to allow increased survival and recruitment of spotted owls. Based on experience from the Removal Experiment, these FMAs would be small enough that they could be reasonably managed for barred owl removal, yet large enough that they should be able to provide for source populations of spotted owls. Spotted owl site-based management, as well as several other types of management areas, would be associated only with Alternative 2 and these are described in Section 2.4.

General Management Areas

The primary focus of management for many of the action alternatives described below, GMAs are large, areas within the boundaries of which barred owl management would occur under each alternative in the manner described in that alternative.

These GMAs were developed, mapped, and prioritized with the assistance of the interagency, intergovernmental team at the physiographic province scale for northern spotted owl, in keeping with the Recovery Plan's focus on maintaining viable northern spotted owl subpopulations within each province (USFWS 2023a, USFWS 2011, p II-1). For all action alternatives, we included the forested edges of the Willamette Valley Physiographic Province with the adjacent forested provinces (Oregon Coast Ranges or Western Oregon Cascades Physiographic Provinces). Most GMAs include enough area to potentially support 200 to 300 northern spotted owl sites, though some are smaller or larger due to topographic or habitat conditions, or specific goals. Because the home range size of spotted owls varies by province, the size of GMAs meeting 200 to 300 pair size ranges from a low of approximately 175,000 acres in the California Coast Province redwood zone to a high of 1,700,000 acres in the Washington provinces.

The larger GMAs allow for the creation of multiple smaller FMAs within each GMA. Multiple smaller management areas within such a landscape would 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, focused barred owl management areas would be created at the time of implementation of any action alternatives containing GMAs. We did not include Tribal lands within GMAs unless requested to do so by the Tribe. The Yurok Tribe

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 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 populated areas. While some areas do remain in the boundaries, these areas would not be part of any barred owl management area, and no firearms use in removal activity would occur within ¼ mile around towns, occupied dwellings, established open campgrounds, and other locations with regular human use. (Appendix 2). Barred owls would 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 northern spotted owl sites, northern spotted owl habitat quality, density, and diversity, estimated barred owl density, location of current and ongoing research efforts, connectivity across province boundaries, potential risk of catastrophic losses to wildfire and other stochastic events, potential or current isolation of northern 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, northern 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.

We do not anticipate that the entire area within any GMA would be under barred owl management at any one time under most alternatives given the large areas involved, potential cost of barred owl management, limitations of access and topography in portions of each area, and the desire to spread the effort across a wider area to reduce risk of the loss of areas to large stochastic events such as wildfires. In each alternative, the total area that could be under barred owl management at one time is defined for each GMA, in terms of a percentage of the area. The actual specific areas under management within a GMA could change over time, but the total amount of management would not exceed the levels described and analyzed under each alternative.

Focal Management Areas

The GMAs represent the outer boundaries of areas within which smaller FMAs would be established during removal implementation, by the implementing agency/entity or a group of agencies/entities, based on general direction and prioritization provided in the selected alternative. This would provide the implementing entities with the opportunity to set the FMA 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, with a total area not to exceed that described in the relevant alternative.

In most GMAs, we recommend FMAs be of a size that could support 50 northern spotted owl pairs. Past analyses and modeling have identified areas capable of supporting 20 spotted owl pairs as having a reasonable likelihood of population stability and persistence over 50 to 100 years, even with low to moderate movement of individuals between these areas (Thomas et al.

1990 p. 24). However, we do not anticipate that barred owl removal could remove all barred owls within an FMA, and barred owls would continue to invade the area each year. Therefore, we recommend a larger size, capable of supporting 50 northern spotted owl pairs, allowing for some limitation on spotted owl habitat use within the area based on competition from remaining or invading barred owls. Our experience with the Barred Owl Removal Experiment showed that we were able to arrest the decline of spotted owls within treatment areas large enough to support approximately 50 pairs.

Habitat and topographic conditions could limit the size of FMAs in some GMAs. In this case, smaller FMAs could be required in such areas, though we recommend that these be as large as possible, with a focus on areas capable of supporting a cluster of multiple sites, rather than single sites. We recommend that smaller FMAs be placed in closer proximity to allow for population interaction. In all cases, the total area of FMAs would be limited to the level described for each GMA in the alternative.

2.4 Alternative 2 – Proposed Action – Strategy Implementation

This alternative is based on the draft Barred Owl Management Strategy, developed by the Service with the assistance of an interagency, intergovernmental team. This is the Service's proposed action. Under this alternative, implementing entities would employ lethal removal methodology and monitoring of all management actions as described in Section 2.3 and below. Implementing entities would still have to meet the requirements of training for removal specialists, abide by the protocol for removal, and provide all required monitoring reports. The primary difference between this proposed action and the other action alternatives is the total area included in potential barred owl management and the location of management areas.

2.4.1 Northern spotted owl

Under this alternative, there would be three approaches to barred owl management, applied across the range at varying scales – 1) northern spotted owl site management, 2) General Management Areas with their associated FMAs, and 3) Special Designated Areas. The details of management under these approaches would vary by province, depending on the condition of northern spotted owls, barred owls, and habitat within the province, as described further in the Strategy.

Northern Spotted Owl Site Management

Site management would be an early and high priority focus of barred owl management in all provinces. Site management would be focused on removing barred owls from within and around occupied northern spotted owl sites to provide for the maintenance of these remaining northern spotted owls while larger block management efforts are developed and implemented. This 'site management' could occur anywhere within a province. These northern spotted owls could provide a source of owls for recolonization of larger blocks as barred owl populations decrease and could be the nucleus of northern spotted owl populations in future management blocks.

In all provinces, this alternative would include management of barred owls in the vicinity of prioritized northern spotted owl sites, including all recently occupied sites, which for the purposes of barred owl management, we define as sites with northern spotted owl detection or occupancy in the past five years. Depending on the condition of northern spotted owl populations in a province, recommendations for site management could include sites with older information, historical sites not recently surveyed, or areas with habitat conditions capable of supporting a northern spotted owl site.

To define the area under management within and around northern spotted owl sites, we used the home range radius. These are province-specific values derived in past studies from the area used by radio-tagged northern spotted owls over the course of a year. The radius defines a circle that includes the average acreage used by the radio-tagged birds (Table 2-1). Northern spotted owl site management would involve the lethal removal of barred owls within an area of at least 1.5 times the northern spotted owl estimated home range radii of the site center. This could be extended to three home range radii if the implementing entity chose to do so. The additional area beyond the estimated home range radii is designed to buffer the spotted owl sites from close proximity of barred owls.

Table 2-1: Alternative 2 – Proposed Action – Strategy Implementation. Standardized home range radii (HRR) for northern 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
Olympic Peninsula	1.8 ¹	2.7	14,657
Western Washington Cascades	1.8	2.7	14,657
Eastern Washington Cascades	1.8	2.7	14,657
Oregon Coast Ranges	1.5	2.3	10,179
Western Oregon Cascades	1.2	1.8	6,514
Eastern Oregon Cascades	1.2	1.8	6,514
Oregon Klamath	1.3	2.0	7,645
California Klamath	1.3	2.0	7,645
California Cascades	1.3	2.0	7,645
California Coast – mixed-conifer zone	1.3	2.0	7,645
California Coast – redwood zone	0.7	1.1	2,217

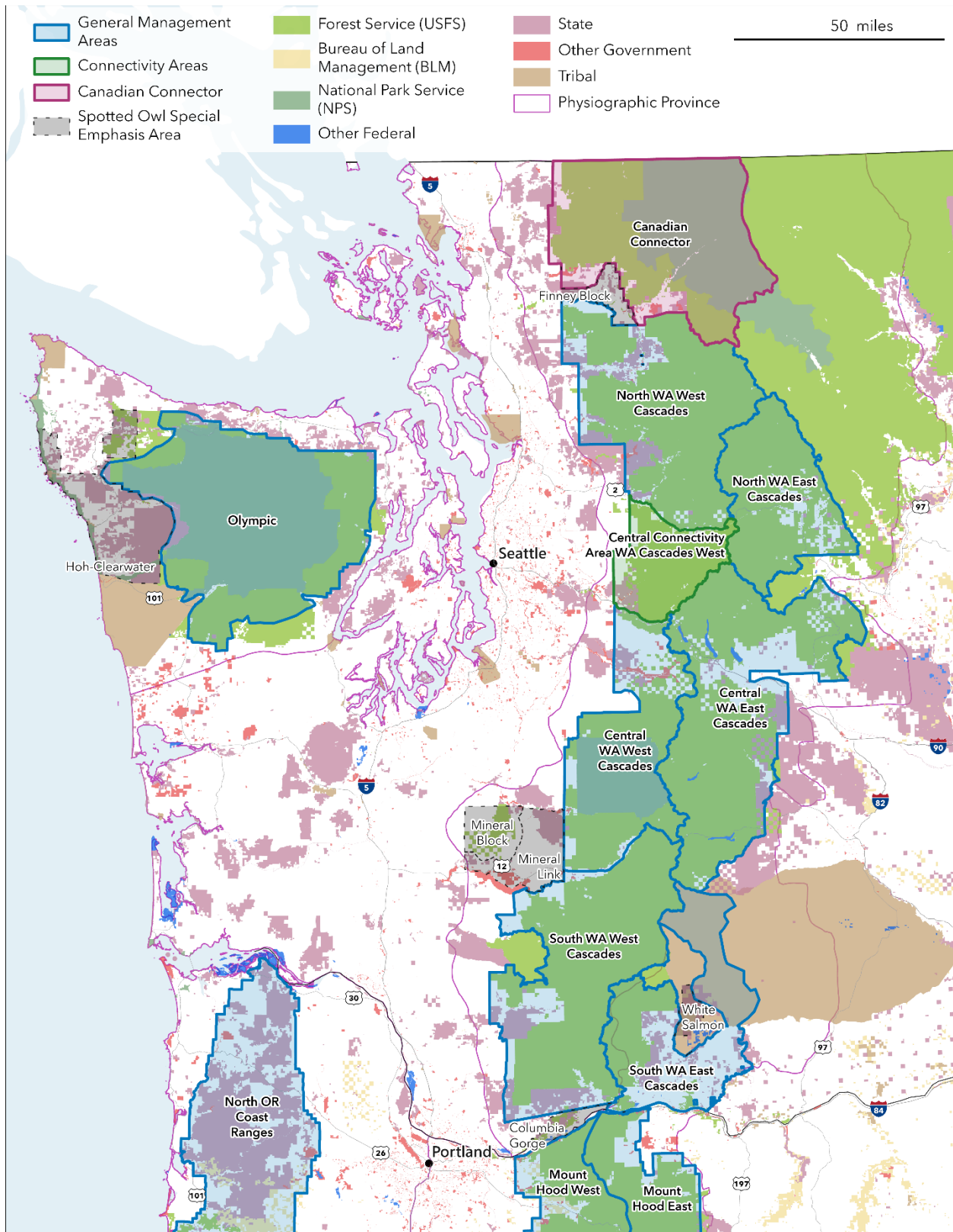
¹In consultation the home range radii used for the Olympic Peninsula is 2.7 miles, based on radiotelemetry studies conducted in the western portion of the province. This is also used in the Washington Forest Practices rules. For the purpose of barred owl management, this resulted in an extremely large area. The biologists 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.

Some northern spotted owl sites would lie within or overlap the boundaries of GMAs, and in areas with denser remaining northern spotted owl populations, buffered sites would overlap significantly.

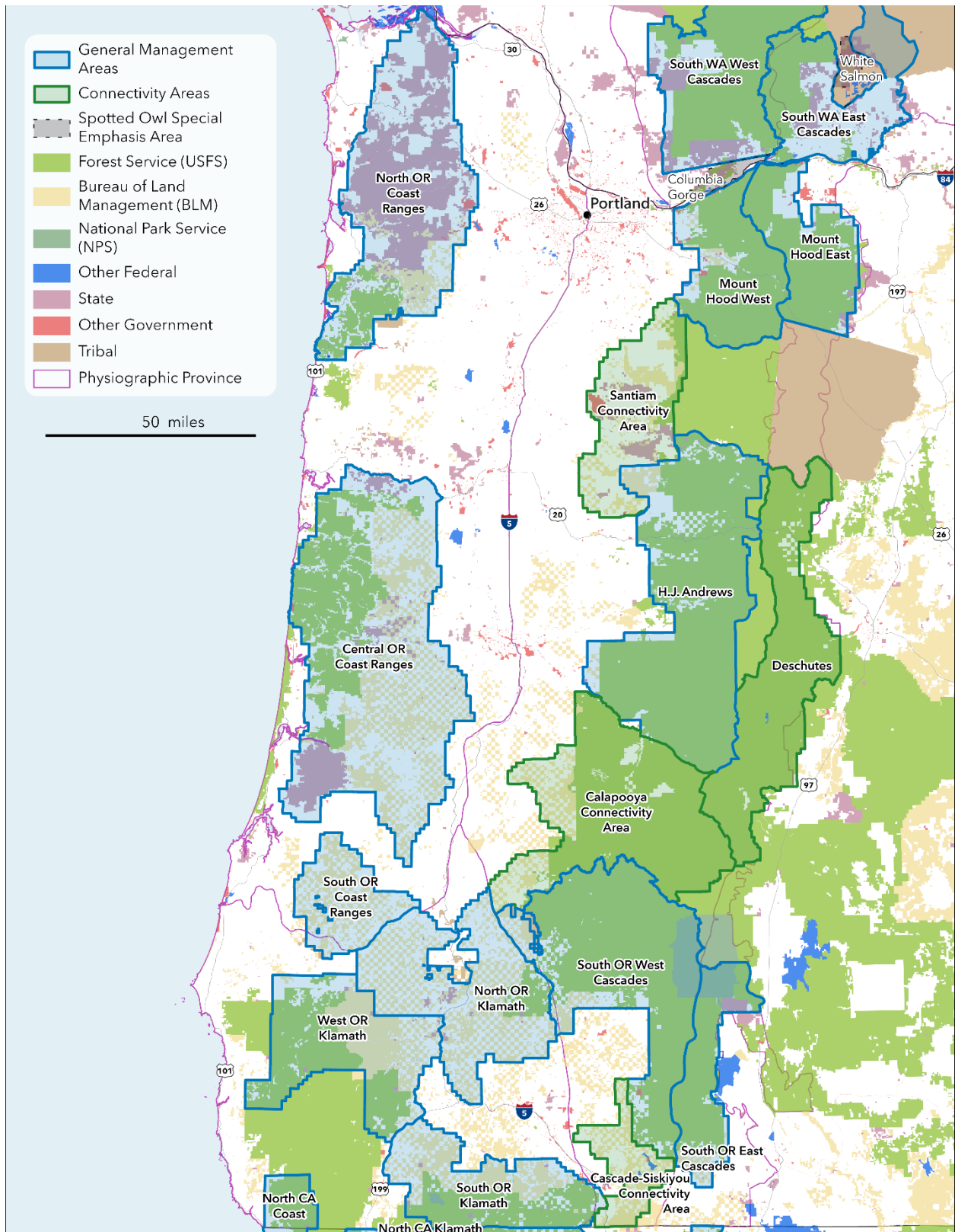
General Management Areas:

General Management Areas would be the primary focus of barred owl management in this alternative. The GMA approach is common to most action alternatives and is described in Section 2.3.4. For this alternative, GMAs were mapped and prioritized in all provinces (Maps 2-2, 2-3, 2-4, Table 2-2). Within GMAs, FMAs would be established during implementation of the Strategy, by the implementing agency/entity or a group of agencies/entities, based on local knowledge of the implementing entity, and would be the location of active barred owl removal. Where habitat and topographic conditions limit the size of potential FMAs, smaller FMAs could be developed. For example, we anticipate that conditions within the GMAs in the Eastern Oregon Cascades and California Cascades provinces would limit application to these smaller FMAs. Similar conditions may exist in portions of other GMAs.

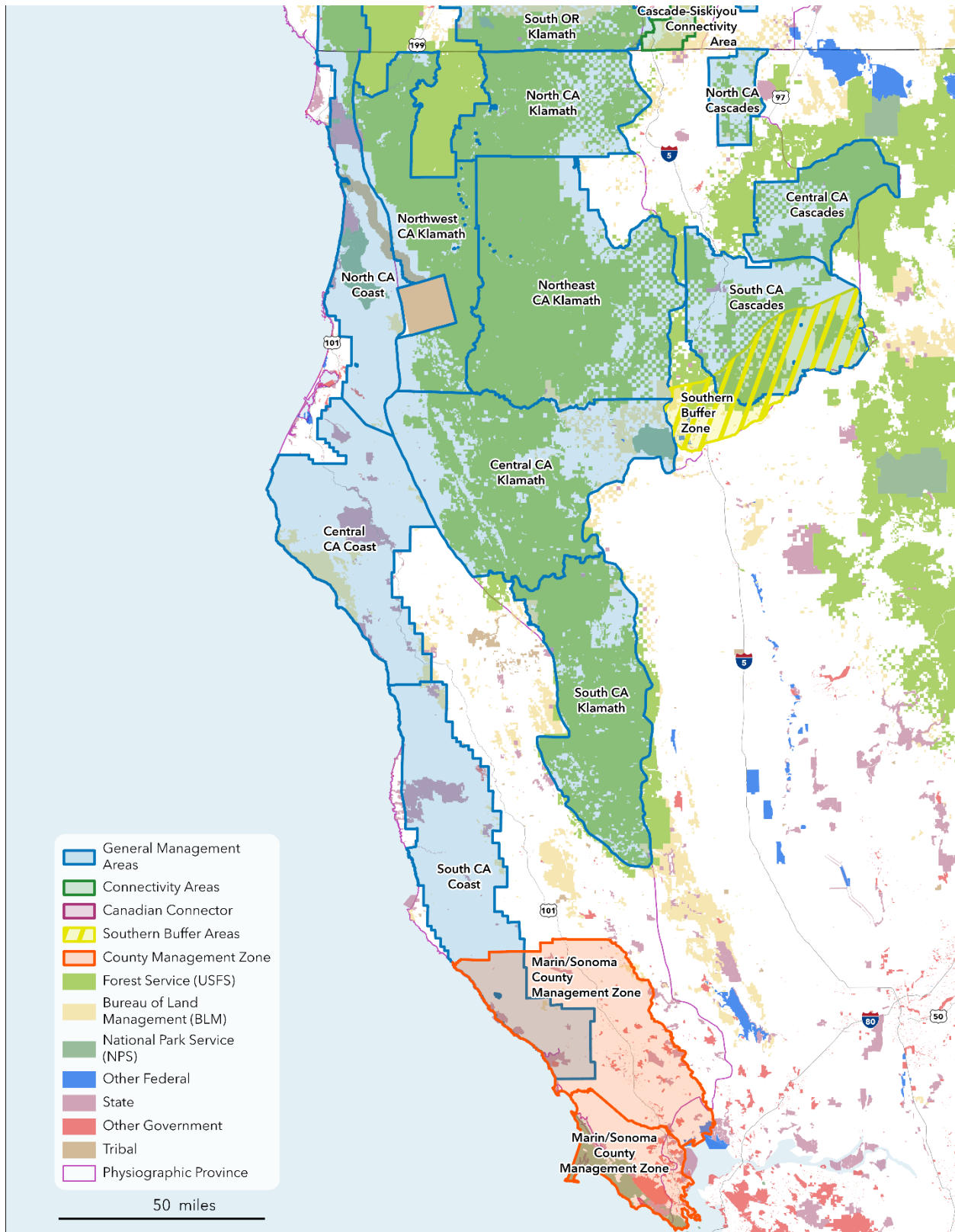
To encourage distribution of implementation across the provinces and range of the northern spotted owl and to set more reasonable expectations on the level of management likely to be feasible at a province scale, the total area of barred owl removal within GMAs would be limited under this alternative. Regardless of their size or location, the total area under FMA management at any one time under this alternative would be limited to a maximum of 50 percent of the forest lands within Priority A GMAs. For Priority B GMAs, FMA management would be limited to 35 percent of the forest lands in the first decade, and 50 percent in later decades. For Priority C GMAs, FMA management would be limited to 25 percent of the forest lands in the first decade, 35 percent in the second decade, and 50 percent in the following decades. Focal management areas could occur anywhere within the GMA boundaries, as long as the total area under management at any one time did not exceed the levels described above. These limits would apply to actions conducted under the final decision, if this alternative is selected. The specific location of management within the GMA could also change over time in response to new information or changes resulting from catastrophic events such as wildfire.



Map 2-2: Alternative 2 – Proposed Action – Strategy Implementation: General Management Areas and Special Designated Areas in the northern spotted owl range in Washington.



Map 2-3: Alternative 2 – Proposed Action – Strategy Implementation: General Management Areas and Special Designated Areas in the northern spotted owl range in Oregon.



Map 2-4. Alternative 2 – Proposed Action – Strategy Implementation: General Management Areas and Special Designated Areas in the northern spotted owl range in northern California.

Table 2-2. General Management Areas, priority ranking, and maximum forest acres under management at any one time by decade under Alternative 2 – Proposed Action – Strategy Implementation.

Physiographic Province	GMA Name	Priority	Maximum Forest Acres Under Management		
			Decade 1	Decade 2	Decade 3
Olympic Peninsula	Olympic	A	598,458	598,458	598,458
Western WA Cascades	Central WA West Cascades	A	327,466	327,466	327,466
	South WA West Cascades	B	385,583	550,833	550,833
	North WA West Cascades	C	225,900	316,260	451,800
Eastern WA Cascades	Central WA East Cascades	A	547,259	547,259	547,259
	North WA East Cascades	B	158,331	226,187	226,187
	South WA East Cascades	C	155,199	217,279	310,359
OR Coast Ranges	Central OR Coast Ranges	A	862,411	862,411	862,411
	North OR Coast Ranges	B	389,643	556,634	556,634
	South OR Coast Ranges	C	74,733	104,626	149,466
Western OR Cascades	H.J Andrews	A	636,573	636,573	636,573
	South OR West Cascades	B	356,676	509,537	509,537
	Mount Hood West	C	116,171	162,640	232,343
Eastern OR Cascades	South OR East Cascades	A	158,196	158,196	158,196
	Deschutes	A	341,917	341,917	341,917
	Mount Hood East	C	100,465	140,650	200,929
OR Klamath	North OR Klamath	A	377,778	377,778	377,778
	West OR Klamath	B	231,012	330,017	330,017
	South OR Klamath	B	180,677	258,110	258,110
CA Coast	North CA Coast	A	323,075	323,075	323,075
	Central CA Coast	B	284,611	406,587	406,587
	South CA Coast	C	243,210	340,494	486,420
CA Klamath	Northwest CA Klamath	A	398,594	398,594	398,594
	North CA Klamath	B	213,067	304,382	304,382
	Central CA Klamath	B	431,387	616,268	616,268
	Northeast CA Klamath	C	375,108	525,151	750,216
	South CA Klamath	C	216,658	303,321	433,316
CA Cascades	South CA Cascades	B	270,611	386,588	386,588
	North CA Cascades	C	34,911	48,875	69,821
	Central CA Cascades	C	99,992	139,988	199,984
TOTAL			9,115,672	11,016,154	12,001,564

Special Designated Areas

We mapped a variety of Special Designated Areas to meet various needs or situations. There are five potential designations, depending on conditions and needs within the province (Table 2-3). Management direction would vary by designation and priority within the province. The described activity would be in addition to, and not a replacement for, site management as described above.

1. Connectivity Areas: We mapped these areas in Washington and Oregon. They generally lie between larger GMAs and are intended to provide for some connection and movement between GMAs once northern spotted owl populations stabilize in the GMAs. While these would be generally of lower priority and would meet their full value as northern spotted owl populations developed in the neighboring GMAs, management to maintain existing northern spotted owl sites would provide a base for expanding management in the future. Therefore, under this alternative, barred owl management could occur on up to 25 percent of the forest lands in the connectivity areas in each province where they occur (Map 2-2 and 2-3).

2. Southern Buffer Zone: This zone includes a 15-mile-wide stretch of forest along the border of the northern spotted owl and California spotted owl range near the California Cascades Physiographic Province. It represents the most likely invasion pathway for barred owls into the California spotted owl range from the north. This alternative would include focused surveys for, and removal of, any barred owls in this area to slow the flow of barred owls into the California spotted owl range. Barred owl management could occur on the entire area at any time (Map 2-4).

3. Canadian Connector: The Government of British Columbia, Canada, is engaged in a barred owl management and northern 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. Under this alternative, in addition to spotted owl site management, barred owl block management would occur on up to 10 percent of the forest lands in this designation at any one time (Map 2-2). This lower level is based on the low priority for this area.

4. Marin/Sonoma County Management Zone: Conditions in Marin and Sonoma County 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 northern spotted owl habitat is found in blocks of limited size managed by various agencies and landowners. Under this alternative, management focus in this area would be on preventing barred owls from becoming established and displacing the remaining northern spotted owls. Therefore, in these counties, barred owls could be removed from the land of willing landowners and land managers anywhere within these counties (Map 2-4).

5. Spotted Owl Special Emphasis Areas: The State of Washington identified 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. Where SOSEAs 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 northern spotted owl populations in the provinces. While these areas would generally be of lower priority, barred owl management could occur on 25 percent of forest lands within the SOSEAs outside of other designations (Map 2-2).

Table 2-3. Special Designated Areas, priority ranking, and maximum forest acres under management at any one time under Alternative 2 – Proposed Action – Strategy Implementation.

Physiographic Province	Special Designation Block Name	Priority	Maximum Forest Acres Under Management
Olympic Peninsula	Olympic Hoh-Clearwater SOSEA	E	89,852
Western WA Cascades	Canadian Connector	E	74,518
	Central Connectivity Area WA Cascades West	D	67,310
	Finney Block SOSEA	E	14,626
	Mineral Block SOSEA	E	26,264
	Mineral Link SOSEA	E	38,969
	Columbia Gorge SOSEA	E	7,943
Eastern WA Cascades	8,522 SOSEA	E	8,522
Western OR Cascades	Santiam Connectivity Area	D	126,815
	Calapooya Connectivity Area	D	246,503
	Cascade-Siskiyou Connectivity Area	D	49,236
CA Coast	Marin/Sonoma County Management Zone	A	587,434
CA Cascades	Southern Buffer Zone	A	450,393

2.4.2 California spotted owl

Barred owl populations are not yet fully established in the range of the California spotted owl. Therefore, barred owl management would be focused on preventing their future establishment. There would be two primary elements: (1) survey, inventory, and monitoring for invading barred owls and (2) removal of any and all barred owls that were located.

Under this alternative, we would take advantage of the current established monitoring networks for the detection of barred and California spotted owls, coupled with additional information from broad-scale systematic sampling, focal monitoring at sentinel California spotted owl research sites, barred owl detections recorded during short-term project-level surveys, and anecdotal observations.

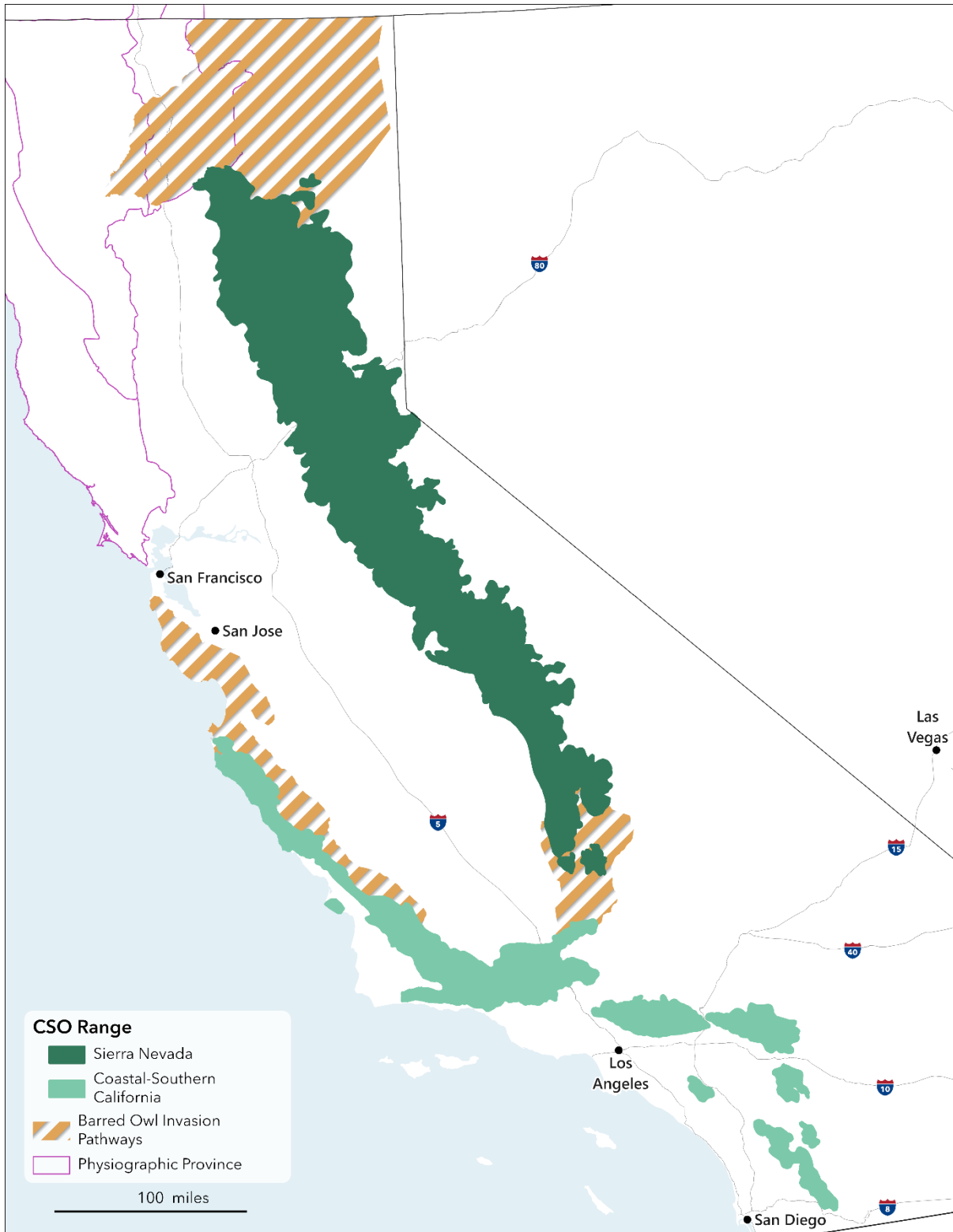
Additional operational monitoring would be added, focused on locating invading barred owls. This would include establishing a focused and extensive inventory and monitoring network within potential barred owl invasion pathways into the Sierra Nevada from the northern spotted owl range in the northern Sierra Nevada area. The primary invasion pathway into the province is through the Shasta-Trinity and Modoc National Forests and surrounding forested areas to the immediate north of the province. For the purposes of the Strategy the northern Sierra Nevada is defined as the Shasta-Trinity (eastern portion), Modoc, Tahoe, Plumas, Lassen National Forests and surrounding forest and woodlands adjacent to the National Forests to the west and east (Map 2-5).

While the primary invasion pathway may be through the northern Sierra Nevada, barred owls could move through the riparian areas of the Central Valley of California, including across the Tehachapi Range. Therefore, under this alternative, if territorial barred owls became established

(i.e., detected more than once from a single area) in this region, they could be removed as part of the Strategy. The alternative would not assume any added monitoring in the Central Valley of California.

California spotted owls in the Coastal-Southern California area are at higher risk due to small populations and fragmented habitat. While barred owls have not yet invaded these areas, ensuring that they would not become established in this area would be the primary focus of this alternative. This alternative would include focused inventory and monitoring within the Coastal-Southern California spotted owl range, in potential invasion pathways along the border closest to the Sierra Nevada province, and in the central coast near the border with the southern end of the California Coast Physiographic Province, north of San Francisco. This would create and maintain an early warning system for barred owls moving into this area.

If territorial barred owls were located on any of the monitoring, inventory, surveys, or incidental reports, within the range of the California spotted owl, or within the potential invasion pathways including the Central Valley of California and the central coast near the border with the southern end of the California Coast Province, this alternative would prioritize efforts to remove these barred owls as quickly as practicable, from the lands of willing landowners or land managers.



Map 2-5. Alternative 2 - California spotted owl range, including Sierra Nevada and Coastal-Southern California segments and primary invasion pathways.

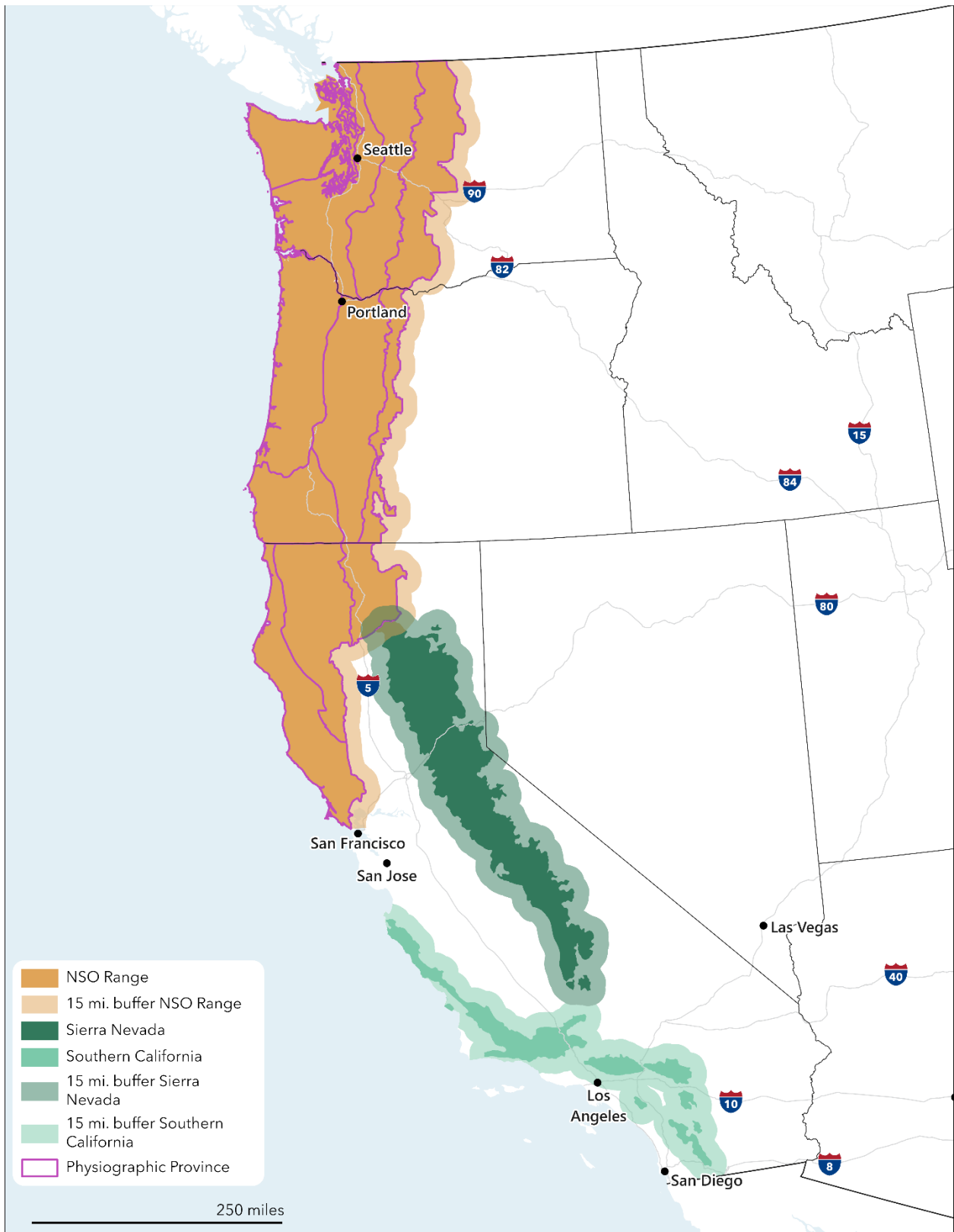
2.5 Alternative 3 – Management Across the Range

Under this alternative, barred owl management could be implemented anywhere within the range of the northern or California spotted owls or within 15 miles of the range of the subspecies (Map 2-6). The 15-mile buffer would allow management in nearby areas where barred owl populations may be producing young birds that would otherwise disperse into the spotted owl ranges.

In the northern spotted owl range, management could occur on areas of any size, with the total area under management capped at 50 percent of the area within the subspecies' range at any point in time. This level of management would allow for substantial areas under barred owl management but reflects the limitations of access and topography in each area, as well as the logistics and expense of operating over such a large area. The location of individual management areas would be determined at the time of implementation, and could change over time, as long as the total did not exceed 50 percent of the total area, or 16,511,470 acres at any time.

In the California spotted owl range, no additional sentinel monitoring would be implemented. Location of barred owls for removal would be limited to information from existing monitoring, research, survey, and other records. Management would be focused on the lethal removal of all barred owls detected from the land of willing landowners, as soon as practicable following detection.

Under this alternative, implementing entities would employ lethal removal methodology and monitoring of all management actions. They would still have to meet the requirements of training for removal specialists, abide by the protocol for removal, and provide all required monitoring reports.



Map 2-6: Alternative 3. Northern and California spotted owl ranges, with 15-mile buffer.

2.6 Alternative 4 – Limited Management by Province/Population

In the northern spotted owl range, under this alternative, barred owl management could be implemented within a single GMA in each physiographic province (Map 2-7). Barred owl management could occur on up to 100 percent of the forest lands in each GMA, though multiple smaller management areas would also be possible (Table 2-4). This single GMA would potentially provide for a single large population of northern spotted owls in each province.

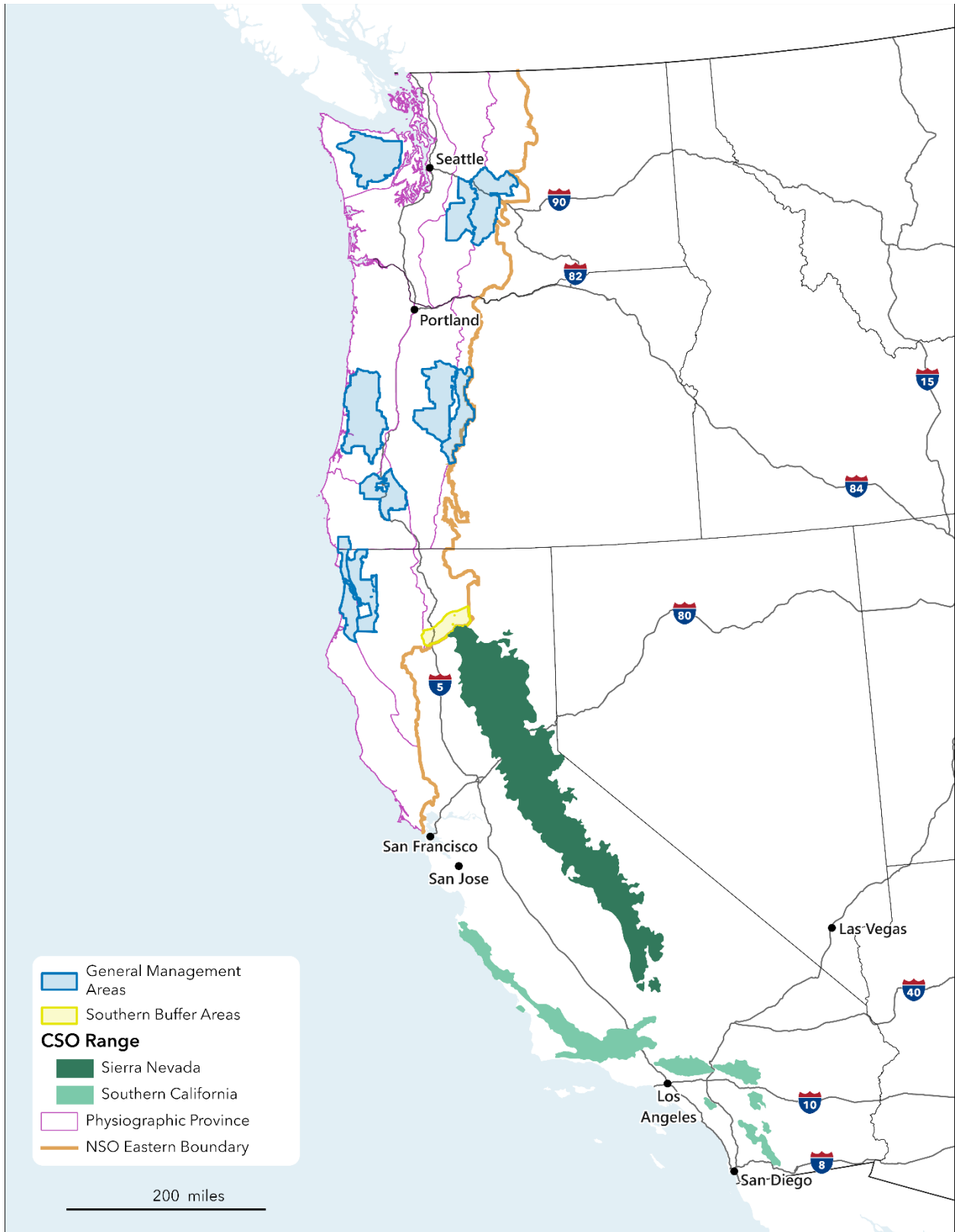
Table 2-4. Estimated maximum forest acres under barred owl management by province under Alternative 4.

Physiographic Province	Maximum Potential Forest Acres Under Management
Olympic Peninsula	1,196,915
Western Washington Cascades	654,931
Eastern Washington Cascades	1,094,518
Oregon Coast Ranges	1,724,821
Western Oregon Cascades	1,273,146
Eastern Oregon Cascades	683,833
Oregon Klamath	755,556
California Coast	646,149
California Klamath	797,188
California Cascades	450,393

In the California spotted owl range, under this alternative, barred owl management would be delayed until barred owl occupancy reached a threshold level. Barred owls would be located using information from existing monitoring, research, and survey efforts, as well as additional focused and extensive inventories in the northern portion of the Sierra Nevada, the most likely barred owl invasion pathway into the Sierra Nevada from the northern spotted owl range.

In the Sierra Nevada portion of the California spotted owl range, barred owl removal would be initiated when monitoring or inventory data indicated that barred owls were being detected on 10 percent or more of an area. Barred owl removal, and monitoring of the removal area, would continue until barred owl detection rates dropped below one percent. Monitoring would continue following cessation of removal and removal would be reinitiated if detection rates rose above 10 percent again.

California spotted owls are proposed for listing as endangered in the Coastal-Southern California portion of their range, inducing us to apply more conservative conditions for barred owl removal in this area. Therefore, barred owl removal in this area would be initiated when monitoring or inventory data indicated that barred owls were being detected on five percent or more of an area. Barred owl removal, and monitoring of the removal area, would continue until barred owl detection rates dropped below one-half percent. Monitoring would continue following cessation of removal and removal would be reinitiated if detection rates rose above five percent again.



Map 2-7. Alternative 4. Northern and California spotted owl ranges.

2.7 Alternative 5 – Management Focused on the Highest Risk Areas

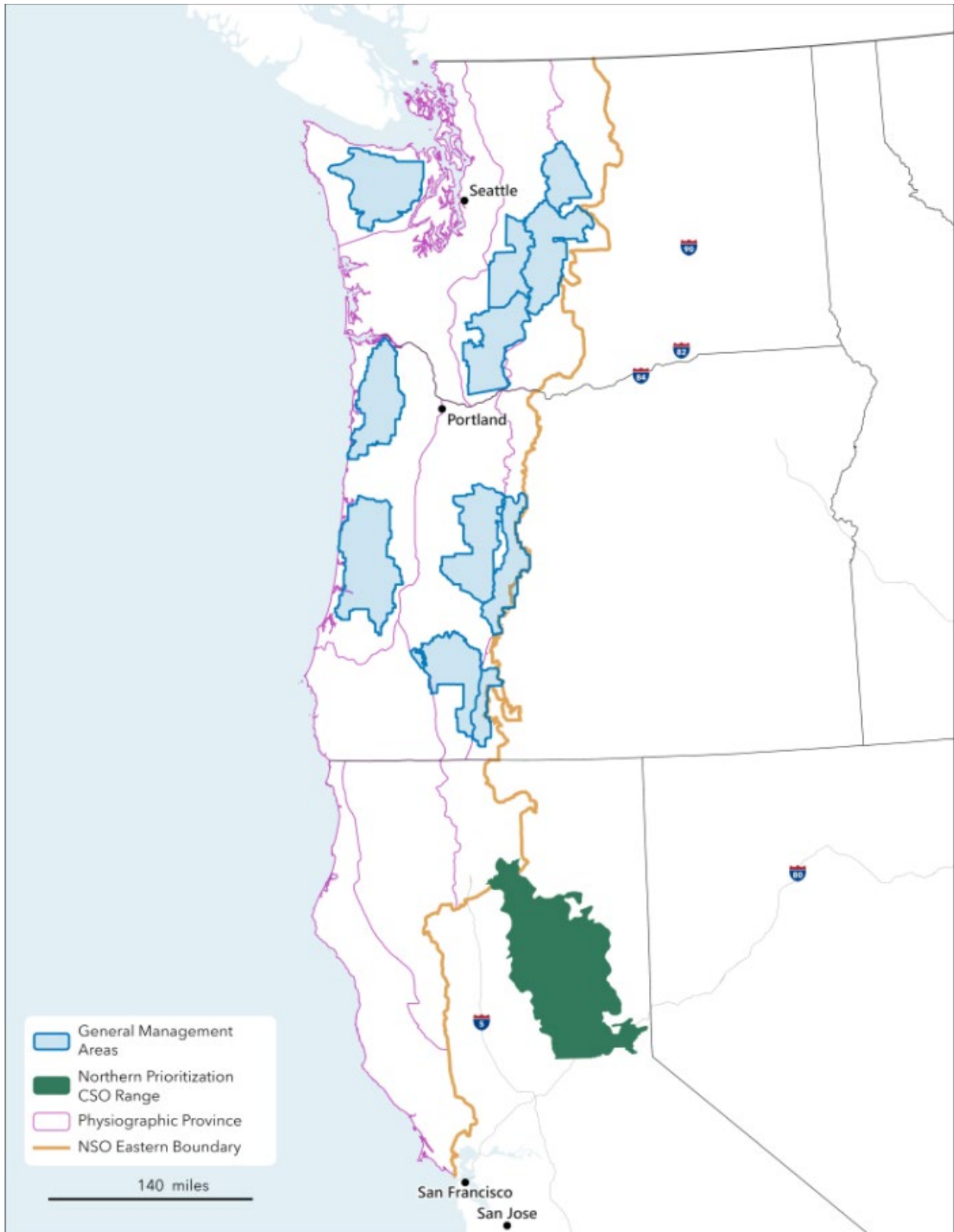
In the northern spotted owl range, under this alternative, barred owl management would be focused on two GMAs in each of the Eastern Washington Cascades, Western Washington Cascades, Eastern Oregon Cascades, Western Oregon Cascades, and Oregon Coast Ranges Physiographic Provinces and one GMA in the Olympic Peninsula Physiographic Province (Map 2-8). These are the provinces in which northern spotted owls are at the highest risk of extirpation in the short term. Within the northern spotted owl range, no management outside these selected GMAs would be authorized under this alternative. Barred owl management could occur on up to 100 percent of the forest lands in each GMA, though multiple smaller management areas would also be possible (Table 2-5).

Table 2-5. Estimated maximum forest acres under barred owl management by province under Alternative 5.

Physiographic Province	Maximum Potential Forest Acres Under Management
Olympic Peninsula	1,196,915
Western Washington Cascades	1,756,596
Eastern Washington Cascades	1,546,892
Oregon Coast Ranges	2,838,088
Western Oregon Cascades	2,292,219
Eastern Oregon Cascades	1,000,224
Oregon Klamath	0
California Coast	0
California Klamath	0
California Cascades	0

In the California spotted owl range, under this alternative, barred owl management would be limited to the northern portion of the Sierra Nevada portion of the subspecies range (Map 2-8). Barred owls would be located using information from existing monitoring, research, survey, and other records, as well as additional focused and extensive inventories in the northern portion of the Sierra Nevada, the most likely barred owl invasion pathway into the Sierra Nevada from the northern spotted owl range. All barred owls detected would be lethally removed from the land of willing landowners, as soon as practicable following detection.

Under this alternative, implementing entities would employ lethal removal methodology and monitoring of all management actions. They would still have to meet the training requirements for removal specialists, abide by the protocol for removal, and provide all required monitoring reports.



Map 2-8. Alternative 5. Northern and California spotted owl ranges.

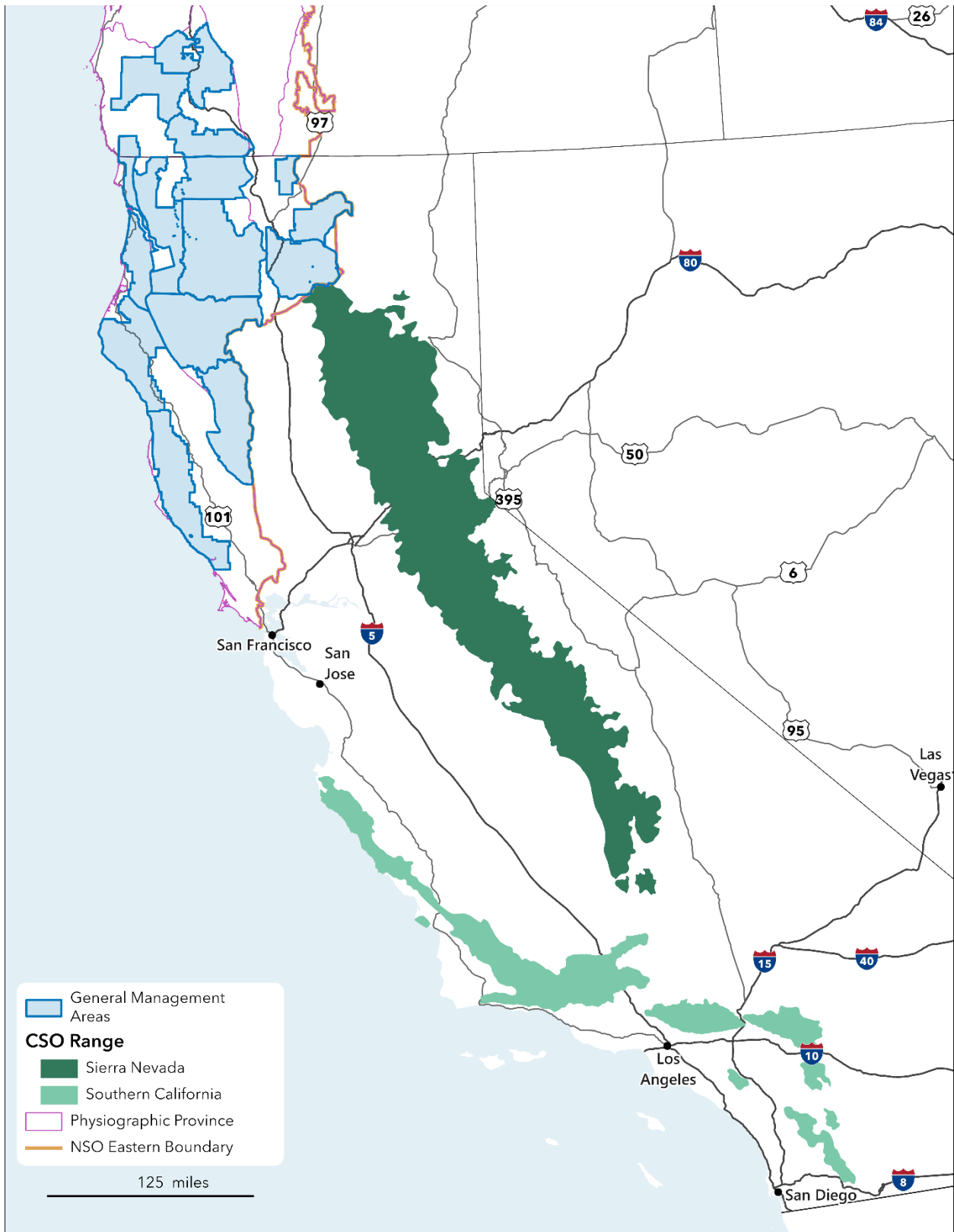
2.8 Alternative 6 – Management Focused on Best Conditions

In the northern spotted owl range, under this alternative, barred owl management would be focused on GMAs in the Oregon Klamath, California Coast, California Klamath, and California Cascades provinces. No management outside these GMAs would be authorized under this alternative (Map 2-9). Barred owl management could occur on up to 75 percent of the forest lands in each GMA, with emphasis on multiple smaller management areas where possible (Table 2-6).

Table 2-6. Estimated maximum forest acres under barred owl management by province under Alternative 6.

Physiographic Province	Maximum Potential Forest Acres Under Management
Olympic Peninsula	0
Western Washington Cascades	0
Eastern Washington Cascades	0
Oregon Coast Ranges	0
Western Oregon Cascades	0
Eastern Oregon Cascades	0
Oregon Klamath	1,448,857
California Coast	1,824,121
California Klamath	3,754,163
California Cascades	984,588

In the California spotted owl range, under this alternative, management would be focused on areas with the best remaining habitat and areas with higher fire resiliency. Implementing entities would identify the subject habitat on their lands for application of this alternative. Monitoring and management would focus on the 50 percent of the Sierra Nevada portion of the range with the best remaining habitat, and the 75 percent of the Coastal-Southern California portion of the range with the best remaining habitat and available access. Because habitat continues to be affected by fires, selection of the areas for this alternative would occur at the time of implementation, and could also change over time in response to new information or changes resulting from catastrophic events such as wildfire. Any barred owls detected during existing monitoring, research, and survey efforts, or anecdotal reports, within these selected areas would be removed. Outside of these selected areas, barred owls could be removed within three miles of any occupied California spotted owl site.



Map 2-9. Alternative 6. Northern and California spotted owl ranges.

2.9 Summary of Alternatives

Table 2-7. Summary description of alternatives in the northern spotted owl range.

Alternative	Maximum Forest Acres under Barred Owl Management	Provinces with Barred Owl Management	Management Approach	Map
1 - No Action	None	None	None	None
2 - Proposed Action	10,904,057 to 13,799,949	All	Northern spotted owl site management, Multiple GMAs, Special Designation Areas	2-2, 2-3, 2-4
3 - Management Across the Range	16,511,470	All plus 15-mile buffer	Anywhere within the range and buffer	2-5
4 - Limited Management by Province/Population	9,277,450	All	Single GMA or area per province	2-7
5 - Management Focused on Highest Risk Areas	10,630,934	Olympic Peninsula, Western Washington Cascades, Eastern Washington Cascades, Oregon Coast Ranges, Western Oregon Cascades, Eastern Oregon Cascades	Two GMAs per province	2-8
6 - Management Focused on Best Conditions	8,011,729	Oregon Klamath, California Coast, California Klamath, California Cascades	GMAs, Southern Buffer Zone	2-9

Table 2-8. Summary description of alternatives in the California spotted owl range.

Alternative	Sierra Nevada	Coastal-Southern California	Map
1 - No Action	None	None	None
2 - Proposed Action	Establish extensive inventory and monitoring network within northern invasion pathways. Remove all barred owls located by survey or monitoring.	Focus inventory/monitoring within the range and potential invasion pathways. Remove all barred owls located by survey or monitoring.	2-5
3 - Management Across the Range	Remove barred owls from range and 15-mile buffer, using existing survey and monitoring data.	Remove barred owls from range and 15-mile buffer, using existing survey and monitoring data.	2-6
4 - Limited Management by Province/Population	Remove barred owls when barred owls are being detected on 10 percent or more of an area.	Remove barred owls when barred owls are being detected on 5 percent or more of an area.	2-7
5 - Management Focused on Highest Risk Areas	Remove barred owls from the northern portion of the Sierra Nevada only.	None	2-8
6 - Management Focused on Best Conditions	Remove barred owls on up to 50 percent of the Sierra Nevada portion of the range with the best remaining habitat and around any occupied California spotted owl site.	Remove barred owls on up to 75 percent of the Coastal-Southern California portion of the range with the best remaining habitat and around any occupied California spotted owl site.	2-9

2.10 Alternatives Considered and Eliminated from Detailed Analysis

Some alternatives were considered but eliminated from detailed analysis (40 CFR 1502.14), including certain alternatives submitted during scoping (summarized in Chapter 5). In general, the reason for eliminating these alternatives or methods from full analysis included:

- Effects that were substantially the same as one of the fully analyzed alternatives.
- Alternative results would not meet the purpose and need for the Strategy.
- Technical or economic infeasibility.

2.10.1 Management in the vicinity of northern spotted owl sites only

In the range of the northern spotted owl, this alternative would target removal of barred owls at northern spotted owl sites, with emphasis on current and recently occupied sites and any new sites that are located. Management would not occur in the California spotted owl range. Management would include removal of barred owls within at least two home range radii (size varies by province), but this could be extended to three home range radii if the implementing entity chose to do so.

Reason for not analyzing in detail: Relative to northern spotted owls, this is a component of Alternative 2 and is analyzed with that alternative. Analysis of the effects of removing barred owls in the vicinity of northern spotted owl sites is contained in the analysis of Alternative 2.

Additionally, in areas where northern spotted owl populations are currently at very low levels, including in Washington and the northern approximately two-thirds of Oregon, management focused only on recently occupied sites would result in very small and isolated management areas, leaving the northern spotted owl population at high risk of extinction. Therefore, northern spotted owl site management alone would not meet the purpose and need for this Strategy.

2.10.2 Manage barred owls in Federal reserved land only

Under this alternative, we would focus barred owl management in Congressionally-reserved areas, including National Parks, National Monuments, National Wild and Scenic Rivers, and designated wilderness areas.

Reason for not analyzing in detail: Federal reserved lands were considered by the development team in the creation of the GMAs and other management areas under Alternative 2. Many Congressionally-reserved areas are designated in landscapes that are not capable of providing spotted or barred owl habitat (e.g., alpine areas), limiting the area available for barred owl management to support northern spotted owls. Congressionally-reserved lands that are capable of supporting these habitats were generally included in the GMAs. Therefore, the effect of barred owl management on these areas is substantially represented in the analysis of Alternative 2.

The portions of Congressionally-reserved lands that are capable of supporting spotted owls are scattered, and often in small patches. They are not well distributed across some of the provinces. The limited road and trail access would further limit our ability to implement barred owl management on these areas. By themselves, they could not provide stable spotted owl populations across the range of the two subspecies and would not meet the purpose and need.

2.10.3 Manage barred owls only in critical habitat

Under this alternative, barred owl management would occur only in areas designated as critical habitat for the northern spotted owl. Northern spotted owl critical habitat is currently limited to public lands (Federal and State) and substantially overlaps with the management areas in Alternative 2. There is no designated critical habitat for the California spotted owl.

Reason for not analyzing in detail: This approach would be limited to the northern spotted owl range and so it would not meet the purpose and need with respect to California spotted owls. As to northern spotted owls, 91 percent of critical habitat is included in the management areas (GMA and Special Designations) of Alternative 2. Therefore, the effects of this alternative would be substantially the same as the effects of Alternative 2.

2.10.4 Nonlethal removal methods

Nonlethal removal involves capture and transport of barred owls out of the study area. This requires a location to place the captured birds, either in the wild or in captivity. In development of the Barred Owl Removal Experiment (USFWS 2013, entire) we examined several placement options based on two general approaches: translocation and release to the wild, or captivity. The results of that analysis remain relevant for this analysis.

We examined two options for translocation releases: release into areas within the western U.S., and release in their historical range in the eastern U.S. Given the barred owl's invasive nature and potential impact on a wide array of prey, we eliminated the option of releasing barred owls in the west, whether within or outside the spotted owl ranges. Their ability to travel long distances could also lead to the return of translocated barred owls to the range of the spotted owl. We contacted State agencies in the historical range of the northern barred owl, the subspecies of barred owls found in the northwest, to determine if they were interested in receiving barred owls for relocation. None of the responding States expressed interest in receiving captured barred owls; the primary reason being lack of empty habitat, coupled with concerns for the potential to introduce new diseases or parasites from the west. There was also concern that the genome of barred owls in the west, after over 100 years of intensive selective pressure, would not match local populations in the east and could disrupt their natural variation. Therefore, translocation is not a viable option.

The remaining option is permanent captivity. Maintaining owls in captivity in a humane and safe environment is difficult and expensive. Owls require specialized facilities, caging, and care. Therefore, the most likely potential for humane captive holding would be by zoo, zoological parks, and similar facilities. As a result, we anticipate the ability to place few barred owls. Since we would not capture barred owls without a location ready to accept them, none of the alternatives could be implemented if limited to nonlethal removal.

2.10.5 Reproductive interference

Another method we considered for managing barred owls was to prevent barred owl reproduction. This approach would be aimed at preventing barred owl reproduction by destroying nests, removing eggs from nests, rendering eggs unviable (e.g., oiling eggs), surgical sterilization, or immuno-contraceptive vaccines. All of these methods would be intended to prevent reproduction while leaving barred owls in place until they die. Hazing at nest sites has been used with some birds to reduce reproductive success. Barred owls are not particularly susceptible to disturbance, as indicated by their presence in urban settings, so hazing is not considered an effective way to prevent barred owl reproduction.

We dismissed the prevention of barred owl reproduction from detailed analysis for the following reasons. While these approaches could eventually cause the territorial barred owl population to decline, this would only occur after the existing territorial birds die and external sources of recruits decline. This could require well over a decade given the lifespan of barred owls. During this time, the barred owls would remain on the landscape and continue to exclude spotted owls from their territories, thereby preventing spotted owl reproduction and reducing their annual

survival rate. By the time barred owl populations dropped to a level where spotted owls could establish territories, the spotted owls would have died. We would be very unlikely to be able to reduce reproduction by barred owls over an area large enough that dispersers (which may travel long distances) would not be able to successfully replace those barred owls dying of natural causes. We would therefore not reduce the barred owl conflicts with spotted owls. This would not meet the purpose and need. In addition, depending on the method of administering agents for sterilization, spotted owls could be exposed to sterilizing agents, reducing their reproduction, which could result in further spotted owl population decline or extirpation.

Finding nests and removing or destroying eggs would require that we find nests early in the nesting season every year and track any renesting efforts, and that we be able to access those nests to remove, oil, or destroy the eggs. Finding barred owl nests is difficult and missing even a few would provide replacements for older barred owls that died, resulting in a lack of empty sites for spotted owls to colonize. Many barred owl nests are in snags or otherwise compromised trees, making climbing the trees to access the eggs too dangerous. It would be nearly impossible to effectively reduce the barred owl influence on enough spotted owl pairs to support spotted owl populations, making this approach technically infeasible.

Sterilization would require capture and handling every barred owl encountered. In most cases this would require capture of all the territorial barred owls, or at least one member of all pairs, across a large area, which would be very expensive. Unless we could sterilize all of the barred owls in the area, there would still be young produced that would recolonize sites when the territorial barred owls died. If even one pair in an area could not be captured, they could produce as many as five young per year. Capture and sterilization would also be stressful on wild birds and these methods would also involve risks of mortality. This approach would be technically and economically infeasible.

2.10.6 Habitat management

We considered whether there were habitat management methods that could reduce the impact of barred owls on spotted owls. We considered two approaches, one that would create habitat conditions favoring spotted owls over barred owls, and another involving the maintenance of habitat to provide more opportunities for both species to survive.

Forest management to favor spotted owls would require that there be forest conditions under which spotted owls had a competitive advantage over barred owls and that we could manage for these conditions. Unfortunately, to date, barred owls have shown the capacity to occupy all forest conditions used by spotted owls, and to displace spotted owls in all of these conditions. While there may be some differences in the forest conditions selected when barred owl populations are low, and barred owls have not displaced spotted owls as rapidly in some areas and under some conditions, the eventual result is exclusion of spotted owls.

While the presence of high-quality spotted owl habitat may assist individual spotted owls in remaining on a site, habitat management alone cannot prevent the eventual exclusion of spotted owls from these habitats (Franklin et al. 2021, p. 18). The purpose and need for this action is focused on the threat from barred owls. Other threats, such as habitat loss, are being addressed

through other processes, such as the Recovery Plan for the Northern Spotted Owl, the Conservation Strategy for the California Spotted Owl, Federal land management plans, and critical habitat designations.

2.10.7 Alternatives to use of firearms to remove barred owls

We also considered alternatives to the use of firearms to lethally remove barred owls, such as the use of poison and capture with euthanasia.

We deem the use of poison to be too dangerous to other species as it would be difficult to ensure delivery to the specific individual for removal, and there would be a potential for secondary poisoning from scavenging of the carcass. The result for the barred owls would not be substantially different from lethal removal using firearms.

Capture and euthanasia of barred owls would be an optional technique allowed under the protocol for removal of barred owls (Appendix 2) in areas where firearm use is inadvisable for safety or other concerns. However, this would result in additional stress for the birds and would be relatively inefficient, resulting in substantially higher costs, so we do not consider this the preferred or primary removal method. While this would be a component of removal, the result for the barred owls would not be substantially different from lethal removal by firearm.

2.10.8 Reduced number of barred owls removed

We considered several options that would result in fewer barred owls removed per land area managed. These options include various levels of partial removal of barred owls and eliminating removal of hybrids.

Partial removal of barred owls would be a reality under all removal scenarios, particularly in areas with moderate to high barred owl densities. In any specific area, some barred owls would not be removed each year due to accessibility, weather, and other issues. Removal studies to date have focused on as complete removal as possible and have shown success under this approach. Intentional partial removal has not been tested.

Deliberately leaving territorial barred owls within a management area would likely result in the production of more barred owls within the management area, thereby allowing for more or quicker recolonization by barred owls of sites cleared of territorial barred owls and reduced opportunity for spotted owls to reclaim sites. Over time this could actually lead to the need to remove more barred owls in total as dispersing barred owls recolonized sites and continued to need to be removed. If in the future partial removal were shown to be effective for spotted owl recovery, the removal protocol could be modified to include this option.

Limiting removal to non-hybrid barred owls, and excluding removal of spotted/barred owl hybrids, would not significantly change the number of owls removed. In most areas, hybrids are very uncommon. However, hybrids do have the same effect on spotted owls, through competitive exclusion, as genetically homogenous barred owls. In addition, allowing hybrids to remain in

areas could lead to an increase in hybrids, and the introgression of barred owl genes into the spotted owl genome, potentially resulting in loss of genetic identity.

2.10.9 Limit competition for food between spotted and barred owls

This approach assumes that competition for food is the primary factor leading to exclusion. While impacts on the prey base from barred owl predation may be contributing to the inability of spotted owls to survive and maintain occupancy in a territory, direct competitive exclusion by barred owls is the likely primary factor affecting the ability of spotted owls to retain territories. Supplemental feeding of spotted owls would not remove the impact of competitive exclusion. Supplemental feeding of barred owls, to reduce their impact on natural prey base, could actually increase reproductive success of barred owls, increasing their populations, which is counter-productive to the Strategy's purpose and need. Therefore, these approaches would not reduce barred owl impacts on spotted owls and would not meet the purpose and need.

2.10.10 Northern spotted owl captive propagation or translocation

Captive breeding or translocation of spotted owls could bolster spotted owl populations in the wild and could be a valuable component of a larger spotted owl recovery strategy. To be successful, these approaches would require the availability of spotted owl habitat with reduced barred owl competition, as would be provided by any of the alternatives. However, the actual captive propagation or translocation would be outside the scope of this action and would require additional Federal action, including additional analysis and permitting.

Chapter 3 - Affected Environment and Environmental Consequences

This chapter provides a description of the analysis area and the current conditions that could be affected by the proposed action or action alternatives (affected environment), and a comparative analysis of the potential effects to the human environment (environmental consequences) of each alternative. For the purposes of this draft EIS, “effect” is synonymous with “consequence” and “impact,” and effects may be beneficial (positive) or adverse (negative). We identified potential effects for the following areas: barred owls, spotted owls, other wildlife species, recreation and visitor use, wilderness, socioeconomics, and climate change. Effects to other resources were considered but dismissed from detailed analysis because there are not likely to be significant effects on public health and safety, cultural resources, Tribes, ethical considerations, environmental justice, or geology, soils, water, vegetation, or air quality. Cumulative effects are described in Chapter 4.

3.1 Analytical Methodologies and Assumptions

This section describes the overall temporal and spatial scale of analysis for this draft EIS, as well as key analytical assumptions that are common to all analyses. The individual sections of this chapter and accompanying appendices include assumptions that are specific to that resource.

The Council on Environmental Quality’s regulations for implementing NEPA direct that NEPA documents “discuss impacts in proportion to their significance. There shall be only brief discussion of other than significant issues” (40 CFR 1502.2(b)). In considering the significance of potential effects, this analysis addresses the degree and duration of beneficial and adverse effects and whether any effects would violate Federal, State, Tribal, or local law protecting the environment.

The regulations also require that an EIS disclose the direct, indirect, and cumulative effects on the quality of the human environment of a proposed action or alternative. Direct effects are those effects that are caused by the action and occur at the same time and place (40 CFR 1508.1(g)(1)). Indirect effects are those effects that are caused by the action and are later in time or farther removed in distance but are still reasonably foreseeable (40 CFR 1508.1(g)(2)). Cumulative effects are effects on the environment that result from the incremental effects of the action when added to the effects of other past, present, and reasonably foreseeable actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative effects can result from individually minor but collectively significant actions taking place over a period of time (40 CFR 1508.1(g)(3)).

The proposed action is issuance of a Special Purpose permit under the Migratory Bird Treaty Act for take of barred owls to implement the proposed Barred Owl Management Strategy (Strategy). We assess direct and indirect effects in this chapter, and cumulative effects in Chapter 4.

As described in Chapter 2, none of the alternatives analyzed require or direct changes to underlying land management for any landowner. Any implementation actions would be limited

to lands of willing landowners or land manager participants. Although the specific timing, size, location, and design of future implementation actions that would occur under each alternative are not certain, we can project a reasonable forecast of how actions expected under the management direction of each alternative would affect the human environment. The analysis also considers best management practices that may be implemented to mitigate or reduce adverse effects where applicable and in accordance with existing regulatory requirements. Effects on short-term use of the environment and long-term productivity of the forest are addressed as part of the environmental consequences in this chapter.

Analysis of effects of any of the action alternatives includes projecting future implementation actions by multiple entities. It is not possible to forecast the duration of the management activities themselves. The MBTA Special Purpose permit can be issued for up to three years, but can be renewed. For the purposes of the analysis of the action in this EIS, we chose a temporal scale of analysis of 30 years. This period of time represents two lifespans of a spotted owl and allows sufficient time to predict and analyze discernable differences in effects to resources across alternatives.

3.2 Description of the Affected Environment

All management actions described in this draft EIS are focused on managing one forest species, barred owl, for the conservation of another forest species, spotted owl. Therefore, the management actions would occur on forest landscapes within the areas described for the affected environment. In all action alternatives, the existing forest management direction or designations determined by each separate landowner or manager are assumed to continue.

For all action alternatives considered in this EIS, barred owl management actions would occur across the range of the northern and California spotted owls, at various levels and in various locations, depending on both the focus of the alternative and the implementation decisions of the agencies involved. The Affected Environment is the area where implementation of an alternative could affect different aspects of the human environment (including the natural and physical environment). Management actions and the affected environment vary between the range of the northern and California spotted owl, and so would be addressed separately in most cases within this chapter.

Implementation of action alternatives could have temporary and limited effects on certain resources outside the management areas themselves. For example, the sound of gunshots from management activity may carry outside the management areas, or shifts in barred owl populations may occur within a few miles of management areas as these birds may move into areas cleared of territorial barred owls. Any effects beyond the boundaries of the management areas are described further for each resource.

3.2.1 Area of Analysis: Northern spotted owl range

Environmental effects of the alternatives are considered at two scales within the northern spotted owl range. These include landscape scale by physiographic province (province) and mapped management areas. In all alternatives, we excluded the Western Washington Lowlands province

due to lack of spotted owl habitat and extensive human development.

At a landscape scale, the analysis of effects is provided at the province level (Map 2-1), Table 3-1). Ownership of the lands varies by province, including Federal agencies, State agencies, other government, and private lands (Table 3-2). Within the Federal lands, the primary land managing agencies are the U.S. Forest Service (Forest Service), Bureau of Land Management (BLM), and the National Park Service (NPS) (Table 3-3). For all analyses, the forested margins of the Willamette Valley province were added to the adjacent provinces.

We also evaluated the effects of the action alternatives at the mapped management area scale. These management areas are described in Section 2.3.4. and displayed on Maps 2-2, 2-3, and 2-4. Action alternatives may include different combinations of these management areas and different levels of management within the areas.

In addition, for Alternative 3, we have included a management zone for 15 miles around the borders of the subspecies range (Map 2-6).

Thus, for the purposes of this EIS, the affected environment is made up of the range of the northern spotted owl, including mapped management areas and spotted owl site management areas, and a 15-mile additional management zone. The affected environment for each alternative is made up of varying combinations of management areas and scales.

Table 3-1. Total acres for land base, forest lands, and spotted owl habitat within each physiographic province included in this analysis. Spotted owl habitat is derived from the 2023 Cover Type Suitability GIS layer (Davis et al. 2023a).

Physiographic Province	Total Acres in Land Base	Forest Acres	Spotted Owl Habitat Acres
Olympic Peninsula	3,034,555	2,721,994	849,431
Western Washington Cascades	6,154,074	5,259,617	1,604,611
Eastern Washington Cascades	5,691,079	4,213,859	738,379
Oregon Coast Range ¹	5,827,250	5,228,622	839,787
Western Oregon Cascades ¹	6,645,785	6,250,177	2,248,777
Eastern Oregon Cascades	2,392,561	2,097,231	324,234
Oregon Klamath	4,003,341	3,619,558	1,306,674
California Coast	5,694,290	3,915,313	1,148,503
California Klamath	6,089,224	5,531,309	1,603,832
California Cascades	2,500,969	1,976,883	297,310
Western Washington Lowlands ²	6,515,511	4,529,737	130,967

¹ For this analysis, the Oregon Coast Range and Western Oregon Cascades provincial data do not include the adjacent forested margin of the Willamette Valley province as they do in other analyses. ² The Western Washington Lowlands Province is not included in the alternatives.

Table 3-2. Distribution of lands by percent of ownership in the physiographic provinces.

Physiographic Province	Total Acres	Federal	State	Tribal	Other Government	Private
Olympic Peninsula	3,034,555	51%	13%	8%	1%	27%
Western Washington Cascades	6,154,074	61%	11%	<1%	1%	27%
Eastern Washington Cascades	5,691,079	64%	9%	15%	<1%	12%
Oregon Coast Range ¹	5,827,250	24%	12%	<1%	1%	63%
Western Oregon Cascades ¹	6,645,785	68%	1%	<1%	<1%	31%
Eastern Oregon Cascades	2,392,561	69%	2%	11%	<1%	18%
Oregon Klamath	4,003,341	53%	1%	<1%	<1%	46%
California Coast	5,694,290	9%	6%	1%	3%	81%
California Klamath	6,089,224	76%	<1%	2%	<1%	22%
California Cascades	2,500,969	46%	1%	<1%	<1%	53%
TOTAL	48,033,128	52%	6%	3%	1%	38%

¹ For this analysis, the Oregon Coast Range and Western Oregon Cascades provincial data do not include the adjacent forested margin of the Willamette Valley province as they do in other analyses.

Table 3-3. Distribution of Federal lands by percent of Federal lands in the physiographic provinces.

Physiographic Province	Total Acres	US Forest Service	Bureau of Land Management	National Park Service	Other Federal
Olympic Peninsula	1,541,428	41%	0%	59%	0%
Western Washington Cascades	3,776,636	79%	0%	21%	0%
Eastern Washington Cascades	3,620,756	95%	0%	4%	1%
Oregon Coast Range	1,428,917	44%	54%	0%	2%
Western Oregon Cascades	4,510,683	82%	16%	2%	0%
Eastern Oregon Cascades	1,654,840	90%	3%	6%	1%
Oregon Klamath	2,120,057	61%	39%	0%	0%
California Coast	491,663	14%	55%	30%	1%
California Klamath	4,620,910	96%	3%	1%	0%
California Cascades	1,139,407	94%	5%	0%	1%
TOTAL	23,398,918	82%	12%	6%	0%

3.2.2 Area of Analysis: California spotted owl range

Because barred owl populations are not yet established in the range of the California spotted owl, management is focused on locating and removing barred owls before this happens under all action alternatives. Barred owl management is focused on the range of this subspecies, including the populations in the Sierra Nevada and Coastal-Southern California. Additionally, all alternatives allow management in the areas adjacent to the current range that may represent potential pathways for the invasion of barred owls into the California spotted owl range (Map 2-5).

For the Sierra Nevada population, potential pathways for invasion include portions of the Shasta-Trinity, Modoc, Tahoe, Plumas, Lassen National Forests and surrounding forest and woodlands adjacent to the National Forests to the west and east (Map 2-5).

A secondary pathway may occur through the riparian areas of the Central Valley. For the Coastal-Southern California population, the potential invasion pathways include areas along the border closest to the Sierra Nevada province and in the central coast near the border with the southern end of the California Coast province.

Therefore, environmental effects of the action alternatives may occur at any time or place within the range of the subspecies or potential invasion pathways. Effects of management would be limited to forested areas, though these may include small patches of forest in invasion pathways.

3.3 Barred Owl

Our discussion of the effects of the proposed management on barred owls is focused on the range of the northern and California spotted owls, and adjacent areas described for management. Barred owls are found in areas outside of these areas but would not be affected by this action. For each alternative we describe the anticipated effects to barred owls, including the maximum number of barred owls we estimate would be removed, and the overall effects to barred owl populations from removal at the provincial, regional, and range-wide scales.

3.3.1 Background and Analytical Methods

For the purpose of this analysis, and to effectively illuminate differences in the outcomes under the alternatives, we assumed that management would begin immediately, be implemented to the maximum extent described in each alternative and continue for 30 years. This represents two lifespans of spotted and barred owls and allows time to predict and analyze differences between alternatives.

As a result of differences in the available data and condition of barred owl populations in the northern and California spotted owl range, we used a different analysis approach in each area.

Northern spotted owl range

We estimated the maximum number of barred owls that would be removed under each action alternative using the methodology described in detail in Appendix 3. Using this methodology, we estimated the number of barred owls currently occupying each province and management area, based on the density of barred owls described below (Table 3-4 and 3-5).

To estimate the maximum number of barred owls removed, we assumed a 90 percent annual removal rate within management areas, and an annual rate of new barred owls into the territorial population that accounts for dispersing juveniles and subadults moving into the management area over time. For each alternative, we estimated the number of barred owls to be removed from

each management area, province, or range the first year and the annual average over the 30 years of the analysis.

For each province, we report the percentage of potential barred owl habitat (as represented by acres of forest lands) and populations under management in each alternative, and the percentage of the barred owl population that would not be managed. For example, if an alternative includes removal on 50 percent of the forest lands in the range of the northern spotted owl, we estimate that we would be removing 50 percent of the barred owl population and leaving 50 percent of the barred owl population untouched. Note that this represents the initial population of barred owls as of 2023. This population would likely continue to grow within the non-managed areas until it reached the carrying capacity for the habitat. We do not attempt to provide population numbers for these unmanaged areas, as there are no data yet available to estimate the carrying capacity of different areas or the eventual number of barred owls this would represent.

There are few population estimates for barred owls and no wide-ranging systematic monitoring. Range-wide population estimates are limited and rely on data not specifically designed to detect owls. However, these remain the best available information. The Partners in Flight Population Estimate Database¹ estimates the global population at 3.5 million (95 % confidence limits of 3.0 to 3.9 million). As this is the only population estimate available, we have used this to put the effects of each alternative in context. In addition, to provide another approach to describe range-wide effects to barred owls, we estimated the proportion of the entire North American barred owl population (based on range maps) affected by each alternative. For example, the range of the northern spotted owl is estimated to represent approximately 3 percent of the total range of the barred owl, so if 50 percent of the NSO range is potentially under management, the effect to the barred owl range-wide would be 1.5 percent.

California spotted owl range

As noted above, we have insufficient information to allow for an accurate estimate of the current barred owl population across the range of the California spotted owl. We do know that, under current research permits, between 10 and 15 barred owls have been removed each year since 2020 in the Sierra Nevada. This may represent a low approximation of the current territorial population in the Sierra Nevada. Even so, we consider this to represent the bulk of the territorial barred owl population and anticipate these removal levels would continue at this rate for the next 10 years if monitoring and removal are implemented. This is generally consistent with the reported number of new individual barred owls and barred owl/spotted owl hybrids reported between 2007 and 2017 (Keane et al. 2018). Because this is based on detected and reported barred owls, and not all areas are well surveyed, this may represent a low estimate of the annual territorial population. Therefore, under full removal alternatives, we assumed the potential annual removal rate at the start of management would be 30 barred owls per year for the Sierra Nevada. Removal would not be evenly distributed across the Sierra Nevada.

Given the lack of substantial self-reproducing populations of barred owls in the Sierra Nevada at this time, most barred owls that become territorial, and therefore subject to removal, in the California spotted owl range are likely the result of long-distance dispersal and invasion from the

¹ <https://pif.birdconservancy.org/population-estimate-database-scores/> - accessed September 27, 2023

range of the northern spotted owl where substantial reproductive barred owl populations exist, rather than local reproduction. However, as barred owl populations in the range of the northern spotted owl continue to increase, we expect dispersal/invasion rates into the California spotted owl range to increase. For the analysis of alternatives, we assumed the number of barred owls that may be removed under each alternative would increase by 1.2 times the second decade, and 2.4 times the third (see Appendix 3 for more details).

The number of barred owls removed in management areas under each alternative would derive from the proportion of the range involved in removal. Based on the past invasion history, we anticipate that barred owls would be more common in the areas nearer the source population, and therefore, where management is applied across a portion of the Sierra Nevada in an alternative, we assumed 75 percent of the population would occur in the northern third of the province, and is therefore where 75 percent of the removal would also occur.

To date no barred owls have been detected in the Coastal-Southern California portion of the range, though this may be due in part to limited survey efforts. Given the early stage of invasion and the smaller area of barred owl management related the Coastal-Southern California range, we anticipate a maximum annual removal in the first decade of five barred owls per year, increasing at the same level described for the Sierra Nevada (see Appendix 3 for more details).

3.3.2 Affected Environment

As described in Chapter 1, barred owls are native to eastern North America and were historically found east of the Great Plains, with a subspecies in central Mexico. Barred owl populations began to expand westward in the early 1900s, reaching the range of the northern spotted owl in the 1960s in British Columbia, Canada. Barred owls established breeding populations and continued to expand southward. The first reports of individual barred owls in the range of the northern spotted owl in the U.S. was in western Washington in 1973 (Hamer et al. 1989, p. 2; Taylor and Forsman 1976, p. 560), Oregon in 1974 (Taylor and Forsman 1976, p. 560), and California in 1976 (Livezey 2009, p. 51). Barred owls are now found throughout the northern spotted owl range (Wiens et al. 2021, p. 7), and occur in high densities in the northern portion of the range. Individuals and small populations of barred owls have been found in the Sierra Nevada mountains within the California spotted owl range (Keane et al. 2018, p. 5). For more detail, see Appendices 1 and 2.

Barred owls remain present and relatively common in their historical range in eastern North America. They are found in the southern edge of the boreal forest, and the forest of western Canada, Alaska, and the northern Rocky Mountains. As described above, they are now found in the Cascades and coastal mountains of Washington, Oregon, and northern California, and have recently extended their range into the Sierra Nevada mountains. They occur in a wide variety of forest conditions, including forest patches in cities.

Northern spotted owl range

We used data from studies that included barred owl surveys to estimate the density of barred owls in the range of the subspecies, then used that data to estimate the baseline barred owl populations in the provinces and management areas as of 2023 as follows.

Based on density data from the control areas of the Barred Owl Removal Experiment (Wiens et al. 2021) and from the Willow Creek study area, barred owl densities were estimated in Table 3-4. Note that barred owl populations in many areas would continue to increase and these numbers reflect only the estimated initial population density for 2023.

Table 3-4. The estimate of the density of territorial barred owls on study areas with extensive barred owl surveys. This does not account for non-territorial barred owls.

Study Area	Physiographic Province	Control Area Acres	Estimated Number in Control Area for Highest Year	Number Detected per 1,000 Acres
Cle Elum	Eastern Washington Cascades	134,672	182	1.35 ¹
Oregon Coast Ranges	Oregon Coast Ranges	219,924	635	2.89 ¹
Union/Myrtle-Klamath	Oregon Klamath	150,734	384	2.55 ¹
Willow Creek	California Klamath	56,241	31	1.19 ²

¹ For the Cle Elum, Oregon Coast Ranges, and Union/Myrtle Study Areas, territorial barred owl densities were estimated for the years 2021-2023 using extrapolation of the linear annual time trend from the survey years (Wiens pers comm. 2023).
² For the Willow Creek, the estimate represents adjusted territorial barred owl densities from 2019, the last year of barred owl surveys on the study area. (A. Franklin pers comm. 2023).

We extrapolated the population of barred owls across each physiographic province using the density from the study areas with the most similar forest conditions and historical presence of barred owls. Using these densities (Table 3-4) and the acres of forest land in each province, we estimated the potential current barred owl population in each province (Table 3-5). Given that these data are limited to four study areas and are extrapolated across large landscapes, these should be considered general estimates. All discussion of barred owl abundance in this EIS within the range of the northern spotted owl are based on this methodology, allowing for comparison across alternatives (for details on this see Appendix 3). Using the same methodology, we estimated the current population of barred owls in each mapped management area (Table 3-6).

Table 3-5. Estimate of potential baseline barred owl populations by physiographic province in the northern spotted owl range as of 2023.

Physiographic Province	Study Area Data Applied	Estimated Number of Barred Owls Detected per 1,000 Acres	Acres of Forest Lands	Estimated Starting Population of Barred Owls
Olympic Peninsula	Oregon Coast Ranges	2.89	2,721,994	7,862
Western Washington Cascades	Oregon Coast Ranges	2.89	5,259,617	15,191
Eastern Washington Cascades	Cle Elum	1.35	4,213,859	5,695
Oregon Coast Ranges	Oregon Coast Ranges	2.89	5,492,609	15,864
Western Oregon Cascades	Oregon Coast Ranges	2.89	6,547,882	18,912
Eastern Oregon Cascades	Cle Elum	1.35	2,097,231	2,834
Oregon Klamath	Union/Myrtle-Klamath	2.55	3,619,558	9,219
California Coast	Willow Creek	1.19	3,915,313	4,676
California Klamath	Willow Creek	1.19	5,531,309	6,606
California Cascades	Willow Creek	1.19	1,976,883	2,361
Total			45,905,992	102,304

Table 3-6. Estimate of potential baseline barred owl populations by mapped areas in the northern spotted owl range.

Physiographic Province	Block Name	Number of Barred Owls Detected per 1,000 Acres	Acres of Forest Lands	Estimated Starting Population of Barred Owls
Olympic Peninsula	Olympic GMA	2.89	1,196,915	3,459
	Olympic Hoh-Clearwater SOSEA	2.89	359,406	1,039
Western Washington Cascades	Central WA West Cascades GMA	2.89	654,931	1,893
	South WA West Cascades GMA	2.89	1,101,665	3,184
	North WA West Cascades GMA	2.89	903,600	2,611
	Canadian Connector	2.89	745,184	2,154
	Central Connectivity Area WA Cascades West	2.89	269,239	778
	Finney Block SOSEA	2.89	58,502	169
	Mineral Block SOSEA	2.89	105,057	304
	Mineral Link SOSEA	2.89	155,877	450
Eastern Washington Cascades	Columbia Gorge SOSEA	2.89	31,771	92
	Central WA East Cascades GMA	1.35	1,094,518	1,478
	North WA East Cascades GMA	1.35	452,374	611
	South WA East Cascades GMA	1.35	620,797	838
Oregon Coast Ranges	White Salmon SOSEA	1.35	34,090	46
	Central OR Coast Ranges GMA	2.89	1,724,821	4,985
	North OR Coast Ranges GMA	2.89	1,113,267	3,217
Western Oregon Cascades	South OR Coast Ranges GMA	2.89	298,931	864
	H.J. Andrews GMA	2.89	1,273,146	3,679
	South OR West Cascades GMA	2.89	1,019,073	2,945
	Mount Hood West GMA	2.89	464,685	1,343
	Calapooya Connectivity Area	2.89	986,011	2,850
	Santiam Connectivity Area	2.89	507,261	1,466
Eastern Oregon Cascades	Cascade-Siskiyou Connectivity Area	1.35	196,943	266
	Deschutes GMA	1.35	683,833	923
	Mount Hood East GMA	1.35	401,858	543
Oregon Klamath	South OR East GMA	1.35	316,391	427
	North OR Klamath GMA	2.55	755,556	1,927
	South OR Klamath GMA	2.55	516,220	1,316
	West OR Klamath GMA	2.55	660,033	1,683

Physiographic Province	Block Name	Number of Barred Owls Detected per 1,000 Acres	Acres of Forest Lands	Estimated Starting Population of Barred Owls
California Coast	North CA Coast GMA	1.19	646,149	769
	Central CA Coast GMA	1.19	813,173	968
	South CA Coast GMA	1.19	972,839	1,158
	Marin/Sonoma County Management Zone ¹	1.19	587,434	699
California Klamath	Northwest CA Klamath GMA	1.19	797,188	949
	Central CA Klamath GMA	1.19	1,232,535	1,467
	North CA Klamath GMA	1.19	608,764	724
	Northeast CA Klamath GMA	1.19	1,500,431	1,786
	South CA Klamath GMA	1.19	866,632	1,031
California Cascades	South CA Cascades GMA	1.19	773,175	920
	Central CA Cascades GMA	1.19	399,967	476
	North CA Cascades GMA	1.19	139,642	166
	Southern Buffer Zone	1.19	450,393	536 ²
Total				58,650
¹ The Marin/Sonoma County Management Zone is likely a substantial overestimate as it is based on data from areas with greater barred owl populations. ² The Southern Buffer zone overlaps the Southern California Cascades GMA. These are not included in the total to avoid double-counting				

California spotted owl range

As barred owls continued to expand south, they reached the range of the California spotted owl as early as 1989. Between 1989 to 2013, a total of 51 barred owls and 27 barred owl/spotted owl hybrids had been detected in the Sierra Nevada (Gutiérrez et al. 2017, p. xxv). By 2017, the cumulative number of barred and barred owl/spotted owl hybrid detections in the Sierra Nevada increased to approximately 145 (Keane et al. 2018, p. 7), with another 2.6-fold increase between 2017 and 2018 (Wood et al. 2020, p. 4). Note, this is the cumulative number of barred and hybrid detections reported over time. This does not represent the current population and many of these sites are no longer occupied by barred owls. Between 2018 and 2020, 76 barred owls or barred owl/spotted owl hybrids were removed from the Sierra Nevada, including 65 from the northern portion, 10 from the central, and 1 in the southern Sierra Nevada. 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).

There is insufficient information to allow for an accurate estimate of the current barred owl density or population in the Sierra Nevada portion of the California spotted owl range at this time. The 10 to 15 barred owls removed each year since 2020 represent a minimum estimate of the current territorial population in the Sierra Nevada each year. To date, no barred owls have been detected in the Coastal-Southern California portion of the range, though this may be partly due to limited survey efforts. Still, we anticipate that birders, landowners, land managers

conducting California spotted owl surveys, and other interested parties would be reporting sightings if there were more than a very few individuals in the area as territorial barred owls are very vocal and easily identified.

3.3.3 Environmental Consequences

The following sections present the potential environmental effects of the no action alternative, proposed action, and alternatives on barred owl populations. Methodologies and underlying data vary between the northern and California spotted owl ranges, therefore we address these separately for each of the action alternatives.

3.3.4 Alternative 1 – No Action

Under the no action alternative, the Strategy would not be completed or implemented, and the Service would not obtain an MBTA permit for management of barred owls. Barred owls would continue to expand within the northern spotted owl range, causing a further decrease in spotted owl populations, likely resulting in extirpation in large portions of their range and eventual extinction of the northern spotted owl subspecies.

Barred owls would continue to move into the California spotted owl range from the north. Based on the history of the barred owl invasion in the northern spotted owl range, we anticipate that increase in barred owls may be slow in the first decade, particularly in the southern Sierra Nevada and the Coastal-Southern California portion of the range. However, once reproductive barred owl populations are established within the subspecies' range, we anticipate that barred owl populations would begin a rapid growth phase.

For purposes of this analysis, we assumed that under the no action alternative, barred owl removal would continue in some areas under other ongoing or future research efforts. Research involving barred owl removal has been conducted in all three States in the past and is currently underway in California for both northern and California spotted owls. Additional research efforts may be initiated in the future that involve removal of barred owls and require an MBTA permit. However, research is, by its nature, relatively short-term and we have no way to estimate the number, extent, location, or duration of those future decisions as permits are processed as they come in from outside requesters.

3.3.5 Alternative 2 – Proposed Action – Strategy Implementation

Alternative 2 includes removal of barred owls from management areas across 10 provinces in the range of the northern spotted owl. These include areas around all recently occupied and newly located spotted owl sites, management of portions of General Management Areas based on their priority rating, and management on portions of several Special Designated Areas (see Chapter 2.4).

In the range of the California spotted owls, all barred owls located on ongoing or future monitoring, inventory, or survey efforts would be removed as soon as practicable after detection across the range of the subspecies and in forest areas representing the potential invasion

pathways into the range. These pathways include the northern Sierra Nevada area, forested areas in the Central Valley, the forested areas between the Coastal-Southern California population and the Sierra Nevada, and in the central coast near the border with the southern end of the California Coast province.

Northern spotted owl range

Under this alternative, under full management, a maximum of nearly 20,000 barred owls would be removed during the first year of management across the range of the northern spotted owl. The area under management would increase over time under this alternative, so the average number of barred owls removed annually would increase by decade from 13,371 in decade one to 17,272 in decade three (Table 3-7). This would represent approximately 13 to 17 percent of the estimated starting population of barred owls in the range of the northern spotted owl and less than one percent of the estimated global barred owl population. Barred owls would be removed from 26 to 33 percent of the forest lands within the range of the northern spotted owl, leaving 67 to 74 percent of the forest lands in this region unmanaged. This would represent barred owl removal from less than one percent of the range of the barred owl in North America.

Table 3-7. Alternative 2 – Proposed Action – Strategy Implementation. Percentage of forest lands under barred owl management by decade, the number of barred owls removed the first year, and the average annual number of barred owls removed by decade in the northern spotted owl range.

Physiographic Province	Maximum Percent of the Forest Lands Managed			Maximum Number of Barred Owls Removed, Annual Average			
	Decade 1	Decade 2	Decade 3	First Year	Decade 1	Decade 2	Decade 3
Olympic Peninsula	25	25	25	1,789	1,259	1,311	1,325
Western Washington Cascades	22	27	30	3,038	2,138	2,736	3,013
Eastern Washington Cascades	19	22	23	1,239	482	606	646
Oregon Coast Ranges	24	28	29	3,449	2,427	2,920	3,024
Western Oregon Cascades	23	26	27	3,854	2,712	3,222	3,378
Eastern Oregon Cascades	31	33	36	790	361	362	399
Oregon Klamath	22	27	27	1,810	1,273	1,637	1,640
California Coast	37	42	46	1,546	1,088	1,314	1,441
California Klamath	30	39	45	1,757	1,237	1,711	2,004
California Cascades	43	52	56	920	420	484	520
TOTAL	26	31	33	20,192	13,397	16,303	17,390

Alternative 2 would result in the removal of barred owls from up to 33 percent of the northern spotted owl range over the 30 years of the analysis. Thus, barred owls would remain untouched on approximately 67 percent of the northern spotted owl range. Removal areas would occur across the entire northern spotted owl range. This alternative would result in an intermediate impact on barred owl populations in the west, as compared to the other action alternatives. The number of barred owls removed under Alternative 2 implementation in the northern spotted owl range would represent less than one percent of the global barred owl population and would not have a significant effect on global barred owl populations.

California spotted owl range

Under Alternative 2, we anticipate barred owls would continue to be detected as they settled and became territorial within the California spotted owl range. Additional monitoring, focused on the northern portion of the Sierra Nevada, the most likely invasion source, would be initiated. This could increase the number of barred owls located and removed. To accommodate this potential increase in removal, we increased the initial estimate of annual removal by 10 percent. Based on the analysis approach described in Section 3.3.1, this would result in the potential removal of approximately 2,100 barred owls over 30 years. Due to increasing rates of invasion, removals would not be evenly distributed over time (Table 3-8).

Table 3-8. Alternative 2 – Proposed Action – Strategy Implementation. The estimated maximum number of barred owls removed by year, and the average annual number of barred owls removed by decade.

California Spotted Owl Population	Maximum Number of Barred Owls Removed per Year in Each Decade			Maximum Cumulative Number of Barred Owls Removed per Decade			Total
	1	2	3	1	2	3	
Sierra Nevada	33	73	112	330	730	1,120	2,180
Coastal-Southern California	6	12	19	60	120	190	370
Total	39	85	131	390	850	1,310	2,550

Alternative 2 would result in the removal of barred owls from the entire range of the California spotted owl. Because the barred owl invasion of this area is still in the early stages, this removal would limit development of barred owl populations. As a result, the actual number removed is relatively low compared to the northern spotted owl range, and intermediate in the California spotted owl range when compared to the other action alternatives. Given the low number of barred owls removed (up to 131 annually and a total of 2,550 over 30 years) in comparison to populations in the West (over 100,000), this Alternative would not have a significant effect on barred owl populations in the West. Alternative 2 implementation in the California spotted owl range would not have a significant effect on barred owl populations range-wide.

3.3.6 Alternative 3 – Management Across the Range

Alternative 3 would allow for barred owl management to be implemented anywhere within the range of the northern or California spotted owls or within 15 miles of the range of the subspecies (Map 2-6) on up to 50 percent of the area. For analysis purposes, we assumed that management would be distributed evenly across the physiographic provinces for the northern spotted owl range, and assumed the 50 percent would be focused largely on the northern portion of the Sierra Nevada.

Northern spotted owl range

Under this alternative, a maximum of approximately 46,000 barred owls could be removed during the first year of management across the range of the northern spotted owl. This assumes that management would be implemented immediately to the maximum extent described in the alternative. The 15-mile buffer adds approximately 5,536,958 acres to the potential barred owl

management area, resulting in a 10 percent increase in total area. This represents the maximum number of barred owls that would be removed if funding and staffing were to be available. An average of 29,948 barred owls would be removed per year for the 30-year duration of the analysis (Table 3-9). This would represent approximately 29 percent of the estimated starting population of barred owls in the range of the northern spotted owl and less than one percent of the estimated global barred owl population. Barred owls would be removed from 50 percent of the forest lands within the range of the northern spotted owl, leaving 50 percent of the forest land in this region unmanaged. This would represent barred owl removal from approximately 1.5 percent of the range of the barred owl in North America.

Table 3-9. Alternative 3. Percentage of forest lands under barred owl management, the number of barred owls removed the first year, and the average annual number of barred owls removed by decade.

Physiographic Province	Maximum Percent of the Forest Lands Managed by Decade	Maximum Number of Barred Owls Removed	
		First Year	Annual Average
Olympic Peninsula	50	3,538	2,402
Western Washington Cascades	50	6,836	4,642
Eastern Washington Cascades	50	2,563	1,055
Oregon Coast Ranges	50	7,139	4,847
Western Oregon Cascades	50	8,510	5,779
Eastern Oregon Cascades	50	1,275	525
Oregon Klamath	50	4,149	2,817
California Coast	50	2,104	1,429
California Klamath	50	2,973	2,019
California Cascades	50	1,062	437
TOTAL	50	46,036	29,948

Alternative 3 would result in the removal of barred owls from up to 50 percent of the northern spotted owl range over the 30 years of the analysis, including a 15-mile buffer area beyond the spotted owl range. Barred owls would remain untouched on approximately 50 percent of the northern spotted owl range. Removal areas would occur across the entire northern spotted owl range. This alternative would result in the greatest impact on barred owl populations in the west, as compared to the other action alternatives. The number of barred owls removed under Alternative 3 implementation in the northern spotted owl range would represent less than one percent of the global barred owl population and would not have a significant effect on global barred owl populations.

California spotted owl range

Under Alternative 3, we anticipate barred owls would continue to be detected as they settled and became territorial within the California spotted owl range. The added 15-mile buffer adds approximately 8,278,647 acres to the potential barred owl management area, resulting in a 50 percent increase in total area.

Management would occur on only 50 percent of the total area. However, given the uneven distribution of barred owls in the California spotted owl range, we assumed that the majority of

the management under this alternative would be focused on the northern Sierra Nevada. Given that only a portion of the area would be under barred owl management, under this alternative, barred owls may establish reproductive populations within the subspecies range. The presence of reproductive barred owls increases the potential rate of invasion of the managed areas, as it reduces the dispersal distance required for invading individuals. To account for this potential increase in invasion, we assumed the number of barred owls that would settle and be removed under management would increase by 50 percent.

Based on the analysis approach described in Section 3.3.1, this would result in the potential removal of approximately 3,465 barred owls over 30 years. Due to increasing rates of invasion, this would not be evenly distributed in time (Table 3-10).

Table 3-10. Alternative 3. The estimated maximum number of barred owls removed by year, and the average annual number of barred owls removed by decade.

California Spotted Owl Population	Maximum Number of Barred Owls Removed per Year, by Decade			Maximum Number of Barred Owls Removed per Decade			Total
	1	2	3	1	2	3	
Sierra Nevada	45	99	153	450	990	1,530	2,970
Coastal-Southern California	8	16	26	75	165	255	495
Total	53	115	179	525	1,155	1,785	3,465

Alternative 3 would result in the removal of barred owls from 50 percent of the entire range of the California spotted owl and an additional 15-mile buffer area beyond the spotted owl range. Because the barred owl invasion of this area is still in the early stages, this removal would limit development of barred owl populations. Barred owls would remain untouched on approximately 50 percent of the range, allowing for the development of populations and an increase in the number of barred owls removed despite the lower acreage under management. As a result, the actual number removed would be higher than removal across the range in Alternative 2. However though higher, this would still be a relatively low number of barred owls removed in comparison to populations in the West. Given the low number of barred owls removed (up to 179 annually and 3,465 over 30 years) in comparison to populations in the West (over 100,000), this Alternative would not have a significant effect on barred owl populations in the West. Alternative 3 implementation in the California spotted owl range would not have a significant effect on global barred owl populations.

3.3.7 Alternative 4 - Limited Management by Province/Population

Alternative 4 would allow for barred owl management to be implemented across 100 percent of the highest priority General Management Area or other mapped area in each province within the range of the northern spotted owl (Map 2-7). In the California spotted owl range, barred owl management would be delayed until detections reached 10 percent of surveys in areas within the Sierra Nevada portion of the population, or 5 percent within the Coastal-Southern California portion of the province.

Northern spotted owl range

Under this alternative, a maximum of approximately 18,500 barred owls could be removed during the first year of management across the range of the northern spotted owl. This assumes that management would be implemented immediately to the maximum extent described in the alternative. This represents the maximum number of barred owls that would be removed if funding and staffing were available. An average of about 13,795 barred owls would be removed per year for the 30-year duration of the analysis (Table 3-11). This would represent approximately 18 percent of the estimated starting population of barred owls in the range of the northern spotted owl and less than one percent of the estimated global barred owl population. Barred owls would be removed from 20 percent of the forest lands within the range of the northern spotted owl, leaving untouched 80 percent of the forest land in this region. The largest percentage of habitat under management would be in the Olympic Peninsula, at 44 percent, leaving 56 percent of the forest land in this province unmanaged. This would represent barred owl removal from approximately 0.6 percent of the range of the barred owl in North America.

Table 3-11. Alternative 4. Percentage of forest lands under barred owl management, the number of barred owls removed the first year, and the average annual number of barred owls removed by decade.

Physiographic Province	Maximum Percent of the Forest Lands Managed	Maximum Number of Barred Owls Removed	
		First Year	Annual Average
Olympic Peninsula	44	3,113	2,114
Western Washington Cascades	12	1,703	1,157
Eastern Washington Cascades	26	1,329	2,114
Oregon Coast Ranges	31	4,486	547
Western Oregon Cascades	19	3,311	2,249
Eastern Oregon Cascades	33	1,734	1,177
Oregon Klamath	21	830	342
California Coast	17	692	470
California Klamath	14	853	580
California Cascades	23	482	470
TOTAL	20	18,537	13,795

Alternative 4 would result in the removal of barred owls from up to 20 percent of the northern spotted owl range over the 30 years of the analysis. Barred owls would remain untouched on approximately 80 percent of the northern spotted owl range. Removal areas would occur across the entire northern spotted owl range. This alternative would result in a relatively low impact on barred owl populations in the west, as compared to the other action alternatives. The number of barred owls removed under Alternative 4 implementation in the northern spotted owl range would represent less than one percent of the global barred owl population and would not have a significant effect on global barred owl populations.

California spotted owl range

Under Alternative 4, barred owl management in the Sierra Nevada would be delayed until barred owl detections reached 10 percent in local areas and 5 percent within the Coastal-Southern California portion of the province. This not only increases the population in the area, but young

produced in these areas would likely move into neighboring areas, leading to the establishment of new populations that themselves reach the threshold for removal. This alternative could lead to a cascade of population creation and removal, with increasing numbers of local populations reaching the threshold level over time.

Based on barred owl removal research, in recently invaded areas, we anticipate that once barred owl management commences, 95 percent of the territorial barred owls can be removed each year, and that over two years, the majority of the established populations would be removed. While removal would be episodic under this approach, it would likely result in a larger total number of barred owls removed per land area. Invading barred owls that would have been removed under steady removal pressure in the preferred alternative would remain until populations reached the threshold and developed into reproducing populations. Young produced within the population would add to the population's growth.

Barred owl populations have a high potential growth rate, as demonstrated by an increase in barred owl occupancy by a factor of 2.6 over one year in a northern Sierra Nevada population that was close to the 10 percent detection threshold we apply in this alternative (Wood et al 2020, p. 4). Therefore, by allowing populations to establish and grow would result in an increase in barred owls.

While removal would be episodic under this approach, it could result in a large total number of barred owls removed per land area. To account for the increase in population under this alternative, we multiplied the number of barred owls removed each year by 2.5. Therefore, we have a starting removal of 75 barred owls per year during removal.

Based on the analysis approach described in Section 3.3.1, this would result in the potential removal of approximately 10,237 barred owls over 30 years. Due to increasing rates of invasion, this is not evenly distributed (Table 3-12).

Table 3-12. Alternative 4. The estimated maximum number of barred owls removed by year, and the average annual number of barred owls removed by decade.

California Spotted Owl Population	Maximum Number of Barred Owls Removed per Year, by Decade			Maximum Number of Barred Owls Removed per Decade			Total
	1	2	3	1	2	3	
Sierra Nevada	75	165	638	750	1,650	6,375	8,775
Coastal-Southern California	12	28	106	125	275	1,062	1,462
Total	87	193	744	875	1,925	7,437	10,237

Alternative 4 would result in the removal of barred owls across the full range of the California spotted owl once threshold levels of barred owls are reached. While the total area under management would be similar to Alternative 2, by delaying and allowing self-sustaining barred owl populations to establish, this alternative would result in the highest number of barred owls removed. However though higher, this would still be a relatively low number of barred owls removed in comparison to populations in the West. Given the relatively low number of barred owls removed (up to 744 annually and a total of 10,237 over 30 years) in comparison to populations in the West (over 100,000), this Alternative would not have a significant effect on barred owl populations in the West. Alternative 4 implementation in the California spotted owl range would not have a significant effect on global barred owl populations.

3.3.8 Alternative 5 – Management Focused on Highest Risk Areas

Alternative 5 would focus barred owl management only in the northern portion of the northern spotted owl range, where the subspecies is at greatest risk of extirpation from barred owl competition. Management could be conducted on 100 percent of two GMAs in the Eastern Washington Cascades, Western Washington Cascades, Eastern Oregon Cascades, Western Oregon Cascades, and Oregon Coast Ranges Physiographic Provinces and one GMA in the Olympic Peninsula Physiographic Province. In the California spotted owl range, under this alternative, barred owl management would be limited to the northern Sierra Nevada portion of the subspecies range.

Northern spotted owl range

Under this alternative, a maximum of approximately 24,100 barred owls could be removed during the first year of management across the range of the northern spotted owl. This assumes that management would be implemented immediately to the maximum extent described in the alternative. This represents the maximum number of barred owls that would be removed if funding and staffing were available. An average of 15,550 barred owls would be removed per year for the 30-year duration of the analysis (Table 3-13). This would represent approximately 15 percent of the estimated starting population of barred owls in the range of the northern spotted owl and less than one percent of the estimated global population of barred owls. Barred owls would be removed from 23 percent of the forest lands within the range of the northern spotted owl, leaving untouched 77 percent of the forest land in this region. The largest percentage of habitat under management would be in the Oregon Coast Ranges, at 52 percent, leaving 48

percent of the forest land in this province unmanaged. This would represent barred owl removal from approximately 0.7 percent of the range of the barred owl in North America.

Table 3-13. Alternative 5. Percentage of forest lands under barred owl management, the number of barred owls removed the first year, and the average annual number of barred owls removed by decade.

Physiographic Province	Maximum Percent of the Forest Lands Managed	Maximum Number of Barred Owls Removed	
		First Year	Annual Average
Olympic Peninsula	44	3,113	2,114
Western Washington Cascades	33	4,569	3,102
Eastern Washington Cascades	37	1,879	773
Oregon Coast Ranges	52	7,382	5,012
Western Oregon Cascades	35	5,962	4,048
Eastern Oregon Cascades	48	1,215	500
Oregon Klamath	0	0	0
California Coast	0	0	0
California Klamath	0	0	0
California Cascades	0	0	0
TOTAL	23	24,121	15,550

Alternative 5 would result in the removal of barred owls from up to 23 percent of the northern spotted owl range over the 30 years of the analysis, focused on the northern portion of the range. The area under removal by province would vary from 33 to 52 percent. Thus, barred owls would remain untouched on approximately 77 percent of the northern spotted owl range, with a strong focus on the southern provinces. However, even in the northern province with the greatest intensity of barred owl removal, 48 percent of the area would have no barred owl removal. This alternative would result in an intermediate impact on barred owl populations in the West, as compared to the other action alternatives. The number of barred owls removed under Alternative 5 implementation in the northern spotted owl range would represent less than one percent of the global barred owl population and would not have a significant effect on global barred owl populations.

California spotted owl range

Under Alternative 5, we anticipate barred owls would continue to be detected as they settle and become territorial within the northern Sierra Nevada. Additional monitoring, focused on the northern portion of the Sierra Nevada, the most likely invasion source, would be initiated. Removals would be limited to the northern Sierra Nevada.

The barred owl invasion and removal is not evenly distributed across the Sierra Nevada. The northern Sierra Nevada, being closer to the source population in the northern spotted owl range, is likely to continue to receive the bulk of the invading barred owls. This was the location of the first barred owl population detected in the California spotted owl range, and we anticipate this could occur again. A barred owl removal experiment conducted in the Sierra Nevada between 2018 and 2020 resulted in the removal of 76 barred owls, of which 65 (85 percent) were removed

in the northern area (Hofstadter 2022). Therefore, under this alternative, we assumed barred owl removal levels at 85% of those from Alternative 2, where management occurred across the Sierra Nevada.

Based on the analysis approach described in Section 3.3.1, this would result in the potential removal of approximately 1,684 barred owls over 30 years (Table 3-14).

Table 3-14. Alternative 5. The estimated maximum number of barred owls removed by year, and the average annual number of barred owls removed by decade.

California Spotted Owl Population	Maximum Number of Barred Owls Removed per Year, by Decade			Maximum Number of Barred Owls Removed per Decade			Total
	1	2	3	1	2	3	
Sierra Nevada	26	56	87	256	561	867	1,684

Alternative 5 would limit the removal of barred owls to the Sierra Nevada portion of the range of the California spotted owl. This alternative would have the lowest acreage under management, and result in the lowest number of barred owls removed. However, in doing so this would allow for populations to become established in portions of the Sierra Nevada and in the Coastal-Southern California portion of the California spotted owl range. Given the low number of barred owls removed (up to 87 annually and a total of 1,684 over 30 years) in comparison to populations in the West (over 100,000), this Alternative would not have a significant effect on barred owl populations in the West. Alternative 5 implementation in the California spotted owl range would not have a significant effect on global barred owl populations.

3.3.9 Alternative 6 - Management Focused on Best Conditions

Alternative 6 would focus barred owl management in the southern portion of the northern spotted owl range, where spotted owl populations have not decreased to the degree they have in the north. Management could occur on up to 75 percent of each GMA in the Oregon Klamath, California Coast, California Klamath, and California Cascades provinces. In the California spotted owl range, under this alternative, barred owl management would be focused on areas with the best remaining habitat and areas with higher fire resiliency, including 50 percent of the Sierra Nevada portion of the range with the best remaining habitat, and the 75 percent of the Coastal-Southern California portion of the range.

Northern spotted owl range

Under this alternative, a maximum of approximately 10,400 barred owls could be removed during the first year of management across the range of the northern spotted owl. This assumes that management would be implemented immediately to the maximum extent described in the alternative. This represents the maximum number of barred owls removed if funding and staffing were to be available. An average of about 6,750 barred owls would be removed per year for the 30-year duration of the analysis (Table 3-15). This would represent approximately seven percent of the estimated starting population of barred owls in the range of the northern spotted owl and less than one percent of the estimated global population of barred owls. Barred owls would be removed from 17 percent of the forest lands within the range of the northern spotted owl, leaving

untouched 83 percent of the forest land in this region. The largest percentage of habitat under management would be in the California Klamath, at 68 percent, leaving 32 percent of the forest land in this province unmanaged. This would represent barred owl removal from approximately 0.5 percent of the range of the barred owl in North America.

Table 3-15. Alternative 6. Percentage of forest lands under barred owl management, the number of barred owls removed the first year, and the average annual number of barred owls removed by decade.

Physiographic Province	Maximum Percent of the Forest Lands Managed	Maximum Number of Barred Owls Removed	
		First Year	Annual Average
Olympic Peninsula	0	0	0
Western Washington Cascades	0	0	0
Eastern Washington Cascades	0	0	0
Oregon Coast Ranges	0	0	0
Western Oregon Cascades	0	0	0
Eastern Oregon Cascades	0	0	0
Oregon Klamath	40	3,325	2,258
California Coast	47	1,954	1,327
California Klamath	68	4,021	2,730
California Cascades	50	1,054	434
TOTAL	17	10,354	6,748

Alternative 6 would result in the removal of barred owls from up to 17 percent of the northern spotted owl range over the 30 years of the analysis, focused on the southern portion of the range. The area under removal by province would vary from 40 to 68 percent of the individual provinces. Thus, barred owls would remain untouched on approximately 83 percent of the northern spotted owl range, with a strong focus on the northern provinces. However, even in the southern province with the greatest intensity of barred owl removal, 32 percent of the area would have no barred owl removal. This alternative would result in the lowest impact on barred owl populations in the west, as compared to the other action alternatives. The number of barred owls removed under Alternative 6 implementation in the northern spotted owl range would represent less than one percent of the global barred owl population and would not have a significant effect on global barred owl populations.

California spotted owl range

Under Alternative 6, barred owl management would occur on 50 percent of the Sierra Nevada portion of the range and the 75 percent of the Coastal-Southern California portion of the range. This would leave 25 to 50 percent of the range unmanaged, where barred owls could establish populations. As in Alternative 3, we anticipate that the presence of reproductive barred owls would increase the potential rate of invasion of the managed areas because the presence of nearby breeding barred owls reduces the dispersal distance required for invading individuals. To account for this potential increase in invasion, we anticipate an increase in the number of barred owls that would settle and be removed under management by 50 percent in the Sierra Nevada and 25 percent in Coastal-Southern California. Based on the analysis approach described in

Section 3.3.1, this would result in the potential removal of approximately 3,380 barred owls over 30 years (Table 3-16).

Table 3-16. Alternative 6. The estimated maximum number of barred owls removed by year, and the average annual number of barred owls removed by decade.

California Spotted Owl Population	Maximum Number of Barred Owls Removed per Year, by Decade			Maximum Number of Barred Owls Removed per Decade			Total
	1	2	3	1	2	3	
Sierra Nevada	45	99	153	450	990	1,530	2,970
Coastal-Southern California	6	14	21	60	140	210	410
Total	51	113	174	510	1130	1,740	3,380

Alternative 6 would limit the removal of barred owls to 50 percent of the Sierra Nevada portion of the range of the California spotted owl and 75 percent of the Coastal-Southern California portion of the range. This alternative would have the lowest acreage under management, and would result in an intermediate number of barred owls removed as compared to the other action alternatives. However, in doing so this would allow for populations to become established in portions of the Sierra Nevada and in the Coastal-Southern California portion of the California spotted owl range. Given the relatively low number of barred owls removed (up to 174 annually, and 3,380 over 30 years) in comparison to populations in the West (approximately 100,000), this Alternative would not have a significant effect on barred owl populations in the West. Alternative 6 implementation in the California spotted owl range would not have a significant effect on global barred owl populations.

3.3.10. Summary of effects of the alternatives on barred owls

Alternative 1 – no action, would have no significant effect on barred owl populations. All the action alternatives would have some level of adverse effect on barred owls through the removal of barred owls from management areas.

In the northern spotted owl range, Alternative 3 would have the greatest adverse impact on barred owl populations due to the large area under removal activities. Alternative 6 would have the lowest adverse effect because barred owl removal would be focused in the southern portion of the northern spotted owl range, which has the lowest density of barred owls at this time, resulting in fewer barred owls being removed per area. However, this alternative would result in no removal in the northern two thirds of the northern spotted owl range, and would have no significant effect on barred owls in those areas. Both Alternatives 5 and 6 would leave large areas of the northern spotted owl range without barred owl management.

In the California spotted owl range, Alternative 4 would result in the most barred owls removed, but would also allow for the establishment of barred owl populations. The increase in barred owls would result in more barred owls being removed once management intervention begins. Alternative 5 would result in the lowest number of barred owls removed due to the limitation of removal to a portion of the northern Sierra Nevada area. However, outside of this area, barred

owls would potentially establish populations, and could offset the effect of removals in the north (Table 3-17).

Table 3-17. Comparison of effects of the alternatives on barred owls.

	Alternative 1 – No Action	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6
Northern Spotted Owl						
Percent of the forest managed	0	26-33	50	20	23	17
Number of barred owls removed in year 1	0	20,192	46,036	18,537	24,121	10,354
Average annual number of barred owls removed over three decades	0	13,397 – 17,390	29,948	13,795	15,550	6,748
Distribution across range	None	Entire	Entire plus buffer	Entire	North only	South only
California Spotted Owl						
Maximum number of barred owls removed total	0	2,550	3,465	10,237	1,684	3,380
Percentage of Range under management	0	100	100 plus buffer	100	56	50-75
Distribution across range	None	Entire	Entire plus buffer	Entire	Sierra Nevada only	Entire

3.4 Northern and California Spotted Owls

Our discussion of the effects of the management of barred owls on spotted owls is, as for other sections, focused on the range of the northern and California spotted owls where barred owls also occur, and adjacent areas described for management. For each alternative we describe the anticipated effects to spotted owls, including the overall effects to northern and California spotted owl populations at the provincial, regional, and range-wide scales.

3.4.1 Background and Analytical Methods

For the purpose of this analysis, and to effectively illuminate differences in the outcomes under the alternatives, we assumed that management would begin immediately, be implemented to the maximum extent described in each alternative and continue for 30 years. This represents two lifespans of spotted owls and allows time to predict and analyze differences between alternatives.

As a result of differences in the available data and condition of northern and California owl populations, we used a different analysis approach for each species.

Northern spotted owl

To estimate the current population of spotted owls in each province, we used an estimate of the carrying capacity for spotted owls based on the habitat condition within the province, and the occupancy of potential sites based on the occupancy levels from the long-term demographic studies. For the purpose of the carrying capacity analysis below, northern spotted owl habitat condition was represented by the 2023 Northern Spotted Owl Habitat GIS layer (Davis et al. 2023b). This mapping of habitat uses methods described by Glenn and others (2017) to identify areas that could support territorial northern spotted owl pairs, based on the amount of nearby nesting and roosting forest cover (as represented by the 2023 Cover Type Suitability GIS layer (Davis et al. 2023a)), topographic position, and other landscape features (see Davis et al. 2022 for more information). The occupancy levels were analyzed as of 2018, and we extrapolated the results to 2023 (Yakulic pers. comm. 2023). These data are focused on pair occupancy. The results are shown in Table 3-18 and represent the starting population for estimates of the effects of the alternatives.

Table 3-18. Estimated number of spotted owl pairs by province in 2023.

Physiographic Province	Estimated Average Carrying Capacity - Pairs	Estimated Percent of Sites Occupied by Spotted Owl Pairs	Estimated Number of Spotted Owl Pairs
Olympic Peninsula	554	7	41
Western Washington Cascades	1,073	6	66
Eastern Washington Cascades	484	4	19
Oregon Coast Ranges	1,777	9	160
Western Oregon Cascades	1,897	19	367
Eastern Oregon Cascades	415	17	69
Oregon Klamath	1,989	13	261
California Coast	5,469	29	1,587
California Klamath	2,931	32	938
California Cascades	389	17	65
TOTAL			3,573

To estimate the northern spotted owl population trend in the absence of barred owl management we used the above starting populations and extrapolated the 5.3 percent annual population decline over the 30 years of the analysis based on the most recent population trend data from the spotted owl demography analysis (Franklin et al. 2021, entire). This was applied to Alternative 1 – no action, and the unmanaged portions of the action alternatives.

Under the action alternatives, barred owl management would reduce barred owl populations in at least some areas, thereby creating areas with significantly lower barred owl populations and creating some barred-owl free forested areas. As barred-owl free habitat became available, we

anticipate that spotted owls would recolonize some of these sites. Although the data are limited, past removal experiments demonstrate such recolonization. Therefore, the Service considers the weight of evidence sufficient to assume this would occur at some level on a range-wide scale.

The first barred owl removal experiment in the northern spotted owl range occurred on Green Diamond lands in northern California from 2009 through 2013 (Diller et al 2016, entire). At the time, this study area was at the front of the barred owl invasion. Following barred owl removal, the spotted owl population trend on these lands changed from declining to increasing on the treatment area where barred owls were removed, while continuing to decline on the control area where barred owls were not removed. This included the reoccupancy of seven sites from which spotted owls had been excluded by barred owls, four of which were reoccupied by the original resident spotted owls. Removal studies in the Sierra Nevada in 2018 through 2020 also found substantial response from California spotted owls, with spotted owls recolonizing 56 percent of the formerly occupied territories within one year (Hofstadter et al. 2022). This was also early in the invasion process.

The Barred Owl Removal Experiment, conducted on four study areas in Washington, Oregon, and northern California, provides insight into the response to barred owl removal in areas with a longer history and higher density of barred owl populations. Barred owl removal occurred between 2013 and 2020, with between four and eight years of removal depending on the study areas. Removal of barred owls had a strong, positive effect on survival of sympatric spotted owls and a weaker, though still positive effect on spotted owl dispersal and recruitment. The estimated mean annual rate of population change for spotted owls stabilized in areas with removals (0.2% decline per year), but continued to decline sharply in areas without removals (12.1% decline per year) (Wiens et al. 2021, p. 5).

Barred owl removal studies on the Hoopa Reservation started in 2013 as part of the Barred Owl Removal Experiment and continued through 2023, representing the longest running barred owl removal study. Over the 10 years, an increase in apparent survival and a stabilization of recruitment resulted in a gradual increase in the number of confirmed pairs of spotted owls at Hoopa (Higley 2023, p. 9). Immediately after initiation of barred owl removal, apparent survival of spotted owls quickly rebounded to pre-barred owl levels. The population trend quickly reached near-stability (Higley 2023, p. 36), and the minimum known survival of juveniles has also rebounded to earlier levels following several years (2010-2013) when it was zero (Higley 2022, p. 14)

Based on the above results, we developed the following approach to analyzing the potential response of northern spotted owls to barred owl removal on management areas.

In areas where the barred owl invasion is just beginning, and barred owls have not affected spotted owl populations to a detectable level, no change in past spotted owl trends is anticipated on areas under management. Areas outside of management areas would begin or intensify declines as barred owl populations increase. For the northern spotted owl range, this is limited to Marin and Sonoma counties. This applies across the California spotted owl range.

In areas where declines related to barred owls are documented, but are relatively recent occurrences, we would expect effects similar to those observed in the Green Diamond (Diller et al. 2016) and Sierra Nevada (Hofstadter et al. 2022) studies. With barred owl removal, we would anticipate a strong immediate response from spotted owls, and continuation of this response until the remaining displaced spotted owls resettled. This would be followed by a slower population increase driven by reproduction and colonization by young produced, until carrying capacity was reached. Unfortunately, areas where we would anticipate this response represent a relatively small portion of the northern spotted owl range. Based on the Green Diamond results, we would anticipate a one percent increase in the population on management areas once the remaining displaced spotted owls had resettled, until the population reached 80 percent of full occupancy.

In the majority of the range of the northern spotted owl, where barred owl populations have been well established for many years, we would anticipate a slower spotted owl population response to barred owl management. This would be due to a lack of displaced adults to return to cleared sites due to natural mortality, and the small population available to produce young. Based on past results, we considered potential population estimates based on population “growth” rate of -0.2 percent, +0.5 percent, and +1 percent annually. The first would represent a substantial improvement on the current rate of population decline, but would still result in a declining population, while the second and third would represent a range of potential positive growth rates. Note that for very small populations, stochastic and random events and the fortunes of the remaining individuals are more likely to affect these results, which could result in more rapid growth, sudden extirpation, or anything in between.

We made all calculations using the estimated starting population in the province described above and projecting the population trend over the 30 years of the analysis. In doing this, we assumed the maximum level of management under the alternative, continued for the full 30 years, allowing for comparison between alternatives. For the analysis, we used the acres of suitable spotted owl habitat within the management areas of each province to estimate the percentage of the population that would be managed (Table 3-19). “Suitable habitat” in this context refers to northern spotted owl nesting and roosting forest conditions, as modeled by the 2023 Cover Type Suitability GIS layer (Davis et al. 2023a). Suitable northern spotted owl habitat described in this document includes lands with suitable and highly-suitable nesting and roosting forest cover types as defined in Davis et al. (2022). We used this to calculate the starting population within the management areas of a province under each alternative.

For analysis of the effects of the alternatives on spotted owls, we chose the middle population change estimate, an annual increase of 0.5 percent. We chose this model of future population growth because it illustrates as a reasonable rate of population change that allows for comparison between alternatives. We caution against using it for other purposes, because spotted owl population models designed for other purposes would focus on other factors that could affect the population growth rates, which are not accounted for here.

Table 3-19. Acres of land and suitable spotted owl habitat by province.

Physiographic Province	Total Acres	Spotted Owl Suitable Habitat Acres
Olympic Peninsula	3,034,555	849,431
Western Washington Cascades	6,154,074	1,604,611
Eastern Washington Cascades	5,691,079	738,379
Oregon Coast Range Expanded	7,300,442	861,739
Western Oregon Cascades Expanded	7,840,576	2,302,374
Eastern Oregon Cascades	2,392,561	324,234
Oregon Klamath	4,003,341	1,306,674
California Coast	5,694,290	1,148,503
California Klamath	6,089,224	1,603,832
California Cascades	2,500,969	297,310
TOTAL	50,701,111	11,037,087

California spotted owl

As with the northern spotted owl, in areas where the barred owl invasion is just beginning, and barred owls have not affected spotted owl populations to a detectable level, no change in past spotted owl trends is anticipated on areas under management. This applies across the California spotted owl range. However, in areas outside of management areas, we anticipate that impacts on spotted owls would occur as barred owl population increase.

Because barred owls have not demonstrably impacted California spotted owl populations to date, with the exception of the northern Sierra Nevada population where barred owls were successfully removed, we do not have data to estimate population trends with and without barred owl management. Therefore, the analysis for California spotted owls is qualitative and based on area managed.

3.4.2 Affected Environment

As described in Chapter 1, northern spotted owls were listed as threatened in 1990. By 2004, the Service had identified competition from the invasive barred owl as a primary threat to northern spotted owl populations (USFWS 2004). The 2011 Revised Recovery Plan for the Northern Spotted Owl (USFWS 2011) recommended that we manage to reduce the negative effects of barred owls on northern spotted owls (Recovery Action 30) (USFWS 2011). In 2020, the Service determined that the northern spotted owl was warranted for listing as an endangered species.

Competition from barred owls has been widely identified as a primary cause of the continuing decline of northern spotted owls. Based on the recent demographic analysis, northern spotted owl populations in the northern half of the species' range have dropped by over 75 percent in two decades and spotted owl populations continue to decline across their range (Franklin et al. 2021). Without management of barred owls, extirpation of northern spotted owls from major portions of their historical range is likely in the near future (Franklin et al. 2021 p. 19, Hofstadter 2022, p. 1).

Barred owls have recently invaded the range of the California spotted owl. While their numbers are currently low, they are considered to be a threat affecting the current condition of California spotted owl populations in the northern Sierra Nevada, and they pose a significant risk in the future. In 2023, the Service proposed listing California spotted owl as threatened in the Sierra Nevada distinct population segment and endangered in the Coastal-Southern California distinct population segment. As part of this analysis, the Service 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 11619).

Given the different condition of northern and California spotted owls, we address the condition of each separately in the background and within the analysis of the effects of each alternative, as appropriate.

Northern spotted owls

Spotted owls are a species that is adapted to relatively stable environments with stable carrying capacities, and as such experience naturally slow population growth. They are slow to reproduce, with generally less than two young per breeding attempt; they do not breed every year; and young spotted owls have a very low survival rate during their first year.

The carrying capacity of forests within the range of the species has declined significantly over time due to the loss of habitat to human caused and natural events such as large wildfires. Most recently, competition from invasive barred owls has further limited the availability of habitat for spotted owls in the northern spotted owl range and threatens to do so in the California spotted owl range.

California spotted owls

California spotted owls are currently found throughout their known historical range, although there is evidence of a decrease in abundance in parts of the range including both the Sierra Nevada and Coastal-Southern California.

Population growth is variable throughout study areas in the Sierra Nevada population where data are available, with documented declines ranging from 31 to 50 percent in some study areas and increases of 25 percent in another. The only available demographic data for the Coastal-Southern California population is from the San Bernardino National Forest (88 FR 11600, 11611). A population decline of 9 percent was observed from 1987 to 1998 in this area, with more recent occupancy analyses showing further declines in population size and documented accelerating declines over the last 30 years, even though this is the study area that historically contained the largest number of California spotted owls. While barred owls have not reached this area and are not the cause of this decline, they would exacerbate this decline by adding additional stressors should they become established.

Barred owls have not demonstrably impacted California spotted owl populations to date, with the exception of the northern Sierra Nevada population. Barred owls were successfully removed

from this population under a removal experiment. We do not have data to estimate California spotted owl population trends with and without barred owl management, as we do for northern spotted owls. Therefore, the analysis for California spotted owls is qualitative and based on area managed.

3.4.3 Environmental Consequences

The following sections present the potential environmental effects of the no action alternative, proposed action, and alternatives on spotted owl populations. Methodologies and underlying data vary between the northern and California spotted owl ranges, therefore we address these separately for each of the action alternatives.

3.4.4 Alternative 1 – No Action

Under the no action alternative, the Strategy would not be completed or implemented, and the Service would not obtain a permit for comprehensive management of barred owls. Barred owls would continue to expand within the northern spotted owl range, further impacting spotted owl populations, and would invade the California spotted owl range. The impact of barred owls on northern and California spotted owls is substantially different at this time, due to the history and timing of the invasion. We have substantial data from the northern spotted owl range that allows us to estimate the potential population response of spotted owls. Our analysis for the California spotted owl range is qualitative (Table 3-20).

Northern spotted owls

The following represents the impact of no action on spotted owl populations over the 30 years of the analysis.

As displayed in Table 3-20, in the absence of barred owl management, the northern spotted owl would likely be extirpated from major portions of its range. Estimated populations below 10 pairs can be considered functionally extirpated. Populations below 20 pairs in an area as large as a province are at high risk of near-term extirpation. Only 2 of the 10 provinces would be left with more than 100 pairs following 30 years. Without management of barred owls, extirpation of northern spotted owls from major portions of their historical range would be likely in the near future. This concern has been echoed by numerous authors, including Franklin et al. 2021 (p. 19).

Table 3-20. Estimate of spotted owl population trend over 30 years under the no action alternative, based on population trends calculated for the northern spotted owl demography analysis.

Physiographic Province	Study Area Used for Rate of Change	Average Rate of Population Change, from Demography Studies	Estimated Number of Pairs in 2023	Number of Remaining Spotted Owl Pairs at Year		
				10	20	30
Olympic Peninsula	Olympic Peninsula	0.917	41	17	7	3
Western Washington Cascades	Rainier	0.943	66	37	20	11
Eastern Washington Cascades	Cle Elum	0.916	19	8	3	1
Oregon Coast Ranges	OR Coast Ranges	0.926	160	75	35	16
Western Oregon Cascades	H.J. Andrews	0.955	367	231	146	92
Eastern Oregon Cascades	Cascades	0.953	69	43	26	16
Oregon Klamath	Klamath	0.935	261	133	68	35
California Coast	Green Diamond Resources	0.947	1,587	921	534	310
California Klamath	NW California	0.971	938	698	520	387
California Cascades	Cascades	0.953	65	40	25	15
TOTAL			3,573	2,203	1,384	886

California spotted owls

Under the no action alternative, barred owls would continue to invade the range of the California spotted owl. Barred owl detections in the subspecies' range have continued to increase, though some of these have been removed as part of ongoing studies. Numbers of barred owls are currently relatively low in the Sierra Nevada, and none have been documented in the Coastal-Southern California portion of the subspecies' range. However, based on the history of invasion in the range of the northern spotted owl, where initial slow population growth was followed by rapid growth once barred owl populations reached a critical mass, we anticipate that the increase in barred owls would accelerate if barred owls were allowed to establish breeding populations. Once this happened, we anticipate that barred owls would displace California spotted owls and cause or exacerbate population declines. Therefore, barred owls are a significant threat to the persistence of California spotted owls, and we expect the magnitude of the threat would increase into the foreseeable future under the no action alternative.

3.4.5 Common to all action alternatives

We evaluated the potential for negative effects of barred owl removal methods on spotted owls. Barred owl removal involves the presence of one to three individuals, the broadcast of barred owl territorial calls, and the one to three discharges of a shotgun at a location adjacent to or within forested areas, spread across the landscape and separate in time.

The presence of small crews along roads and trails is a common occurrence and the removal efforts would not represent a substantial increase in such activity. Barred owls call frequently. The additional of broadcasts to attract barred owls would not substantially change the soundscape for spotted owls. Neither of these activities are likely to negatively affect spotted owls under any action alternative.

Even when they are nesting, spotted owls are not overly sensitive to the short duration, sharp, and occasional noise of the type created by the firing of shotguns for barred owl removal. To further reduce the potential for disturbing nesting spotted owls, removal would generally not occur within 300 yards of a known active spotted owl nest during the critical breeding period for northern spotted owls (March 1 to July 31, or as established locally). If spotted owls were detected in the immediate vicinity of barred owls, removal efforts for the barred owls would generally be postponed to a later date unless the barred owl could be “pulled” at least one-half mile away from the spotted owls. Spotted owls respond to barred owl calls in some cases, so we anticipate that spotted owls nesting near a potential barred owl removal location may respond, thereby engaging the requirement to avoid the spotted owls. Both of these markedly reduce the potential for barred owl removal to occur near spotted owl nests.

The limited duration of the noise (one to two shotgun discharges), widely scattered over time and space, coupled with the strong attenuation of sound over distance in the forest stand, lead us to conclude that any disturbance of spotted owls from barred owl removal would be very short term and highly unlikely to affect spotted owl survival and reproduction, even where it inadvertently occurs close to an active nest. Therefore, we do not anticipate any likely negative effects of the act of barred owl removal on spotted owls under any of the action alternatives.

3.4.6 Alternative 2 – Proposed Action – Strategy Implementation

Alternative 2 includes removal of barred owls from management areas across nine provinces in the range of the northern spotted owl. These include areas around all recently occupied and newly located spotted owl sites, management of portions of General Management Areas based on their priority rating, and management on portions of several Special Designated Areas (see Chapter 2.4. Maps 2-2, 2-3, and 2-4).

This proposed action would reduce the loss of access to available habitat related to competitive exclusion by barred owls, at least within management areas, allowing spotted owls to recolonize these areas and potentially improving the declining population trends (Table 3-21). At the edge of the invasion, where displaced spotted owls may remain, recolonization of the habitat may be rapid (Diller et al 2016, pp. 702-3; Hofstadter 2022, p. 4). However, in the majority of the

northern spotted owl range, where spotted owl populations are very low the ability of spotted owls to recolonize these sites is more limited.

In the range of the California spotted owls, all barred owls located on ongoing or future monitoring, inventory, or survey efforts would be removed as soon as practicable after detection across the range of the subspecies and in forest areas representing the potential invasion pathways into the range, including the northern Sierra Nevada area, forested areas in the Central Valley, the forested areas between the Coastal-Southern California population and the Sierra Nevada, and in the central coast near the border with the southern end of the California Coast province.

Table 3-21. Northern spotted owl population estimate under Alternative 2 – Proposed Action – Strategy Implementation, with 0.5 percent annual increase in spotted owl population in managed areas.

Physiographic Province	Estimated Number of Pairs in 2023	Number of Spotted Owl Pairs at Year		
		10	20	30
Olympic Peninsula	41	44	46	49
Western Washington Cascades	66	70	74	78
Eastern Washington Cascades	19	21	22	23
Oregon Coast Ranges	160	170	179	188
Western Oregon Cascades	367	392	412	433
Eastern Oregon Cascades	69	75	79	83
Oregon Klamath	261	278	292	307
California Coast	1,587	1,683	1,769	1,860
California Klamath	938	996	1,047	1,100
California Cascades	65	69	72	76
TOTAL	3,573	3,798	3,992	4,197

Northern spotted owls

Under Alternative 2, all occupied spotted owl sites are managed, whether through site management or within a management area. In all provinces and for all potential population trends, the spotted owl populations under Alternative 2 are higher than under Alternative 1, the no action, resulting in a beneficial effect to northern spotted owls.

California spotted owls

Under Alternative 2, barred owls would be continuously removed as they are located across the range of the subspecies and within the likely invasion pathways, thereby keeping barred owl population growth in check. This includes 22,022,018 acres of forested landscape where barred owls could settle. Increased monitoring in the invasion pathways and the Sierra Nevada and expansive inventory efforts in the Coastal-Southern California population would increase the likelihood of detecting invading barred owls before they can establish breeding populations within the range of the California spotted owl. Therefore, Alternative 2 would have a beneficial

effect on California spotted owls because it would prevent barred owls from causing or exacerbating California spotted owl population declines.

3.4.7 Alternative 3 – Management Across the Range

Alternative 3 would allow for barred owl management to be implemented anywhere within the range of the northern or California spotted owls or within 15 miles of the range of the subspecies (Map 2-6) on up to 50 percent of the area. For analysis purposes, we have assumed management would be distributed evenly across each of the physiographic provinces for the northern spotted owl range, and in the California spotted owl range, assumed the 50 percent would be focused largely on the northern portion of the Sierra Nevada. While total spotted owl populations would increase on the management areas, the overall effect within each province is a continuing, though slower, decline (Table 3-22).

Table 3-22. Northern spotted owl population estimate under Alternative 3, with 0.5 percent annual increase in spotted owl population in managed areas with the northern spotted owl range.

Physiographic Province	Estimated Number of Pairs in 2023	Managed and Unmanaged Areas	Number of Spotted Owl Pairs at Year			Province Total at Year 30
			10	20	30	
Olympic Peninsula	41	Unmanaged Area (50%)	9	4	2	26
		Managed Area	22	23	24	
Western Washington Cascades	66	Unmanaged Area (50%)	18	10	6	44
		Managed Area	35	36	38	
Eastern Washington Cascades	19	Unmanaged Area (50%)	4	2	1	12
		Managed Area	10	11	11	
Oregon Coast Ranges	160	Unmanaged Area (50%)	37	17	8	101
		Managed Area	84	89	93	
Western Oregon Cascades	367	Unmanaged Area (50%)	116	73	46	259
		Managed Area	193	203	213	
Eastern Oregon Cascades	69	Unmanaged Area (50%)	21	13	8	48
		Managed Area	36	38	40	
Oregon Klamath	261	Unmanaged Area (50%)	67	34	17	169
		Managed Area	137	144	152	
California Coast	1,587	Unmanaged Area (50%)	460	267	155	1,077
		Managed Area	834	877	922	
California Klamath	938	Unmanaged Area (50%)	349	260	193	738
		Managed Area	493	518	545	
California Cascades	65	Unmanaged Area (50%)	20	12	8	46
		Managed Area	34	36	38	
TOTAL	3,573		2,979	2,667	2,520	2,520

Northern spotted owls

Under Alternative 3, barred owls would be managed on 50 percent of the forest lands in each province plus the 15-mile buffer, leaving 50 percent unmanaged for barred owls. Because the 15-mile buffer is outside the range of the spotted owl subspecies, barred owl management in these areas would not directly lead to increases in the spotted owl population. It would reduce the number of barred owls available to recolonize management areas. Alternative 3 would result in an increase in spotted owl population on the management areas and would have a beneficial effect to northern spotted owls across their range.

California spotted owls

Under Alternative 3, barred owls would be continuously removed as they are located across the range of the subspecies, within the likely invasion pathways and anywhere within 15 miles of the subspecies' range. The addition of the 15-mile buffer of neighboring areas represents a relatively small but valuable reduction in the potential for barred owls to invade the California spotted owl range, adding 4,139,324 acres of forested lands to the potential management area. This would allow for detection and removal for barred owls that may invade along pathways not previously identified in Alternative 2. Alternative 3 would have a beneficial effect on California spotted owls because it would keep barred owl population growth in check, and prevent barred owls from causing or exacerbating California spotted owl population declines.

3.4.8 Alternative 4 – Limited Management by Province/Population

Alternative 4 would allow for barred owl management to be implemented across 100 percent of the highest priority GMA or other mapped area in each province within the range of the northern spotted owls (Map 2.7). Spotted owl populations would increase on the management areas but given the small portion of most provinces under management in this Alternative, the overall effect within each province is a continuing, though slower, decline (Table 3-23). In the California spotted owl range, barred owl management would be delayed until detections reached 10 percent of surveys in areas within the Sierra Nevada portion of the population, or 5 percent within the Coastal-Southern California portion of the province.

Northern spotted owls

Under Alternative 4, barred owls would be managed on the smallest area of the action alternatives, though this would be distributed across the range of the species. Spotted owl populations would increase on the management areas, resulting in at least one area of spotted owl population stability or improvement in each province. Alternative 4 would result in an increase in spotted owl population on the management area in each province and would have a beneficial effect to northern spotted owls across their range, though lower than in Alternatives 2 or 3.

Table 3-23. Northern spotted owl population estimate under Alternative 4, with 0.5 percent annual increase in spotted owl population in managed areas.

Physiographic Province	Estimated Number of Pairs in 2023	Managed and Unmanaged Areas	Number of Spotted Owl Pairs at Year			Province Total at Year 30
			10	20	30	
Olympic Peninsula	41	Unmanaged Area (21%)	4	2	1	39
		Managed Area	34	36	38	
Western Washington Cascades	66	Unmanaged Area (85%)	31	17	10	21
		Managed Area	10	11	11	
Eastern Washington Cascades	19	Unmanaged Area (63%)	5	2	1	9
		Managed Area	8	8	8	
Oregon Coast Ranges	160	Unmanaged Area (42%)	31	15	7	115
		Managed Area	98	103	108	
Western Oregon Cascades	367	Unmanaged Area (73%)	169	106	67	182
		Managed Area	104	110	115	
Eastern Oregon Cascades	69	Unmanaged Area (85%)	36	22	14	26
		Managed Area	11	11	12	
Oregon Klamath	261	Unmanaged Area (64%)	85	43	11	120
		Managed Area	99	104	109	
California Coast	1,587	Unmanaged Area (74%)	682	396	229	708
		Managed Area	434	456	479	
California Klamath	938	Unmanaged Area (71%)	496	369	275	591
		Managed Area	286	301	316	
California Cascades	65	Unmanaged Area (71%)	28	18	11	33
		Managed Area	20	21	22	
TOTAL	3,573		2,671	2,151	1,844	1,844

California spotted owls

Under alternative 4, barred owl management would be delayed until detections reached 10 percent of surveys in areas within the Sierra Nevada portion of the population, or 5 percent within the Coastal-Southern California portion of the province. This would allow breeding populations to be established, providing additional barred owl young to disperse and settle across the range of the subspecies. While removal of populations at this level can be very successful (Hofstadter et al, 2022), this still increases the potential impacts on spotted owls in the area that are displaced by barred owl prior to the population level reaching the threshold for barred owl management. This also increases the likelihood of increases in barred owl population throughout the range as additional populations are seeded by the young produced on sites before management begins.

While we have insufficient data to estimate a specific population level impact, this would substantially increase impacts to California spotted owl populations and risk further establishment of barred owls to a level where complete removal is no longer feasible. Alternative 4 would have a beneficial effect on California spotted owls by removing newly established barred owl populations in the California spotted owl range relatively early in their development. However, because it would allow for establishment of barred owl populations and an increase in barred owls within the subspecies range, it also would have an adverse effect, and could result in declines in California spotted owl population in the vicinity of the barred owl populations. The result would be a small overall adverse effect on California spotted owls.

3.4.9 Alternative 5 – Management Focused on Highest Risk Areas

Alternative 5 would focus barred owl management in the northern portion of the northern spotted owl range, where the subspecies is at greatest risk of extirpation from barred owl competition. Management could be conducted on 100 percent of two GMAs in the Eastern Washington Cascades, Western Washington Cascades, Eastern Oregon Cascades, Western Oregon Cascades, and Oregon Coast Ranges Physiographic Provinces and one GMA in the Olympic Peninsula Physiographic Province (Map 2-8). Spotted owl populations would increase on the management areas in the northern portion of the range, but given the relatively small portion of most provinces under management in this alternative, the overall effect within each northern province would be a continuing, though slower, rate of northern spotted owl population decline (Table 3-24). Because of the lack of management in the southern portion of the northern spotted owl range, spotted owl populations in these areas would continue to decline rapidly.

In the California spotted owl range, under this alternative, barred owl management would be limited to the northern Sierra Nevada portion of the subspecies range (32 percent of the range). This alternative would increase monitoring and immediate removal of all territorial barred owls in the most likely primary pathway for invading barred owls but would allow for barred owls across the rest of the range to settle and increase (Table 3-25).

Northern spotted owls

Under Alternative 5, barred owl management would be focused on the northern portion of the range, where spotted owls are at the highest risk of extirpation. No barred owl management or removal would occur in the southern portion of the range. Alternative 5 would be beneficial to spotted owls in the northern portion of their range by reducing the impact of barred owls in these areas, but an adverse effect on spotted owls in the southern four provinces. By allowing barred owls to continue to increase and expand in the Oregon Klamath and California portions of the northern spotted owl range, this alternative would increase the risk of decline in these populations. These are currently the areas where the northern spotted owl populations have the greatest remaining occupancy rates.

Table 3-24. Northern spotted owl population estimate under Alternative 5 in provinces with barred owl management, based on 0.5 percent annual increase in spotted owl population in managed areas.

Physiographic Province	Estimated Number of Pairs in 2023	Managed and Unmanaged Areas	Number of Spotted Owl Pairs at Year			Province Total at Year 30
			10	20	30	
Olympic Peninsula	41	Unmanaged Area (21%)	4	2	1	39
		Managed Area	34	36	38	
Western Washington Cascades	66	Unmanaged Area (56%)	20	11	6	40
		Managed Area	30	32	34	
Eastern Washington Cascades	19	Unmanaged Area (43%)	3	1	1	14
		Managed Area	12	12	13	
Oregon Coast Ranges	160	Unmanaged Area (27%)	20	9	4	140
		Managed Area	123	129	136	
Western Oregon Cascades	367	Unmanaged Area (53%)	123	77	49	250
		Managed Area	182	191	201	
Eastern Oregon Cascades	69	Unmanaged Area (61%)	26	16	10	41
		Managed Area	28	30	31	
TOTAL	722		605	546	524	524

Table 3-25. Northern spotted owl population estimate under Alternative 5 in provinces without barred owl management, using current average annual rate of population change.

Physiographic Province	Estimated Number of Pairs 2023	Average Annual Rate of Population Change	Number of Spotted Owl Pairs at Year			Province Total at Year 30
			10	20	30	
Oregon Klamath	261	0.935	133	68	35	35
California Coast	1,587	0.947	921	534	310	310
California Klamath	938	0.971	698	520	387	387
California Cascades	65	0.953	40	25	15	15
TOTAL	2,851		1,792	1,147	747	747

California spotted owls

Under Alternative 5, barred owl management would be limited to the northern Sierra Nevada portion of the subspecies range. Barred owls can disperse over very long distances and could move through the northern Sierra Nevada without being detected and removed, particularly since removal efforts work best on territorial barred owls. Dispersing barred owls do not respond to calls or approach, making removal unlikely. While the majority of barred owls removed under studies in the Sierra Nevada to date were within the northern Sierra Nevada management area, (66/76 barred owls, 85 percent) the remaining 15 percent were removed from areas south of the

management area. Therefore, Alternative 5 would have a beneficial effect on California spotted owl in the northern Sierra Nevada, but a potentially adverse effect in the remainder of the Sierra Nevada. We anticipate that barred owls would cause or exacerbate declines in California spotted owl populations in the central and southern portions of the Sierra Nevada.

There are currently no confirmed barred owls in the Coastal-Southern California portion of the range. We anticipate that over time, given the long-distance dispersal capability and continuing population increases to the north, barred owls would invade this area. Under Alternative 5, these barred owls would not be managed, resulting in adverse effects on California spotted owls in this area. We anticipate that eventually, unmanaged population growth of barred owls in the Coastal-Southern California would exacerbate population declines of California spotted owls in this area.

3.4.10 Alternative 6 – Management Focused on Best Conditions

Alternative 6 would focus barred owl management in the southern portion of the northern spotted owl range, where spotted owl populations have not decreased to the degree they have in the north. Management could occur on up to 75 percent of each GMAs in the Oregon Klamath, California Coast, California Klamath, and California Cascades provinces (Map 2.9). Spotted owl populations would increase on the management areas in the southern portion of the range, and given the relatively large area under barred owl management, the overall effect within each southern province is a substantial slowing of the rate of decline of northern spotted owl populations (Table 3-26). Because of the lack of management in the northern portion of the northern spotted owl range, spotted owl populations in these areas would continue to decline rapidly toward extirpation.

In the California spotted owl range, under this alternative, barred owl management would be focused on areas with the best remaining habitat and areas with higher fire resiliency, including 50 percent of the Sierra Nevada portion of the range with the best remaining habitat, and the 75 percent of the Coastal-Southern California portion of the range (Table 3-27).

Northern spotted owls

Under Alternative 6, barred owl management would be focused on the southern portion of the range, where spotted owls are lower immediate risk of extirpation. Barred owls would continue to expand in the northern portion of the range. This would result in an adverse effect on northern spotted owls in Washington and northern Oregon, and likely lead to extirpation of spotted owls in these areas in the near or intermediate term. In the southern portion of the range, Alternative 6 would have a positive effect on spotted owls by focusing barred owl removal in these areas, where spotted owl populations are likely to respond more quickly to barred owl management due to larger starting populations.

Table 3-26. Northern spotted owl population estimate under Alternative 6 in provinces with barred owl management, based on 0.5 percent annual increase in spotted owl population in managed areas.

Physiographic Province	Estimated Number of Pairs 2023	Managed and Unmanaged Areas	Number of Spotted Owl Pairs at Year			Province Total at Year 30
			10	20	30	
Oregon Klamath	261	Unmanaged Area (39%)	52	27	14	199
		Managed Area	167	176	185	
California Coast	1,587	Unmanaged Area (31%)	285	166	96	1,368
		Managed Area	1,151	1,210	1,272	
California Klamath	938	Unmanaged Area (31%)	216	161	120	871
		Managed Area	680	715	751	
California Cascades	65	Unmanaged Area (33%)	13	8	5	55
		Managed Area	45	48	50	
TOTAL	2,851		2,609	2,511	2,493	2,493

Table 3-27. Northern spotted owl population estimate under Alternative 6 in provinces without barred owl management, using current average annual rate of population change.

Physiographic Province	Estimated Number of Pairs 2023	Average Rate of Population Change	Number of Spotted Owl Pairs at Year			Province Total at Year 30
			10	20	30	
Olympic Peninsula	41	0.917	17	7	3	3
Western Washington Cascades	66	0.943	37	20	11	11
Eastern Washington Cascades	19	0.916	8	3	1	1
Oregon Coast Ranges	160	0.926	75	35	16	16
Western Oregon Cascades	367	0.955	231	146	92	92
Eastern Oregon Cascades	69	0.953	43	26	16	16
TOTAL	722		411	237	139	139

California spotted owls

Under Alternative 6, barred owl management would be limited to the 50 percent of the Sierra Nevada portion of the subspecies range and 75 percent of the Coastal-Southern California portion of the range. While we anticipate the implementing entities would choose the highest quality spotted owl areas, and the areas most likely to be invaded by barred owls, this still leaves 50 and 25 percent of each portion of the range, respectively, without management. Under this alternative, we anticipate barred owl population growth and population establishment would be slower than in Alternative 1, 4 or 5, but would be greater than in Alternatives 2 and 3. As a result, displacement by barred owls would cause or exacerbate California spotted owl population declines, but to a lesser degree than in Alternatives 1, 4, or 5. This would still result in a potential adverse effect to California spotted owls.

3.4.11 Summary of Effects to Spotted Owls

Alternative 1, the no action alternative, would have the greatest adverse effect on spotted owls and would result in the greatest decline in spotted owl populations for both subspecies.

Alternatives 2 through 4 include barred owl removal throughout the range of the northern spotted owls, while Alternatives 5 and 6 would only include removal in certain portions the range and thus contribute less to the recovery of northern spotted owls. Alternative 2 would better improve the survival and recovery of northern spotted owls than the other alternatives because it would result in the greatest increase in northern spotted owl populations, in part due to the focus on managing recently occupied sites in addition to management areas. Alternative 2 also has a beneficial effect on California spotted owls by inclusion of control areas intended to prevent or slow the southward invasion of barred owls. Alternative 3 would have the greatest area of barred owl removal, but lower benefits to on northern spotted owl populations than Alternative 2 due to the lack of focus on high priority areas. The added monitoring and removal in buffer areas would result in an increased beneficial effect on California spotted owls. Alternative 4 would have a substantially smaller, but still positive, effect on northern spotted owls than Alternative 2 due to the restriction of management with each province. Alternative 4 would have an adverse effect on California spotted owls by allowing barred owls to establish populations before removal effort are initiated.

Alternatives 5 and 6 would include no barred owl management in portions of the northern spotted owl range, leading to adverse effects in these areas, though beneficial effects in the areas where removal would occur. This would potentially result in the extirpation of northern spotted owls from large portions of their historical range. Alternative 5 would have an adverse effect on a large portion of the California spotted owl population because barred owl removal would be limited to the northern Sierra Nevada. Alternative 6 would have an overall adverse effect because not all areas are included, leaving room for barred owl populations to be established (Table 3-28).

Table 3-28. Comparison of effects of the alternatives on spotted owls.

	Alternative 1 – No Action	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6
Northern Spotted Owl						
Percent of the forest managed	0	26-33 plus site management	50	20	23	17
Range-wide number of spotted owl pairs at year 30	886	4,197	2,520	1,844	1,554	2,632
Distribution across range	None	Entire	Entire plus buffer	Entire	North only	South only
Effect	Adverse	Beneficial	Beneficial	Beneficial	Beneficial in north, adverse in south	Beneficial in south, adverse in north
California Spotted Owl						
Percentage of Range under management	0	100	100 plus buffer	100	56	50-75
Distribution across range	None	Entire	Entire plus buffer	Entire	Sierra Nevada only	Entire
Effect	Adverse	Beneficial	Beneficial	Beneficial and adverse, Small overall adverse	Beneficial in northern Sierra Nevada, adverse in remainder of the range	Adverse

3.5 Other Wildlife Species

Our discussion of the effects of the proposed management of barred owls for the conservation of spotted owls on other wildlife species is focused on the range of the northern and California spotted owls, and adjacent areas described for management. For each alternative, we considered the effects of barred owl removal and associated activities on other wildlife species that overlap with the action.

3.5.1 Background and Analytical Methods

For the purpose of this analysis, and to effectively illuminate differences in the outcomes under the alternatives, we assumed that management would begin immediately, be implemented to the maximum extent described in each alternative and continue for 30 years. This represents two lifespans of spotted and barred owls and allows time to predict and analyze differences between alternatives.

Sections 3.3 and 3.4 of this EIS describe effects to barred owls and northern spotted owls, respectively. Other wildlife species may be affected by the removal of barred owls in the treatment area in two ways: reduction of predation/competition and disturbance from the removal activities. Both effects are limited to the barred owl management areas. We focused particularly on species identified as at risk or sensitive under Feder and State law, as these are the species more likely to be significantly affected under the alternatives. In this chapter we refer to sensitive species, a term we use to encompass the variety of at-risk species in the study areas. This term includes various State and Federal designations such as threatened or endangered species, proposed species, candidate species, species of concern, special status species, and sensitive species.

For most species, we developed a general qualitative description of the potential impact of barred owl management. We focused species specific analyses on species already identified at risk with depressed or declining populations, using Federal and State lists to identify these species.

We developed a list of species designated as endangered, threatened, candidate, proposed, or other special status by Federal and State agencies. Using agency and internet databases, we compared the range and habitat of these species to the areas under potential barred owl management and eliminated species whose range or habitat did not overlap potential management of barred owl habitat.

We used the diet and effects data described below to estimate which of these species were most likely to be affected by barred owl predation or competition and therefore affected by their removal. Given the information on food habits, we conclude that any terrestrial forest species under 35 ounces, or any aquatic forest species that either uses shallows at some point in its life cycle or comes to the surface, are potential prey for barred owls.

The reduction of barred owl populations would reduce barred owl predation and competition in management areas for the duration of management efforts. This would affect not only spotted owls, but many other wildlife species that are either potential prey or competitors of barred owls. We summarized the known and potential effects of barred owls on species other than spotted owls in the northwest, including both documented impacts and potential impacts based on food habits.

Species that are sensitive to human presence or noise may also be directly affected by the barred owl management. Management activities would involve the presence of individuals or small crews involved in surveying and removal. Surveys may involve traveling off roads or trails to place recording devices, or broadcasting conspecific calls as part of location or monitoring. Lethal removal involves the discharging a shotgun one to three times at a site,

potentially repeated once or twice a year. Broadcast calls may be detected by humans for some distance, but generally represent a “natural sound”. Shotgun discharge maybe detected over a mile away or more, depending on terrain and atmospheric conditions.

3.5.2 Affected Environment

Barred owls are generalist predators and opportunistic hunters. While considered primarily nocturnal, they also hunt during the day (Mazur and James 2000, p. 5). Barred owls often hunt from perches, waiting to pounce on potential prey. They have been known to perch over water to catch fish, or wade in shallow water for crayfish or fish and can hunt from the ground, running and pouncing on prey such as amphibians, and probably plunge into snow for small animals (Mazur and James 2000, p. 5).

Barred owls eat almost any species they encounter, including small mammals, birds, reptiles, amphibians, fish, earthworms, snails, slugs, insects, and crayfish (Baumbusch 2023, entire; Kryshak et al. 2022, entire, Hamer et al. 2001). They consume a wide variety of birds, including ducks, hawks, other owls, grouse, woodpeckers, and songbirds. The barred owl diet varies across the seasons, taking seasonal advantage of changes in available prey, with amphibians, reptiles, and invertebrates representing a large portion of their summer diet in some areas. A more detailed discussion of prey items can be found in Baumbusch 2023, Kryshak et al. 2022, and Wiens et al. 2014.

Because the impact of a new predator or competitor is likely to be more serious for species that are already reduced in abundance or at risk, we were particularly interested in any direct evidence of endangered, threatened, candidate, or sensitive species in the barred owl diet. For example, Graham (2011, unpubl. data), analyzed pellets containing 187 prey items collected from the BLM Siuslaw Field Office in Oregon, and from Olympic National Park in Washington. The pellets contained remnants of red tree vole. Baumbusch (2023, p. 23-25) also found red tree voles in the diet of barred owls in the Oregon Coast Ranges and the Oregon Klamath provinces. The North Oregon Coast Distinct Population of the red tree vole, located north of the Siuslaw River, is now a Federal candidate species under the ESA.

We also sought evidence of barred owl effects on other wildlife species populations. For example, between 1998 and 2002, western screech-owls disappeared from 22 locations in lower mainland British Columbia. The decline of screech owls was linked by timing to the barred owl expansion, predation by barred owls (Wiens et al. 2014), and competition for nest cavities and habitat loss (Elliott 2006, p. 8). Declines in screech owl detections coincide with an increase in barred owl detections in the results of 15 years of owl surveys from 1995 to 2010 on Bainbridge Island in Washington, west of Seattle. Barred owls were first detected on the island in 1993. In 1995, western screech-owls were detected at 11 locations on the island. By July 2008, 90 barred owls were detected. No screech owls have been detected since the 2008 to 2009 season (Acker 2012).

Wildlife Species Considered in this Analysis:

Any medium to small terrestrial forest species or any aquatic forest species that used shallows

at times may be potential prey for barred owl and any species that preys on these may compete with barred owls for their prey. While many species are at risk of predation from barred owls, for common species with large populations this predation generally does not represent a substantial risk to their populations at a regional scale. However, where densities of barred owl are very high, even relatively common species may be at some risk for local population effects (Baumbusch 2023, p. 29-31).

For rare or endemic species, or species with already depressed or declining populations, added competition with or predation by non-native barred owls may have significant effects. Therefore, we have concentrated our species-specific analysis of the effect of barred owl management to species listed as threatened or endangered under State or Federal law, and those identified as State or Federal candidate, proposed, species of concern, special status species, or sensitive species. We have limited this list to species that live in or pass through forest habitat (since species that do not use forests are less likely to be barred owl prey or competitors) and species that barred owls are likely to prey on or compete directly with (eliminating large mammals such as grizzly bears and plants).

Table 3-29 displays the Federal and State listed species that occur within the action area and may interact with barred owls. The status of the species provides some indication of its level of risk. That is, endangered species are likely at more risk than sensitive species. These effects may be negative (disturbance) or positive (removal of predation or competition from barred owls in treatment areas). For a more complete list of species of concern, see Appendix 7.

Not all of these species within the range of the northern and California spotted owls are likely to encounter barred owls. For example, river bottom dwellers or species found in large open spaces are not likely to come into contact with barred owl. We limited our list to species that occur in the forest environment and whose range overlaps our analysis area.

Table 3-29. List of Federal and State listed forest species that may be affected by barred owl management actions. Listing status E = endangered, T = threatened, C = candidate, PT = proposed threatened, PE = proposed endangered. For State status, S = species of concern or other designation. State designations nomenclature varies across the States, therefore, species of concern is a general category of species on various State lists that do not fit the above categories.

Species Common Name	Listing Status				Potential Interaction with Barred Owl	
	Federal	WA	OR	CA	Prey	Competitor
Mammals						
Canada Lynx <i>Lynd canadensis</i>	T	E	-	-		Yes
Cascade Red Fox <i>Vulpes vulpes cascadenis</i>	-	E	-	-		Yes
Fisher <i>Pekania pennanti</i>	E (in part)	E	S	T/S		Yes
Mazama Pocket Gopher <i>Thomomys mazama</i>	T	T	-	-	Yes	
Pacific (Humboldt) Marten <i>Martes caurina humboldtensis</i>	T (in part)	-	S	E		Yes
Point Arena Mountain Beaver <i>Aplodontia rufa nigra</i>	E	-	-	S	Yes	
Red Tree Vole <i>Arborimus longicaudus</i>	C	-	S	-	Yes	
Riparian Brush Rabbit <i>Sylvilagus bachmani riparius</i>	E	-	-	E	Yes	
Riparian Woodrat (=San Joaquin Valley) <i>Neotoma fuscipes riparia</i>	E	-	-	-	Yes	
Sierra Nevada Red Fox <i>Vulpes vulpes necator</i>	E	-	S	T		Yes
Western Grey Squirrel <i>Sciurus griseus</i>	-	T	S	-	Yes	
BIRDS						
Belding's Savannah Sparrow <i>Passerculus sandwichensis beldingi</i>	-	-	-	E	Yes	
Great Grey Owl <i>Strix nebulosa Yosemiteensis</i>	-	-	S	E		Yes
Little Willow Flycatcher <i>Empidonax traillii brewsteri</i>	-	-	-	E	Yes	
Marbled Murrelet <i>Brachyramphus marmoratus</i>	T	E	E	E	Yes	
Spotted Owl <i>Strix occidentalis</i>	T	E	T	T/S		Yes
Oregon Vesper Sparrow <i>Pooecetes gramineus affinis</i>	-	E	S	S	Yes	
Southwestern Willow Flycatcher <i>Empidonax traillii extimus</i>	T	-	-	E	Yes	

Species Common Name	Listing Status				Potential Interaction with Barred Owl	
	Federal	WA	OR	CA	Prey	Competitor
Western Yellow-billed Cuckoo <i>Coccyzus americanus</i>	T	E	-	E	Yes	
AMPHIBIANS AND REPTILES						
California Red-legged Frog <i>Rana draytonii</i>	T	-	-	S	Yes	
California Tiger Salamander <i>Ambystoma californiense</i>	E/T	-	-	T	Yes	
Foothill Yellow-legged Frog <i>Rana boylei</i>	PE/PT	S	S	E/T	Yes	
Kern Canyon Slender Salamander <i>Batrachoseps simatus</i>	PT	-	-	T	Yes	
Limestone Salamander <i>Hydromantes brunus</i>	-	-	-	T	Yes	
Mountain Yellow-legged Frog <i>Rana muscosa</i>	E	-	-	E	Yes	
Oregon Spotted Frog <i>Rana pretiosa</i>	T	S	S	S	Yes	
Relictual Slender Salamander <i>Batrachoseps relictus</i>	PE	-	-	S	Yes	
San Francisco Garter Snake <i>Thamnophis sirtalis tetrataenia</i>	E	-	-	E	Yes	
Southern Rubber Boa <i>Charina umbratica</i>	-	-	-	T	Yes	
Santa Cruz Long-toed Salamander <i>Ambystoma macrodactylum croceum</i>	E	-	-	E	Yes	
Scott Bar Salamander <i>Plethodon asupak</i>	-	-	-	T	Yes	
Shasta Salamander <i>Hydromantes shastae, H. samweli, H. wintu</i>	-	-	-	T	Yes	
Sierra Nevada Yellow-legged Frog <i>Rana sierrae</i>	E	-	-	T	Yes	
Siskiyou Mountains Salamander <i>Plethodon stormi</i>	-	-	S	T	Yes	
Western Pond Turtle <i>Actinemys marmorata</i>	-	E	S	S	Yes	
Yosemite Toad <i>Anaxyrus canorus</i>	T	-	-	S	Yes	
Fish						
Bull Trout DPSs <i>Salvelinus confluentus</i>	T	C	S	E	Yes	

Species Common Name	Listing Status				Potential Interaction with Barred Owl	
	Federal	WA	OR	CA	Prey	Competitor
Chinook Salmon DPSs <i>Oncorhynchus tshawytscha</i>	E/T	-	T	E/T	Yes	
Coho Salmon DPSs <i>Oncorhynchus kisutch</i>	E/T	-	E/S	E/T	Yes	
Eulachon <i>Thaleichthys pacificus</i>	T	-	-	-	Yes	
Lahontan Cutthroat Trout <i>Oncorhynchus clarkii henshawi</i>	T	-	T	-	Yes	
Little Kern Golden Trout <i>Oncorhynchus aguabonita whitei</i>	T	-	-	-	Yes	
Paiute Cutthroat Trout <i>Oncorhynchus clarkii seleniris</i>	T	-	-	-	Yes	
Steelhead DPSs <i>Oncorhynchus mykiss irideus</i>	E/T	C	S	E/CE	Yes	
Invertebrates						
California Freshwater Shrimp <i>Syncaris pacifica</i>	E	-	-	-	Yes	
Trinity Bristle Snail <i>Monadenia infumata setosa</i>	-	-	-	T	Yes	

3.5.3 Environmental Consequences

We evaluated the potential for disturbance to significantly impact species, focusing on the noise from lethal removal of barred owls as having the greatest potential for affecting species. The short duration of the sound, coupled with long periods between potential removals, reduces the potential for disturbance to impact species. However, individuals of very sensitive species may still be affected at this level of disturbance.

The action alternatives all have two potential effects on species other than barred and northern spotted owls: the effects from the removal of barred owls on the species' populations and the direct effects of the removal activities, primarily related to disturbance.

In barred owl management areas, the reduction of barred owl populations to lower levels could positively affect prey species or species with which barred owls compete for prey, habitat, or space. It could reduce pressure on barred owl prey species (small vertebrates and invertebrates) and reduce competition with other predators of small vertebrates and invertebrates (e.g., owls, hawks, raccoons, and American marten) as long as management continues. In areas where barred owl populations are not yet established, barred owl management would prevent negative effects on potential prey and competitor species. We have focused our analysis of effects on species already at risk or with reduced populations, where the reduction in predation or competition has the greatest potential impact on the overall population health.

Effects on Prey

We examined existing food habit data to identify if any of the Federally listed, candidate, or sensitive species have been documented as barred owl prey. Remains of 147 red tree voles were found in samples, representing 1.8 percent of prey biomass in a Eugene BLM barred owl diet study (Graham 2011, unpubl. data) and tree voles were a component of the diet of barred owls in the Oregon Coast Ranges and Oregon Klamath study areas (Baumbusch 2023, p. 23-25). Kryshak et al. (2022, p. 7) did not detect any listed species, but noted that such species were by their nature rare and easily missed with samples representing limited geography and a single day of diet information. They did find evidence of significant predation of amphibians indicating a potential risk to threatened or endangered amphibians. Failure to detect a species in current barred owl food habit studies does not indicate that they are not taken on occasion as opportunity allows, only that they are not a primary food item in the areas where the studies have been conducted. For endangered or threatened species, even opportunistic predation may be of substantial concern.

Some species found in prey studies may indicate that similar endangered, threatened, proposed, candidate, or sensitive species are also likely prey. For example, the Pacific sideband snail, which was found in the barred owl diet study, is similar to the Trinity bristle snail, listed as threatened in the State of California and found within barred owl study areas. Some species appear to be vulnerable though we have no hard evidence they are barred owl prey. While marbled murrelets have not been found in barred owl prey studies, young marbled murrelets are likely vulnerable to opportunistic predation while in the nest. Adult murrelets may also be vulnerable if caught while incubating eggs or brooding young. Marbled murrelet nesting habitat is also barred owl habitat, making an encounter likely.

Species which are documented as prey or potential prey for barred owls may experience a positive effect of reduced predation on the treatment areas as long as management continues. In areas where barred owl populations are not yet established, potential prey species would not experience reductions in their populations as a result of barred owl invasion, because management would prevent the establishment of barred owl populations.

Disturbance from Surveys

The potential for direct disturbance effects from barred owl removal depends on the type and intensity of the activity and the sensitivity of the species. Surveys for spotted and barred owls involve the presence of surveyors in vehicles along roads and walking on trails, or off trail for survey work. These are activities similar to those that normally occur within forest landscapes, so we do not anticipate this activity would result in an increasing background level of human presence. This portion of the activity has no significant effect on other wildlife species.

Some surveys and most removals would involve using recorded barred owls calls at survey points to locate barred owls. If members of a species are very sensitive to, and disturbed by, the sound of barred owls, this could elicit a reaction. However, only a few surveys would be conducted each year in any location. Thus, exposure to this activity is very low. In addition, areas targeted for management are those where barred owl presence has already been detected,

likely via barred owl calls. Animals in these areas are likely already used to hearing barred owl calls on a more regular basis than the surveys. Therefore, surveys would not likely increase the background level of calling significantly, and we anticipate no significant effect of calling surveys on other wildlife species. This leaves the effects of removal itself.

Lethal removal involves the presence of an individual or small crew at the site for a short period (15 minutes to 1 hour) and the sound of gunshots. Many of the areas designated for removal are generally open for human use, whether by the landowner or the public, so the presence of a small crew is within the normal background activity. Therefore, we do not anticipate effects from the crew's presence.

Disturbance from Removal

Removal of barred owls involves one to three gunshots. The shots would be separated by a few minutes or days, depending on whether both members of the barred owl pair are removed in a single visit. The sound of gunshots is loud, but short. A 12-gauge shotgun has a noise level of about 150 decibels at the site of the shot, which attenuates with distance. The distance at which the sound reaches background levels can be further affected by steep slopes, ridges, and dense vegetation, all of which increase the rate of attenuation. Most barred owl removal would be conducted from roads or trails in heavily forested landscapes, leading to greater attenuation of the sound of the shot. Because of the instantaneous nature of a gunshot, and variables such as topography, ground cover, forest density, background ambient noise levels, and many other factors, it is difficult to generalize the distance at which the noise from the shot would disturb wildlife.

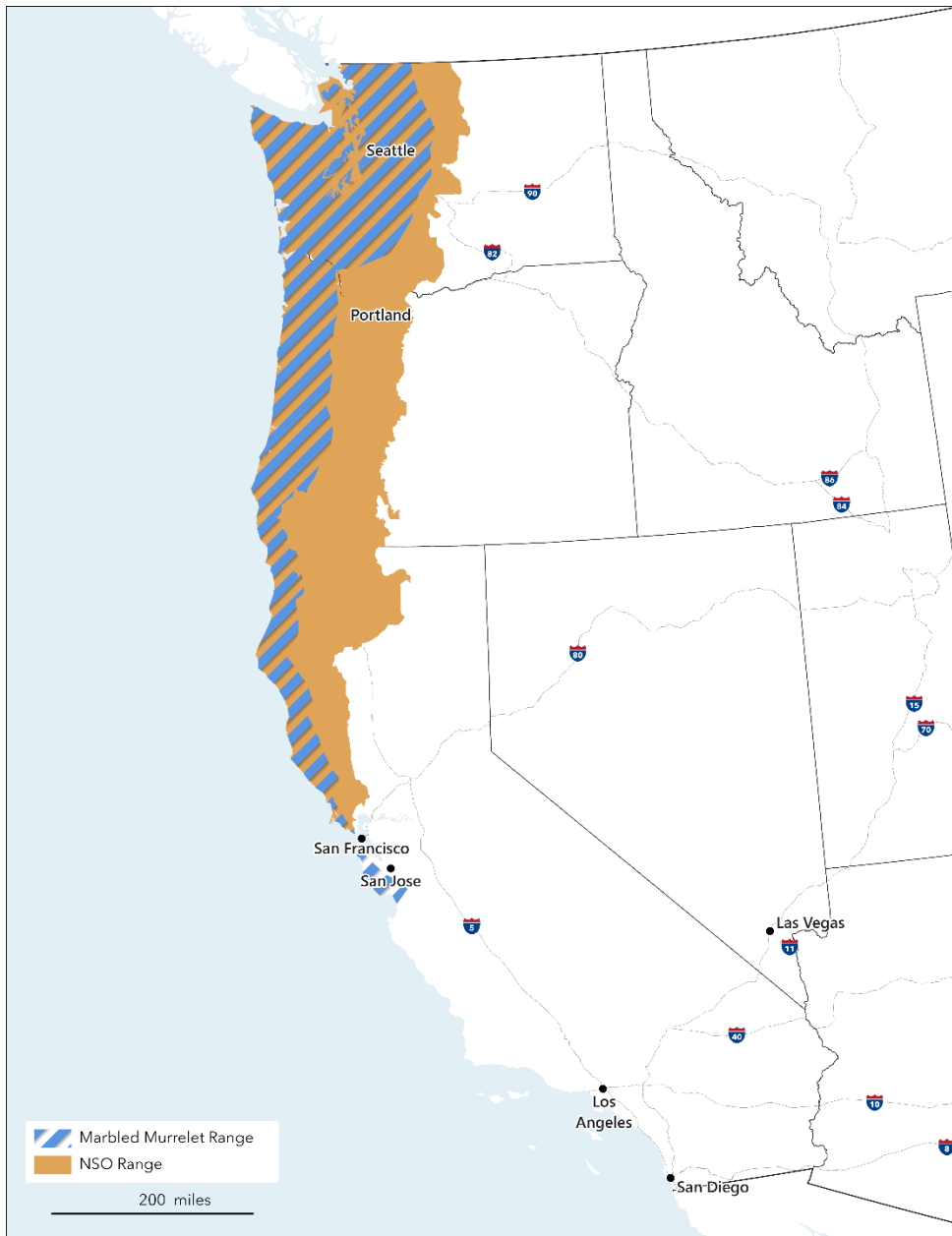
In areas with dense barred owl populations, additional shots may be taken during a single night to remove barred owls on neighboring barred owl territories. Removal locations are based on the presence of a territorial barred owl and are likely at least one-half mile or more apart. Because barred owls may reoccupy sites within a single season, removal could happen up to two or three times a year at some sites, separated by weeks or months.

Most of the management areas, with the exception of National and State Parks, are open for hunting (most of which happens in the fall) and target shooting. Our limited shooting in these areas is likely to blend into the background noise and not affect most species. In National and State Parks, areas within the park but near the boundary, animals may experience some level of habituation to hunting and shooting on neighboring lands. In areas deeper within a National or State Park, sounds of shots may be novel. To the extent that individuals react to the unknown, this may cause some potential for short-term disturbance regardless of habituation.

For most wildlife species, we do not anticipate any significant effect from the limited disturbance of one to three shotgun reports at dusk or night, due to the limited duration and scope of the disturbance. While individuals may respond by startling or flushing (flying or moving away from the noise), these are often very limited and normal responses that are unlikely to permanently affect most individuals or populations. For example, most nesting birds are unlikely to abandon nests from this limited level and duration of disturbance and short-term disruption of incubation or feeding is unlikely to significantly affect reproduction.

For species at already depressed population levels, a disturbance such as shooting that occurs at a sensitive time in their life history could have individual-level effects.

Of all the species listed in Table 3-29, few are likely to be disturbed by barred owl removal activities. We did identify a potential for disturbance to marbled murrelets from shotgun discharge under certain conditions, where barred owl management occurs within the nesting range and habitat of the marbled murrelet during the nesting season. This would only occur in the range of the northern spotted owl, and only where the management activity overlaps marbled murrelet nesting habitat (Map 3-1).



Map 3-1. Overlap of marbled murrelet inland range and northern spotted owl range.

Barred owl removal overlaps marbled murrelet nesting period and habitat within the range of the murrelet. Most barred owl removal would occur in the early spring and summer during barred owl nesting season, and again in the fall when barred owls become more responsive. The spring and summer removal periods overlap marbled murrelet nesting season, the fall removals would not. Barred owls use a wide variety of forest conditions. While some of these do not contain murrelet nesting habitat, most murrelet nesting habitat is potential barred owl habitat also. Adult marbled murrelets typically feed young around dawn and dusk, although fewer feedings take place at dusk and during the day. Barred owl removal often happens at dusk or in the early evening. If the gunshots are in the immediate vicinity of an active nest and happen when murrelet adults are returning to the nest, this could potentially interrupt the feeding of young.

Excessive noise, particularly if repeated often, can result in an aborted food delivery by adults to the young, may flush brooding adults thus exposing its egg or young to predation, or cause premature fledging of young. Under all alternatives, the proposed actions could occur during the murrelet nesting season and in nesting habitat; however, the noise is limited in duration and would not be repeated often. In areas where murrelet breeding populations are low, the likelihood that an individual removal effort would occur within the vicinity of an active nest at the exact time that the adults are delivering food is low, but not zero. With increased barred owl management, the potential that such an event would occur at least once would increase. The higher the murrelet nesting population density, the more likely an interaction with barred owl removal.

Given the above, we anticipate a low likelihood of a measurable negative impact to marbled murrelet populations in most of the management areas, due to the limited potential for, and short duration of, exposure to shotgun noise. However, when considered over the expanse of potential barred owl management areas, some individual murrelets would likely be exposed to removal activity and may be affected by short term disturbance associated with the discharged of a firearm. In areas with dense murrelet nesting, the potential for disturbance effects to individual murrelets is higher.

At the population level, the effects of disturbance to individual murrelets would have a small but potentially positive effect by reducing the potential for murrelet predation by barred owls. Removal of barred owls in the fall, after the marbled murrelet breeding season would have no effect, as would removal in the late winter/early spring before murrelet nesting begins. In special cases, disturbance to murrelets may be reduced by using alternative methods, such as trap and euthanize” or a “quiet” shotgun (see Appendix 3). However, these techniques are not always practical to employ, therefore these would not be a requirement for removal under all alternatives.

We have not identified any threats from disturbance to any other endangered, threatened, candidate, or sensitive species.

3.5.4 Alternative 1 – No Action

Under the no action alternative, the Strategy would not be completed or implemented, and the Service would not obtain a permit for management of barred owls. Barred owls would continue to expand within the northern spotted owl range. As barred owls continue to expand their range and populations within the northern spotted owl range, vulnerable species would experience increasing predation or competition (Holm et al. 2016). Barred owls would continue to invade the California spotted owl range, eventually affecting potential prey and competitor species within the Sierra Nevada and southern California forests.

3.5.5 Effects Common to All Action Alternatives

Barred owls, as a generalist invasive predator, exert pressure on many species not adapted to this novel source of predation. Removal of barred owls have a potential beneficial effect on potential prey or competing native predators. The species beneficially affected by each action alternative would vary due to differences in the location of barred owl management. The species potentially affected by each action alternative varies based on the location of barred owl management. Table 3-30 provides a list of Federal or State listed species that may be affected by barred owl management under each action alternative.

Table 3-30. Federal and State listed forest species that may be affected by barred owl management under the action alternatives.

Species	Action Alternative				
	2	3	4	5	6
Mammals					
Canada Lynx	Yes	Yes	Yes	Yes	-
Cascade Red Fox	Yes	Yes	Yes	Yes	-
Fisher (Sierra Nevada DPS)	Yes	Yes	Yes	Yes	-
Pacific (Humboldt) Marten	Yes	Yes	Yes	Yes	Yes
Mazama Pocket Gopher	-	-	-	-	-
Point Arena Mountain Beaver	Yes	Yes	-	-	Yes
Riparian Brush Rabbit	Yes	Yes	-	-	-
Riparian Woodrat (=San Joaquin Valley)	Yes	Yes	-	-	-
Red Tree Vole	Yes	Yes	-	Yes	-
Sierra Nevada Red Fox	Yes	Yes	-	Yes	Yes
Western Grey Squirrel	Yes	Yes	Yes	Yes	-
Belding's Savannah Sparrow	Yes	Yes	-	Yes	Yes
Birds					
Belding's Savannah Sparrow	Yes	Yes	-	Yes	Yes
Great Grey Owl	Yes	Yes	Yes	Yes	Yes
Little Willow Flycatcher	Yes	Yes	Yes	Yes	Yes
Marbled Murrelet	Yes	Yes	Yes	Yes	Yes
Spotted Owl	Yes	Yes	Yes	Yes	Yes
Oregon Vesper Sparrow	Yes	Yes	Yes	Yes	Yes
Southwestern Willow Flycatcher	Yes	Yes	-	Yes	Yes
Western Yellow-billed Cuckoo	Yes	Yes	Yes	Yes	Yes

Species	Action Alternative				
	2	3	4	5	6
Amphibians And Reptiles					
California Red-legged Frog	Yes	Yes	Yes	Yes	Yes
California Tiger Salamander	Yes	Yes	-	Yes	Yes
Foothill Yellow-legged Frog	Yes	Yes	Yes	Yes	Yes
Kern Canyon Slender Salamander	Yes	Yes	-	Yes	Yes
Limestone Salamander	Yes	Yes	-	Yes	Yes
Mountain Yellow-legged Frog	Yes	Yes	-	Yes	Yes
Oregon Spotted Frog	Yes	Yes	Yes	Yes	-
Relictual Slender Salamander	Yes	Yes	-	Yes	Yes
San Francisco Garter Snake	Yes	Yes	-	-	-
Santa Cruz Long-toed Salamander	Yes	-	-	-	-
Scott Bar Salamander	Yes	Yes	Yes	-	Yes
Shasta Salamander	Yes	Yes	Yes	-	Yes
Sierra Nevada Yellow-legged Frog	Yes	Yes	Yes	Yes	Yes
Siskiyou Mountains Salamander	Yes	Yes	Yes	-	Yes
Southern Rubber Boa	Yes	Yes	-	Yes	Yes
Western Pond Turtle	Yes	Yes	Yes	Yes	Yes
Yosemite Toad	Yes	Yes	-	Yes	Yes
Fish					
Bull Trout DPSs	Yes	Yes	Yes	Yes	Yes
Chinook Salmon DPSs	Yes	Yes	Yes	Yes	Yes
Coho Salmon DPSs	Yes	Yes	Yes	Yes	Yes
Eulachon DPS	Yes	Yes	Yes	Yes	Yes
Lahontan Cutthroat Trout	Yes	Yes	Yes	Yes	Yes
Little Kern Golden Trout	Yes	Yes	-	Yes	Yes
Paiute Cutthroat Trout	Yes	Yes	-	Yes	Yes
Steelhead DPSs	Yes	Yes	Yes	Yes	Yes
Invertebrates					
California Freshwater Shrimp	Yes	Yes	Yes	-	Yes
Trinity Bristle Snail	Yes	Yes	Yes	-	Yes

As described above, marbled murrelets may be disturbed by the noise involved with the removal of barred owls, if removal occurs within the range of the murrelet, within nesting habitat, and during the nesting season. This limits the provinces and potential management areas where murrelets are potentially affected. Provinces where overlap occurs include the majority of the Olympic Peninsula, Oregon Coast Ranges, and California Coast provinces and portions of the Western Washington Cascades, Eastern Washington Cascades, Oregon Klamath, and California Klamath provinces. Because the area of barred owl management varies by alternative, the potential area of impact for marbled murrelets varies (Table 3-31).

Table 3-31. Acres of potential barred owl management areas within the range of the marbled murrelet.

Physiographic Province	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6
Olympic Peninsula	598,457	1,360,997	1,196,915	1,196,915	0
Western Washington Cascades	995,200	2,143,974	654,931	1,115,272	0
Eastern Washington Cascades	366,061	398,677	482,445	759,865	0
Oregon Coast Ranges	1,472,988	2,726,934	1,724,821	2,838,088	0
Western Oregon Cascades	4,198	127,431	0	0	0
Oregon Klamath	245,797	768,864	191,737	0	393,684
California Coast	1,021,449	1,490,680	646,149	0	2,135,580
California Klamath	318,004	430,348	558,131	0	483,497
TOTAL	5,022,156	9,447,908	5,455,133	5,910,145	3,012,767

3.5.6. Summary of effects of the alternatives on other wildlife species.

Barred owls are a generalist non-native predator that exerts pressure on species not adapted to this new source of predation, leading to negative effects on potential prey species and competitors for the prey. Barred owl removal in the northern spotted owl range would have a beneficial effect on potential prey species by reducing this novel source of predation and on potential competitors by reducing competitive pressure. Barred owl removal in the California spotted owl range would prevent negative effects of barred owl predation and competition by preventing the establishment of barred owl populations in the areas described in the alternatives. The specific species affected would vary by location of management, as displayed in Table 3-30.

The act of removing barred owls involves discharge of shotguns and the noise associated with that discharge. Because murrelets are relatively easy to disturb. If barred owl removal occurs near nesting murrelets during critical periods of the nesting cycle, it could lead to adverse effects to the individual murrelets. Barred owl management activities that overlap the marbled murrelet range (Table 3-31) would have a small, but adverse effect on marbled murrelets. The potential degree of this impact at the population level depends on the area of removal activity that overlaps the range of the murrelet. This would be lowest under Alternative 6 and limited to the southern portion of the murrelet’s range. The potential impact would be greatest under Alternative 3 due to the large overlap with marble murrelet habitat in Washington, Oregon, and California.

3.6 Recreation and Visitor Use

Our discussion of the effects of the proposed management of barred owls on recreation and visitor use is focused on the range of the northern and California spotted owls, and adjacent areas described for management. For each alternative, we considered the effects of barred owl removal and associated activities on designated recreational areas or areas heavily used by visitors that overlap with the action.

3.6.1 Background and Analytical Methods

For the purpose of this analysis, and to effectively illuminate differences in the outcomes under the alternatives, we assumed that management would begin immediately, be implemented to the maximum extent described in each alternative and continue for 30 years. This represents two lifespans of spotted and barred owls and allows time to predict and analyze differences between alternatives.

Given the proposed management of barred owls throughout areas in Washington, Oregon, and California, we anticipate that at least some activities associated with the proposed action would occur within, or adjacent to, designated recreational areas or areas heavily used by visitors. The primary mechanism for effects to recreation and visitor use includes the presence of small crews on the ground and the sound of firing the shotgun at barred owl sites, the latter having the most potential for disruption. The presence of small crews (one to three people) involved in surveying and removal are within the normal size of groups using all lands under consideration for barred owl management and we do not anticipate any substantial effect of their presence.

We anticipate that the sound of gunshots is more apt to disturb visitors and recreationists. Visitor expectations and responses to these mechanisms is dependent on their expectations of management within an area. Impacts from sounds or activities that are unexpected in one area may be unremarkable and not cause disturbance to visitors or recreationists in another setting. For example, the sound of gunshots in a National Park where hunting is not allowed would be notable, while gunshots on National Forest and BLM managed public lands during the hunting season would not. Even in National Parks, gunshots may be heard near the borders of the parks where the neighboring lands are open for hunting.

The sound of gunfire is sharp, loud, but short. A 12-gauge shotgun has a momentary noise level of about 150 dB at the site of the shot. For comparison, this is equivalent to firecrackers or a close lightning strike. This sound attenuates with distance, and can be further affected by steep slopes, ridges, and dense vegetation, all of which increase the rate of attenuation. Most barred owl removal would be conducted from roads or trails in heavily forested landscapes within the northern spotted owl range, leading to greater attenuation of the sound of the shot. Within the range of the California spotted owl, barred owl removal would also be conducted primarily from roads and trails, but in a variety of forested and woodland landscapes. A gunshot may be audible to humans as much as a mile away, depending on the topography, ground cover, forest density, and background ambient noise levels.

Since the primary effects of barred owl lethal removal on recreation and visitor use is related to the sound of shotguns, we considered whether hunting or target shooting was likely under different ownerships, how likely it is for a visitor to hear gunshots in these areas, the timing or seasonality of the gunshots, and the potential for visitors to be present in the area during the removal activity.

3.6.2 Affected Environment

Barred owl management could occur on all or part of ten National Park or Monument units managed by the National Park Service in the range of the northern spotted owl. These include North Cascades National Park and Ross Lake National Recreation Area, Olympic National Park, and Mount Rainier National Park in Washington; Crater Lake National Park and Oregon Caves National Monument and Preserve in Oregon; and Redwood National Park, Whiskey Town National Recreation Area, Lassen Volcanic National Park, Muir Woods National Monument, Golden Gate National Recreation Area, and Point Reyes National Seashore. Additionally, the Forest Service and BLM manage similar areas including the Mount Saint Helens National Volcanic Monument, Columbia River Gorge National Recreation Area, Cascade Siskiyou National Monument, Berryessa Snow Mountain National Monument, Giant Sequoia National Monument, and San Gabriel Mountains National Monument.

Barred owl management could occur on all or part of four National Park units in the range of the California spotted owl: Lassen Volcanic, Sequoia & Kings Canyon and Yosemite National Parks, as well as Devil's Postpile National Monument. We anticipate that management activities involving firearms would be excluded in populated areas (e.g., NPS housing, developed areas, and open established campgrounds).

We have organized our discussion around three categories, based on differences in land ownership and management: (1) National Parks, where hunting is typically not allowed; (2) other Federal lands (National Forests, BLM lands, and some National Recreation Areas) outside of wilderness areas, where hunting, and some target shooting, is generally allowed; and (3) non-Federal lands, where hunting and shooting may or may not be allowed.

In this section, we discuss the relevant context of different landscapes in the affected environment. In particular, we describe whether these areas are open to hunting or shooting, and whether this is likely to disturb visitors.

National Parks

The greatest potential for disturbance effects to recreation or visitor use occurs in National Parks where hunting is typically not allowed; therefore, we conducted a detailed review of National Park policies and processes.

The National Park Service Management Policies (NPS 2006, entire) guides management at the parks, which help parks manage their resources as dictated by unique park-by-park underlying legislation and also the Organic and Redwoods Acts of 1916, and 1978, respectively. National Park units may also have enabling legislation or presidential proclamations with park-specific mandates. The National Park Service manages National Parks, some National Monuments, and some National Recreation Areas. Ross Lake National Recreation Area, while managed by the National Park Service, is open for hunting.

The primary mission of the NPS is the preservation of resources, including natural resources, in an unimpaired condition. The Management Policies recognize that non-native (also called “exotic” or “alien”) species are an example of human-caused disturbance that can have severe impacts on natural biota and ecosystems. Pursuant to Section 4.4.4.2 of the Management

Policies, parks are specifically mandated to control exotic species “up to and including eradication” of a population if that species does not meet an identified park purpose; if such control is “prudent and feasible”; if the exotic species interferes with natural processes, disrupts the genetic integrity of native species, damages cultural resources, significantly hampers park management or affects other specified criteria.

Relative to the potential physical effects of this proposed experiment, the policy states that the National Park Service will preserve, to the greatest extent possible, the natural soundscapes of parks, i.e., sounds of animals and physical processes (NPS 2006, 56). The National Park Service will protect natural soundscapes from unacceptable impacts by preventing and minimizing unnatural sounds that, through frequency, magnitude, and duration, adversely affect the natural soundscape, or other park resources or values (NPS 2006, p. 56).

Restoration is also an important focus of National Park Service policy. “[T]he National Park Service will use the best available technology to restore the biological components of these systems, accelerating their recovery...Efforts may include removal of exotic species” (NPS 2006, p. 39). Native species are defined as all species that have occurred, now occur, or may occur as a result of natural processes on lands designated as units of the National Park System. Exotic species are those that occupy or could occupy park lands directly or indirectly as the result of deliberate or accidental human activities (NPS 2006, p. 43). The Service has evaluated the situation regarding the potential for barred owls to be considered invasive (Appendix 1). Based on this analysis, we consider the barred owl to be an invasive species present in the West as a result of the indirect effect of human activities, and therefore an exotic species.

The National Park Service relies on natural processes to maintain native animal species whenever possible, however, it may manage individuals or populations when such intervention will not cause unacceptable impacts to populations of species, and when it is necessary to protect rare, threatened, or endangered species. There is precedent for removal of species in National Parks, such as the removal of golden eagles, mule deer, and Roosevelt elk from Channel Islands National, Burmese pythons from Everglades National Park, mountain goats from the Olympic National Park, feral hogs from Great Smoky Mountain National Park, fallow and axis deer from Point Reyes National Seashore, and brown-headed cowbirds from Grand Canyon National Park and Golden Gate National Recreation Area, to name a few.

Visitors use National Parks for a wide variety of recreation including, but not limited to, hiking, camping, scenic viewing, bird watching, skiing, rock and mountain climbing, nature study, and photography. Some activities take visitors into the backcountry, away from roads and developed areas. In the West visitation is generally highest in the summer, dropping off in the fall with the start of school and inclement weather. However, visitors access portions of the parks in all seasons. Most recreation use is concentrated during the daylight hours, except for overnight camping and other limited nighttime uses.

Other Federal Lands

National Monuments are located on Federal lands and are affected by the land management policies and plans of the managing Federal agency in accordance with individual monument

Congressional legislation establishing the monument, or Presidential Proclamation through the Antiquities Act. A full range of recreation activities may occur in National Monuments, with the exact allowable uses determined in their establishing legislation or proclamation. Hunting, and in some cases target shooting, may be allowed on these lands. For example, the Columbia River Gorge Scenic Area (under the jurisdiction of the Forest Service), Cascade-Siskiyou National Monument (under the jurisdiction of BLM), and Berryessa Snow Mountain National Monument (under the jurisdiction of BLM) are open for hunting in accordance with State laws.

Recreational activities also take place on other types of Federal lands including National Forests, National Wildlife Refuges, National Recreation Areas, and others. Recreation on these lands include a wide array from hiking and backpacking to recreational vehicle camping and hunting. As in National Parks, some activities take visitors away from roads and developed areas. Because hunting is allowed in most of these areas, the sound of gunshots is part of the background soundscape, at least during hunting season. Barred owl removal could occur at any time of the year but is usually concentrated in the spring and early summer breeding season, and the fall when barred owls are again responsive. Firearm hunting seasons, which are set by the States annually, occur primarily in the fall, with some spring hunting seasons. Target shooting, where not prohibited, may occur at any time of the year. This soundscape includes not only shooting, but traffic noise and many other human sounds in developed areas, and airplane noise, and in some places, all-terrain vehicles.

Hunting on all lands must be in compliance with State regulations. Big game hunting seasons are generally in the fall with some hunting seasons starting in late summer or extending into the spring. In Oregon there is a spring bear hunt and Washington allows cougar hunting through April. Small mammal hunting seasons may start in mid-summer and extend into early spring, depending on the species. In Oregon, hunting of unprotected mammals is allowed year-round, as are coyotes in Washington. Turkey season runs from fall through spring, end of May in Washington and Oregon, April in California. Wild pig (aka feral swine) can be hunted year-round in California and Oregon. Therefore, in areas open to hunting, shots may be heard most months of the year, with a concentration during big game hunting in the fall, and a secondary increase in the spring. Target shooting may occur at any time of the year.

Non-Federal Lands

Potential management areas under the action alternatives include contain non-Federal lands (such as State, County, municipal, or private lands) which may or may not allow hunting. Some State or County Parks are managed similar to National Parks, and visitors would not anticipate the sound of gunshots. Other State and county lands are open to hunting and target shooting, making the sound of gunshots part of the background soundscape.

In management areas where a checkerboard pattern of ownership occurs, non-Federal lands are interspersed with Federal lands that are open to hunting, so the sound of gunshots may be heard in many areas of these non-Federal lands regardless of whether or not they are open to hunting. On non-federal lands, when hunting is restricted, non-Federal landowners often restrict other recreation through posting of no trespassing signs. If these lands are closed to trespassing, then

there should be no recreation or visitor use, and therefore no visitors to disturb. For purposes of this discussion, we assumed that all non-Federal lands in the range of the northern and California spotted owl are open to hunting and other recreational purposes. We also assumed that recreational visitors could occur throughout these lands, although not to the extent they could be present on National Parks or other Federal lands.

3.6.3 Environmental Consequences

The following sections present the potential environmental effects of the no action alternative, proposed action, and alternatives on recreation and visitor use.

3.6.4 Alternative 1 – No Action

Under Alternative 1, the No Action Alternative, no Barred Owl Management Strategy would be finalized or implemented, and the Service would not obtain a permit for comprehensive management of barred owls. Because there would be no activities on the ground, there would be no effect on recreation or visitor use from management activities.

3.6.5 Effects Common to All Action Alternatives

Under any alternative, barred owl removal on management areas would entail the presence of one to three people at sites in the forest for 15 minutes to a few hours, primarily at dusk or during the night. This could occur at any time of the year, though is usually concentrated in the spring and early summer, and again in the fall, as barred owls are more responsive at these times. Most removal would be conducted from roads, or along trails. Off-trail removal would be very limited due to the danger of traveling off trail in remote areas at night. Lethal removal would involve attracting barred owls with recorded calls and shooting birds that respond and approach closely. This method would result in one to two shots fired during a removal visit. If all birds are not removed in a single visit, or new barred owls reoccupy the site after removal, additional visits and shots may be required, though these would be separated by days or weeks from the initial removal. Removal locations are based on the presence of a territorial barred owl and are likely at least one-half mile or more apart. Barred owls may reoccupy these sites within a single season, therefore one to two additional removals may occur within a single year on some sites.

The intensity of removal would vary across management areas in the northern and California spotted owl ranges under any alternative. With the exception of the far southern end of the northern spotted owl range, barred owl populations are well established. In these areas, barred owl removal, with associated gunshots, would occur approximately one to four times a year, as new barred owls replace the ones removed. In the southern portion of the northern spotted owl range, and the California spotted owl range, removals would be scattered and intermittent, and not likely to recur in the same area within a year, or even between years.

We anticipate that the primary effect of any of the action alternatives on recreational resources and visitor use is the short-term elevated sound levels resulting from the discharge of a firearm

one or two times per removal effort. In areas where hunting or target shooting is not otherwise allowed, this may change the soundscape for recreationists or visitors in the area.

National Parks

All action alternatives include the potential for removal on National Park lands. In parks, we anticipate potential soundscape effects because these areas are open to recreational or visitor use but closed to hunting. Because visitors would not expect to hear gunshots, especially in the interior parts of the park, the sound of gunshots could impact their recreational experience and potentially cause concern and distress for some individuals. It is also possible that some visitors may alter their plans to avoid management areas.

Use of firearms in the National Parks is not without precedent, as they have been used for ungulate management in Olympic National Park and Point Reyes National Seashore in recent years. Thus, the idea of firearm use in management within National Parks may not be as unexpected as in the past. We do not anticipate that barred owl management would require any specific area closures, however, individual park units may choose to do so out of an abundance of caution. Safety protocols would be in place to ensure that there is no danger to visitors if areas are not closed (Appendix 3) and additional restrictions may be applied by individual units. Individual units may also set standards for removal above that contained in the protocol, including the use of “quiet” guns or other modifications to standard shotguns to reduce noise in areas of high human use and potential conflicts or the option to capture and euthanize barred owls. However, as this would be a local decision, the following analysis assumes removal by a standard 12-gauge shotgun.

Because removal occurs primarily at dusk or night, we anticipate fewer visitors would be exposed to the sound of gunshots than if actions took place during the day, though this still represents a potential effect on the soundscape for those visitors that are in the area.

Other Federal Lands

Most National Forest and BLM-managed lands are open to hunting, and in some cases target shooting. The Bear Valley National Wildlife Refuge in Oregon is forested, lies within the northern spotted owl range and 15-mile buffer, and is open for hunting. Because the sound of gunshots is not unexpected in these areas, we do not anticipate any significant effects on National Forests or BLM lands within management areas as barred owl removal would not be a significant change in the background soundscape.

The effects in National Monuments managed singularly or jointly by the Forest Service and BLM depend on the individual monument establishing legislation or proclamation. We expect no significant effects in monuments where hunting is allowed or occurs just outside the boundaries. In monuments that are closed to hunting, we expect similar limited effects to those in National Park lands.

Non-Federal Lands

All action alternatives include barred owl management areas containing non-Federal lands

that may be part of, or adjacent to, the management areas. Where these lands are open to public use (not closed to all uses), hunting is often allowed, and any users would likely be accustomed to the sound of occasional gunshots. Therefore, we expect that barred owl management would have no significant effect on recreation or visitor use on these lands. Where hunting and trespassing is prohibited on these lands, we would also expect no effect because no recreational visitors would be present.

3.6.6 Alternative 2 – Proposed Action – Strategy Implementation

Alternative 2 would include removal of barred owls from management areas across 10 provinces in the range of the northern spotted owl. These would include areas around all recently occupied and newly located spotted owl sites, management of portions of GMAs based on their priority rating, and management on portions of several Special Designated Areas, many of which include National Park lands.

Under this Alternative, barred owl management could occur on all or part of nine National Park or National Park-managed Monument units in the range of the northern spotted owl. These include North Cascades National Park and Ross Lake National Recreation Area, Olympic National Park, and Mount Rainier National Park in Washington; Crater Lake National Park and Oregon Caves National Monument and Preserve in Oregon; and Whiskeytown National Recreation Area, Redwood National Park, Muir Woods National Monument, Golden Gate National Recreation Area, and Point Reyes National Seashore in California. This could involve management on up to 1,385,692 acres of forest land within the Parks, as described in Table 3-32. The acres under management would be a subset of the maximum acres of forest lands within each park and some areas, including populated areas, would be excluded.

Under Alternative 2, barred owl management could occur on all or part of Lassen Volcanic, Sequoia & Kings Canyon and Yosemite National Parks, as well as Devil's Postpile National Monument in the range of the California spotted owl.

Barred owl populations are high within the northern part of the range, resulting in more intensive barred owl removal on management areas within the northern parks. Whiskeytown National Recreation Area, Muir Woods National Monument, and Point Reyes National Seashore currently have lower barred owl densities and would require less removal activity in the initial years of implementation.

In the range of the California spotted owls under the Preferred Alternative, all barred owls located on ongoing or future monitoring, inventory, or survey efforts could be removed as soon as practicable after detection across the range of the subspecies and in forest areas representing the potential invasion pathways into the range, including the northern Sierra Nevada area, forested areas in the Central Valley, the forested areas between the Coastal-Southern California population and the Sierra Nevada, and in the central coast near the border with the southern end of the California Coast province. Under this alternative, barred owl management could occur on all or part of three National Parks in California, including Lassen Volcanic, Sequoia/Kings Canyon, and Yosemite National Parks. However, as barred owls would be removed as soon as

located, the intensity of disturbance would be significantly lower than in the northern spotted owl range.

Table 3-32. National Parks Lands included in Alternative 2 with the maximum potential forested acres within each National Park unit.

National Park Unit	Physiographic Province/Population	Maximum Acres of Forest Lands within the National Park Unit
North Cascades National Park and Ross Lake National Recreation Area	Western and Eastern Washington Cascades	299,922
Olympic National Park	Olympic Peninsula	697,021
Mount Rainier National Park	Western Washington Cascades	144,752
Crater Lake National Park	Western and Eastern Oregon Cascades	103,152
Oregon Caves National Monument	Oregon Klamath	4,535
Redwood National Park	California Coast	72,120
Whiskeytown National Recreation Area	California Klamath	36,159
Muir Woods National Monument	California Coast	527
Golden Gate National Recreation Area	California Coast	28,703
Point Reyes National Seashore	California Coast	38,898
Lassen Volcanic National Park	Sierra Nevada	94,910
Sequoia & Kings Canyon National Park	Sierra Nevada	367,744
Yosemite National Park	Sierra Nevada	441,682
Devil's Postpile National Monument	Sierra Nevada	719

Barred owl populations are very low in the Sierra Nevada, including Sequoia & Kings Canyon and Yosemite National Parks. Barred owls are likely to occur more frequently in Lassen Volcanic National Park than in the parks farther south. In all of these parks, removal of barred owls is anticipated to be an occasional event, prompted by the detection of a barred owl within a National Park.

Alternative 2 would result in potential disturbance to visitors in areas where gunshots are not typically heard or expected, such as National Parks, some National Monuments, and State Parks that occur within the management areas. However, fewer visitors would likely to be exposed to the sound of gunshots during the evening/night hours compared to the total annual visitors using these areas for recreation. On areas where hunting or target shooting are allowed, including Federal, State, and private lands, we anticipate no significant disturbance from the sound of gunshots as these are part of the background soundscape. On areas closed to recreation, no significant effect would occur. The potential for disturbance to visitors would be greater in the northern spotted owl range. In the California spotted owl range, disturbance would be occasional, intermittent, and widely spaced.

3.6.7 Alternative 3 – Management Across the Range

Alternative 3 would allow for barred owl management to be implemented anywhere within the

range of the northern or California spotted owls or within 15 miles of the range of the subspecies (Map 2.6) on up to 50 percent of the area at any one time. For analysis purposes, we assumed that management would be distributed evenly across the physiographic provinces for the northern spotted owl range, and assumed the 50 percent would be focused largely on the northern portion of the Sierra Nevada. However, individual barred owls could be removed from throughout the Sierra Nevada.

Under this alternative, barred owl management could occur on the same National Park-managed units described in the Preferred Alternative.

Like Alternative 2, Alternative 3 would result in potential disturbance to visitors in areas where gunshots are not typically heard or expected, such as National Parks, some National Monuments, and State Parks that occur within the management areas. This alternative covers a larger area than other action alternatives, and thus could result in greater disturbance of visitors and visitor use. On areas where hunting or target shooting are allowed, including Federal, State, and private lands, we anticipate no significant disturbance from the sound of gunshots as these are part of the background soundscape. On areas closed to recreation, no significant effect would occur. The potential for disturbance to visitors would be greater in the northern spotted owl range and the associated 15-mile buffer area. In the California spotted owl range and associated 15-mile buffer, disturbance would be occasional, intermittent, and widely spaced.

3.6.8 Alternative 4 – Limited Management by Province/Population

Alternative 4 would allow for barred owl management to be implemented across 100 percent of the highest priority General Management Area or other mapped area in each province within the range of the northern spotted owls (Map 2-7). Under this alternative, barred owl management could include Olympic National Park and Mount Rainier National Park in Washington, and Redwood National Park in California in the northern spotted owl range. This could involve management on up to 913,892 acres of forest land within the National Park-managed units.

In the California spotted owl range, barred owl management would be delayed until detections reached 10 percent of surveys in areas within the Sierra Nevada portion of the population, or five percent within the Coastal-Southern California portion of the province. Barred owl management could still occur in Lassen Volcanic, Sequoia/Kings Canyon, and Yosemite National Parks. However, management would not be initiated until detections reached 10 percent. Thus, there would be no soundscape impacts until the 10 percent threshold was reached, but given the larger population, more barred owls would be removed in a shorter period of time, resulting in greater impacts on the soundscape.

Alternative 4 would result in less potential disturbance to visitors in areas where gunshots are not typically heard or expected, such as National Parks, some National Monuments, and State Parks that occur within the management areas, due to the smaller acreage and fewer such areas included barred owl management areas in the range of the northern spotted owl. On areas where hunting or target shooting are allowed, including Federal, State, and private lands, we anticipate no significant disturbance from the sound of gunshots as these are part of the background soundscape.

In the range of the California spotted owls, barred owl removal would be delayed, and barred owl populations allowed to develop prior to removal. By allowing populations to develop, this alternative would result in a greater potential for disturbance with the increased number of barred owls removed and the resulting increase in gunshots. On areas closed to recreation, no significant effect would occur.

3.6.9 Alternative 5 – Management Focused on Highest Risk Areas

Alternative 5 would focus barred owl management in the northern portion of the northern spotted owl range, where the subspecies is at greatest risk of extirpation from barred owl competition (Map 2-8). Management could be conducted on 100 percent of two GMAs in the Eastern Washington Cascades, Western Washington Cascades, Eastern Oregon Cascades, Western Oregon Cascades, and Oregon Coast Ranges Physiographic Provinces and one GMA in the Olympic Peninsula Physiographic Province. Under this alternative, barred owl management could include Olympic and Mount Rainier National Parks in Washington and Crater Lake National Park in Oregon. No management would occur on Oregon Caves National Monument and Preserve in Oregon and Redwood National Park, Muir Woods National Monument, Point Reyes National Seashore in California, and Whiskeytown National Recreation Area. This could involve management on up to 944,924 acres of forest land within the Park units. Soundscape impacts would be limited to the northern parks, and within these would be the same as the Preferred Alternative.

In the California spotted owl range, under this alternative, barred owl management would be limited to the northern Sierra Nevada portion of the subspecies range. Barred owl management would only occur on Lassen Volcanic National Park within the California spotted owl range. No management, and therefore no effect to the soundscape, would occur in Sequoia/Kings Canyon and Yosemite National Parks.

Under Alternative 5, potential disturbance to visitors in the northern spotted owl range would be limited to areas in Washington and portions of Oregon. Barred owl removal would occur in three National Parks. In the California spotted owl range, barred owl removal and the associated disturbance from gunfire, would be limited to a portion of the Sierra Nevada, including only Lassen Volcanic National Park. Thus, this would result in less potential disturbance to visitors in areas where gunshots are not typically heard or expected, such as National Parks, some National Monuments, and State Parks that occur within the management areas, due to the smaller acreage and fewer such areas included barred owl management areas.

On areas where hunting or target shooting are allowed, including Federal, State, and private lands, we anticipate no significant disturbance from the sound of gunshots as these are part of the background soundscape.

3.6.10 Alternative 6 – Management Focused on Best Conditions

Alternative 6 would focus barred owl management in the southern portion of the northern spotted owl range, where spotted owl populations have not decreased to the degree they have in the north

(Map 2-9). Management could occur on up to 75 percent of each GMA in the Oregon Klamath, California Coast, California Klamath, and California Cascades provinces. In the California spotted owl range, under this alternative, barred owl management would be focused on areas with the best remaining habitat and areas with higher fire resiliency, including 50 percent of the Sierra Nevada portion of the range with the best remaining habitat, and the 75 percent of the Coastal-Southern California portion of the range.

Under this Alternative, barred owl management could occur on all or part of five National Park or National Park-managed Monument units in the range of the northern spotted owl. These include Oregon Caves National Monument and Preserve in Oregon and Whiskeytown National Recreation Area, Redwood National Pars, Muir Woods National Monument, Golden Gate National Recreation Area, and Point Reyes National Seashore in California. This could involve management on up to 140,845 acres of forest land within the National Park-managed units.

In the range of the California spotted owl under the Preferred Alternative, barred owl surveys and removals would be concentrated in the best habitat areas with higher fire resiliency. These areas would be determined prior to implementation and could include up to 50 percent of the Sierra Nevada range and 75 percent of the Coastal-Southern California range. Under this alternative, barred owl management could occur on all or part of three National Parks in California, including Lassen Volcanic, and Sequoia/Kings Canyon, and Yosemite National Parks.

Under Alternative 6, potential disturbance to visitors in the northern spotted owl range would be limited to areas in southern Oregon and California. Barred owl removal would occur in three National Parks. In the California spotted owl range, barred owl removal and the associated disturbance from gunfire, would be limited to a portion of the Sierra Nevada, including only Lassen Volcanic National Park. Thus, this would result in less potential disturbance to visitors in areas where gunshots are not typically heard or expected, such as National Parks, some National Monuments, and State Parks that occur within the management areas, due to the smaller acreage and fewer such areas included barred owl management areas.

On areas where hunting or target shooting are allowed, including Federal, State, and private lands, we anticipate no significant disturbance from the sound of gunshots as these are part of the background soundscape.

3.6.11 Summary of Effects by Alternative

Alternative 1, the no action alternative, would have no effect on recreation and visitor use. The primary adverse effect of the action alternatives on recreation and visitor use would be the potential disturbance to users from the sound of gunshots, changing the soundscape. On areas where hunting or target shooting are allowed, we anticipate no significant disturbance from the sound of gunshots, particularly during hunting seasons, as these are part of the background soundscape. On areas where hunting and target shooting are not allowed, the sound of gunshots would adversely affect some users. These areas include most National and State Parks. The primary difference between alternatives would be the number and location of closed areas where barred owl removal would occur, including the National Park units listed in Table 3-33.

Table 3-33. Summary of National Park administered areas potentially included in each action alternative. “X” indicates National Park units that are at least partially included in potential barred owl management under each alternative; “-” means no lands are included.

National Park Unit	Alternative					
	1 - no action	2	3	4	5	6
North Cascades National Park and Ross Lake National Recreation Area	-	X	X	-	X	-
Olympic National Park	-	X	X	X	X	-
Mount Rainier National Park	-	X	X	X	X	-
Crater Lake National Park	-	X	X	-	X	-
Oregon Caves National Monument	-	X	X	-	-	X
Redwood National Park	-	X	X	X	-	X
Whiskeytown National Recreation Area	-	X	X	-	-	X
Muir Woods National Monument	-	X	X	-	-	X
Point Reyes National Seashore	-	X	X	-	-	X
Golden Gate National Recreation Area	-	X	X	-	-	X
Lassen Volcanic National Park	-	X	X	X	X	X
Yosemite National Park	-	X	X	X	-	X
Sequoia/Kings Canyon National Park	-	X	X	X	-	X
Devil’s Postpile National Monument	-	X	X	X	-	X
Total	0	14	14	7	5	10

3.7 Wilderness Areas

Our discussion of the effects of the proposed management of barred owls on Wilderness Areas is focused on the range of the northern and California spotted owls, and adjacent areas described for management. For each alternative, we considered the effects of barred owl removal and associated activities on designated Wilderness Areas that overlap with the action.

3.7.1 Background and Analytical Methods

For the purpose of this analysis, and to effectively illuminate differences in the outcomes under the alternatives, we assumed that management would begin immediately, be implemented to the maximum extent described in each alternative and continue for 30 years. This represents two lifespans of spotted and barred owls and allows time to predict and analyze differences between alternatives.

Given the proposed management of barred owls throughout areas in Washington, Oregon, and California, we anticipate that at least some activities associated with the proposed action would occur within designated Wilderness Areas. Wilderness administering agencies must preserve wilderness character, a mandate found in the declaration of policy in the act (16 USC 1131(a)) and the direction for use of wilderness areas (16 USC 1133(b)). Roads, motor vehicles, motorized equipment or motorboats, aircraft landing, mechanical transport, or

structures or installations are generally prohibited (16 USC 1133(c)). By policy, Federal land management agencies generally take no actions to diminish wilderness character of study areas and recommended, proposed, or eligible lands to the extent that action would preclude future wilderness designation (Forest Service Manual 1900, National Park Service Management Policies Chapter 6, Bureau of Land Management Manual 6330).

Wilderness character is defined as a “holistic concept based on the interaction of (1) biophysical environments primarily free from modern human manipulation and impact, (2) personal experiences in natural environments relatively free from the encumbrances and signs of modern society, and (3) symbolic meanings of humility, restraint, and interdependence that inspire human connection with nature. Taken together, these tangible and intangible values define wilderness character and distinguish wilderness from all other lands” (Landres et al. 2015).

Five qualities of wilderness character have been defined to monitor how stewardship actions, impacts from modernization, and other changes occurring inside or outside of a given wilderness area affect the wilderness area over time (Landres et al. 2015). These are:

- **Untrammeled:** Wilderness is essentially unhindered and free from modern human actions that control or manipulate the community of life.
- **Natural:** Wilderness maintains ecological systems that are substantially free from the effects of modern civilization.
- **Undeveloped:** Wilderness retains its primeval character and influence and is essentially without permanent improvements or modern human occupation.
- **Solitude or Primitive and Unconfined Recreation:** Wilderness provides outstanding opportunities for solitude or primitive and unconfined recreation.
- **Other Features of Value:** Wilderness may also contain other features of scientific, educational, scenic, or historical value.

While the alternatives do not compel any particular action, the ESA requires Federal agencies (including those which manage wilderness) to use their legal authorities in the recovery of threatened and endangered species. These wilderness-administering agencies are also charged with varying conservation mandates, and it is reasonable to assume that some barred owl management could occur within designated wilderness and wilderness study areas. Therefore, the analysis includes both a quantitative estimate of how much wilderness area might be impacted, as well as a qualitative analysis of the impacts of each of the alternatives are evaluated for their impact on wilderness character. The qualitative analysis references other portions of the EIS where necessary to provide greater detail and avoid duplication. The implementation of the alternatives in wilderness would depend on additional analysis and decision making, so the effects described in this section represent an upper bound to the geographic extent of impacts.

3.7.2 Affected Environment

Areas suggested for management under various action alternatives include Federal lands designated as wilderness by Congress, as well as areas managed as wilderness by policy by Federal land management agencies (lands recommended, proposed, or deemed eligible for wilderness designation, wilderness study areas). Specific data are provided for designated

wilderness and wilderness study areas. Additional lands managed as wilderness by agency policies exist in the analysis area but are unmapped. Within the range of the spotted owls, there are approximately 9,558,745 acres of designated wilderness and approximately 205,160 acres in of lands managed to preserve eligibility for designation (Table 3-34 and 3-35).

Table 3-34 – Acres of designated wilderness, wilderness study areas, and forested acres within the wilderness in each physiographic province in the northern spotted owl range.

Physiographic Province	Acres of Designated Wilderness	Acres Managed for Wilderness Values	Acres of Forest Habitat in Wilderness
Olympic Peninsula	953,230	0	774,254
Western Washington Cascades	1,740,165	0	1,138,785
Eastern Washington Cascades	1,475,574	15,058	933,386
Oregon Coast Ranges	59,241	7,792	61,754
Western Oregon Cascades	768,131	67,032	752,835
Eastern Oregon Cascades	387,794	69,312	354,881
Oregon Klamath	259,193	208	256,261
California Coast	136,217	6,641	120,414
California Klamath	1,291,826	2,146	1,222,571
California Cascades	48,630	0	22,145
TOTAL	7,120,001	168,189	5,637,286

Table 3-35 – Acres of designated wilderness, wilderness study areas, and forested acres within the wilderness within the range of each California spotted owl population segment.

California Spotted Owl Population	Acres of Designated Wilderness	Acres Managed for Wilderness Values	Acres of Forest Habitat in Wilderness
Sierra Nevada Population	1,323,186	32,959	1,136,940
Coastal- Southern California Population	1,115,558	4,012	931,707
TOTAL	2,438,744	36,971	2,068,647

3.7.3 Environmental Consequences

The following sections present the potential environmental effects of the no action alternative, proposed action, and alternatives on Wilderness Areas, focusing on the wilderness character qualities discussed above. Wilderness and wilderness areas have very specific direction in law, regulations, and agency policies that would need to be addressed in implementation of barred owl management relative to wilderness.

3.7.4 Alternative 1 – No Action Alternative

Under Alternative 1 – No Action, no Barred Owl Management Strategy would be finalized or implemented, and the Service would not obtain a permit for management of barred owls, therefore no barred owl removal would occur within wilderness. Therefore, there would be no effect on the untrammeled, undeveloped, solitude or primitive and unconfined recreation, and other features of value qualities of wilderness. This alternative would have a negative effect on the natural quality of wilderness because native northern and California spotted owl populations would continue to decline or be locally extirpated while barred owls persist or increase in wilderness (see Section 3.4 Affected Environment and Environmental Consequences—Northern and California Spotted Owls). This effect would likely become permanent when spotted owls become extinct.

These impacts could occur on all wilderness in the action area, including up to 9,558,745 acres of designated wilderness and 205,160 acres of wilderness study areas. Under Alternative 1, wilderness character would continue to be adversely affected over the long-term by ever decreasing, and eventually extinction of, spotted owl populations.

3.7.5 Effects Common to All Action Alternatives

The primary mechanism for effects of the action alternatives to wilderness include surveying for and removal of barred owls and post-removal monitoring. All of these actions involve the small crews of two to four individual operating from trails in the wilderness area.

Surveys and barred owl removal would involve the presence of one to three people at specific sites along trails in the forest for 15 minutes to a few hours, primarily at dusk or during the night. This could occur at any time of the year, though it is usually concentrated in the spring and early summer, and again in the fall, as barred owls are more responsive at these times. Weather and access may limit activity in higher elevation areas in the spring. Most removal would be from trails. Off-trail removal would be very limited due to the danger of traveling off trail in remote areas at night. Lethal removal would involve attracting barred owls with recorded calls and shooting birds that respond and approach closely. This method would result in one to two shots fired during a removal visit. If all birds are not removed in a single visit, or new barred owls reoccupy the site after removal, additional visits and shots may be required, though these would be separated by days or weeks from the initial removal. Removal locations are based on the presence of a territorial barred owl and are likely at least one-half mile or more apart. Barred owls may reoccupy these sites within a single season, therefore one to two additional removals may occur within a single year on some sites.

Monitoring would involve small crews placing ARUs along or near trails. Any use of these monitoring installations in wilderness would be subject to approval through a minimum requirements analysis. These small units are placed off trail and out of site of the trail. They would be placed, serviced, and retrieved each year, resulting in three or more visits to the area by the crews.

The intentional manipulation of wildlife populations would result in negative impacts to untrammelled quality. Monitoring installations, if approved, would negatively impact the undeveloped quality. The sights and sounds of modern human activity needed to implement all alternatives, include gunfire, which would negatively impact solitude or primitive and unconfined recreation. Gunfire, particularly outside of hunting season where wilderness is open for hunting, could also affect natural soundscapes, negatively impacting the natural quality. Removal of barred owls is expected to allow for increasing or stable populations of native northern and spotted owls, which would preserve or improve the natural quality of wilderness (see Section 3.4 Spotted Owls).

These impacts would occur across the areas described in Table 3-36, though removal activity is likely to be focused on areas with trail access. The duration and intensity of barred owl removal would vary depending on the condition of invasive barred owls in the area.

Table 3-36. Expected impacts of barred owl removal on wilderness.

Element of the Action	Expected Impact
manipulation of wildlife populations	negative impact to untrammelled quality
sights and sounds of modern human activity	negative impact to solitude or primitive and unconfined recreation
populations of native species	positive impact to natural quality
populations of non-native species	negative impact to natural quality
unnatural soundscapes	negative impact to natural quality
monitoring installations	negative impact to undeveloped quality

In areas where barred owl populations have been established, survey and removal would occur over multiple years. While we anticipate a reduction in barred owl populations within management areas as a result of removal, the wide distribution of barred owls within the region would persist.

The California spotted owl range, and Sonoma and Marin Counties in the southern end of the northern spotted owl range, are at the front of the barred owl invasion and barred owls are found in very low numbers. Early detection and rapid response is the most effective management approach along an invasion front. Therefore, the approach to barred owl management in these areas would be to regularly survey or monitor for barred owls and removed them as quickly as possible. While surveying would occur across the years, removal efforts would be low intensity and intermittent.

The location, level, and intensity of these impacts would vary by alternatives.

3.7.6 Alternative 2 – Proposed Action – Strategy Implementation

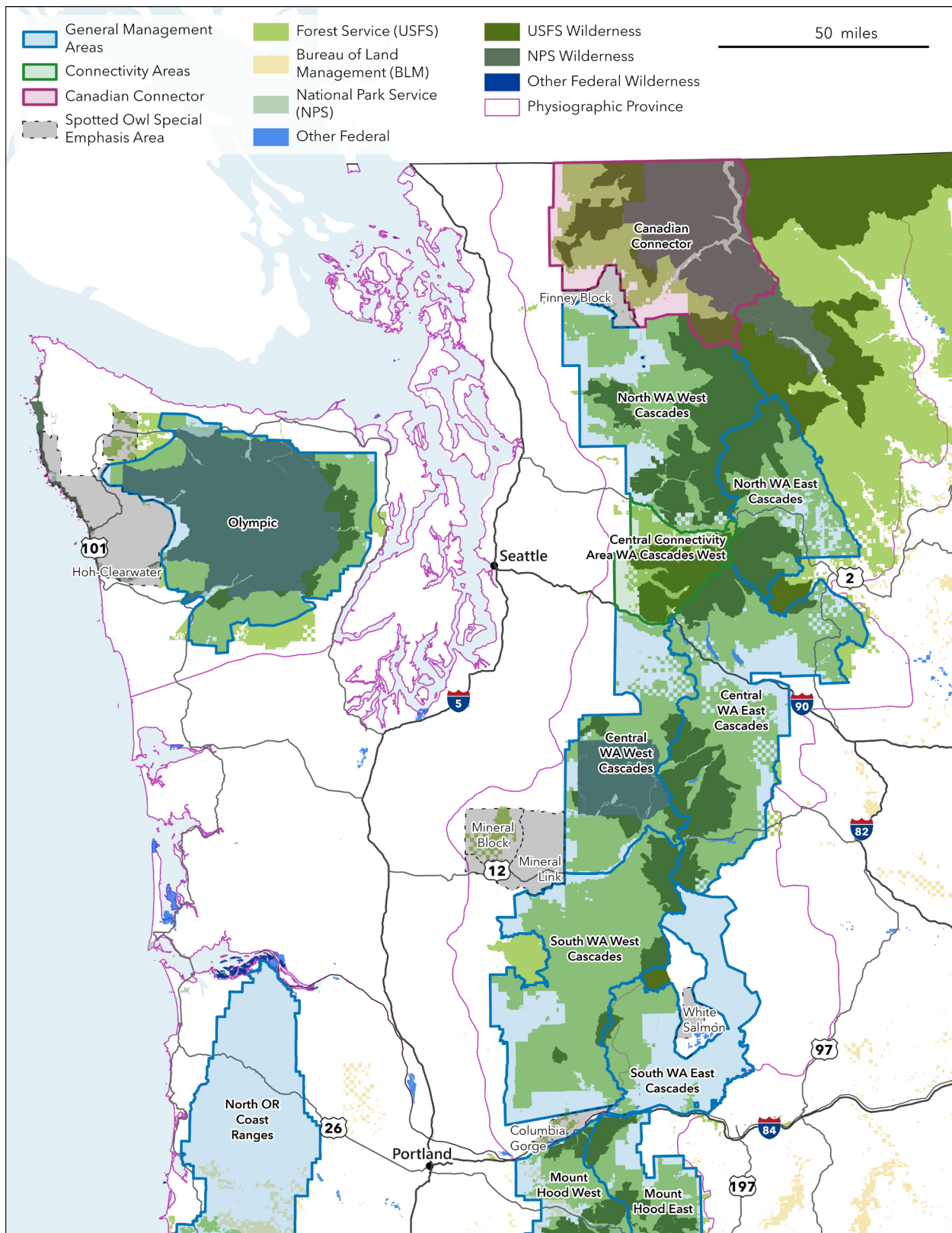
Alternative 2 would include removal of barred owls from management areas across ten provinces in the range of the northern spotted owl. These would include areas around all recently occupied and newly located spotted owl sites, management of portions of General Management Areas based on their priority rating, and management on portions of several Special Designated Areas (see Chapter 2.3.1).

In the range of the California spotted owls, all barred owls located on ongoing or future monitoring, inventory, or survey efforts would be removed as soon as practicable after detection across the range of the subspecies and in forest areas representing the potential invasion pathways into the range. These pathways include the northern Sierra Nevada area, forested areas in the Central Valley, the forested areas between the Coastal-Southern California population and the Sierra Nevada, and in the central coast near the border with the southern end of the California Coast province. Many of these management areas include wilderness.

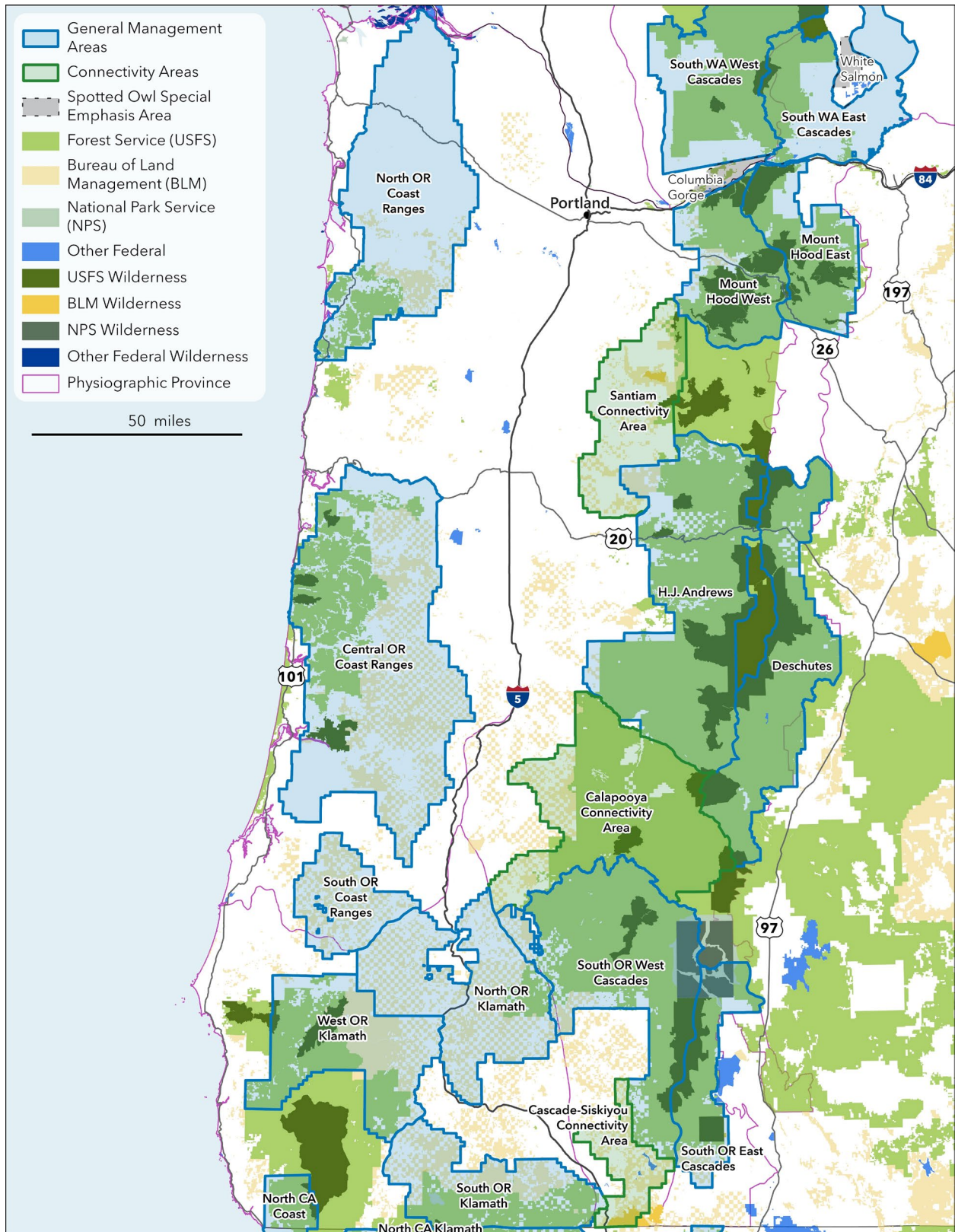
Under Alternative 2 impacts could occur on approximately 7,952,797 acres of designated wilderness and approximately 141,350 acres of wilderness study areas (Maps 3-2, 3-3, 3-4, and 3-5; Tables 3-37 and 3-38) directly involved in barred owls management and additional wilderness outside of barred owl management areas that would potentially be impacted by the loss of northern spotted owls. This would represent 83 percent of the designated wilderness and wilderness study areas within the range of the northern and California spotted owls.

Alternative 2 would have a negative effect on wilderness character on these lands in the following manner. The manipulation of wildlife populations through the removal of individual barred owls would negatively affect the untrammeled quality. The sights and sound of modern human activity, including the presence of additional crews on the landscape for survey, removal, and monitoring, would negatively affect solitude or primitive and unconfined recreation quality. The presence of unnatural soundscapes, including gunfire, and the reduction in the population of non-native species would negatively affect natural quality. The placement of ARUs within the wilderness would have a small but negative effect on undeveloped quality. This alternative would have a positive effect on natural quality of wilderness because native northern and California spotted owl populations would stabilize and potentially increase.

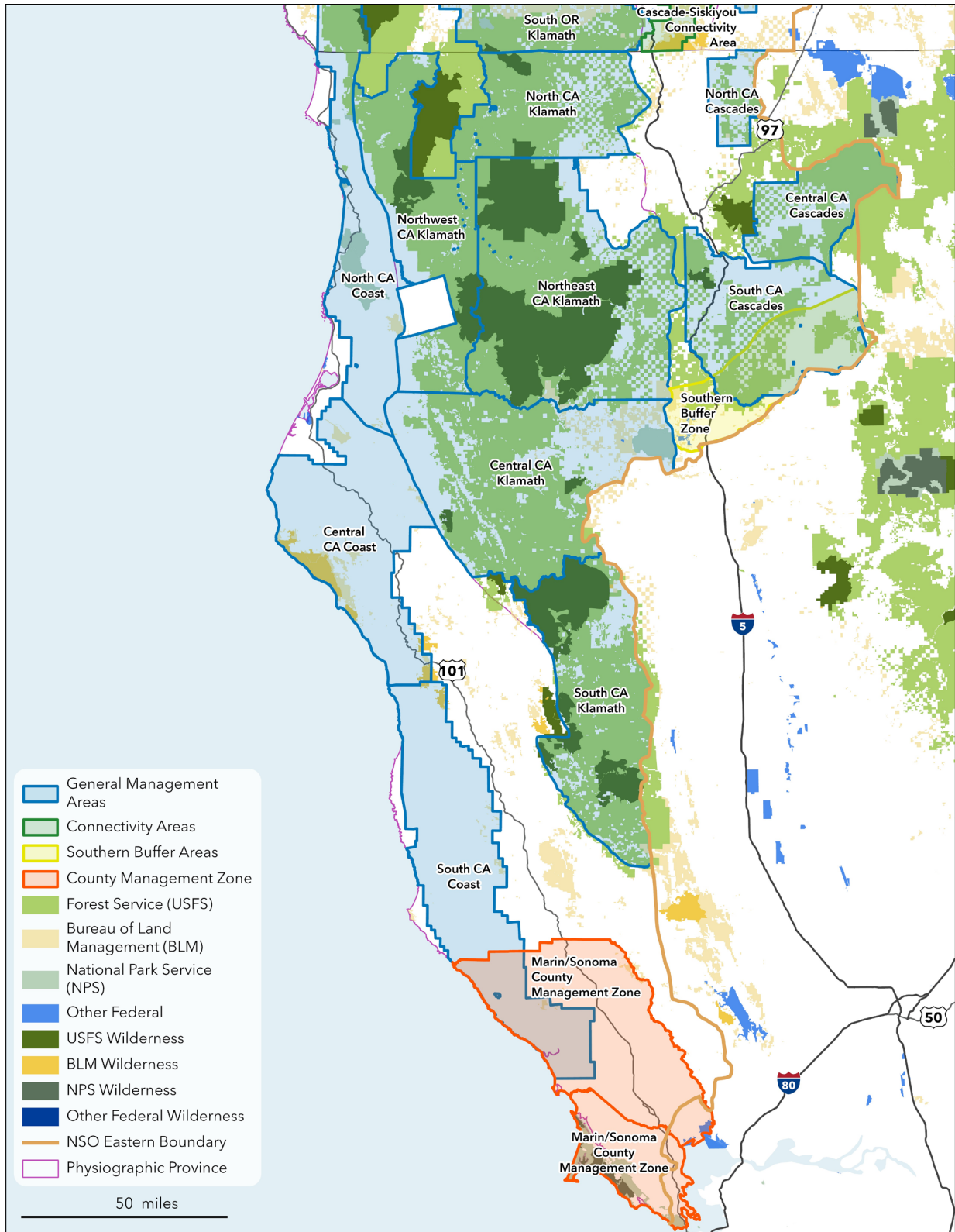
This Alternative would permit action in the second largest amount of wilderness compared to the other action alternatives. The overall effect in those areas would be to preserve wilderness character in the long term by preventing the extirpation of a native species in wilderness areas included in Alternative 2. In wilderness where action would not occur, wilderness character would continue to be adversely affected over the long-term by ever decreasing, and eventually extinction of, spotted owl populations in these wilderness areas.



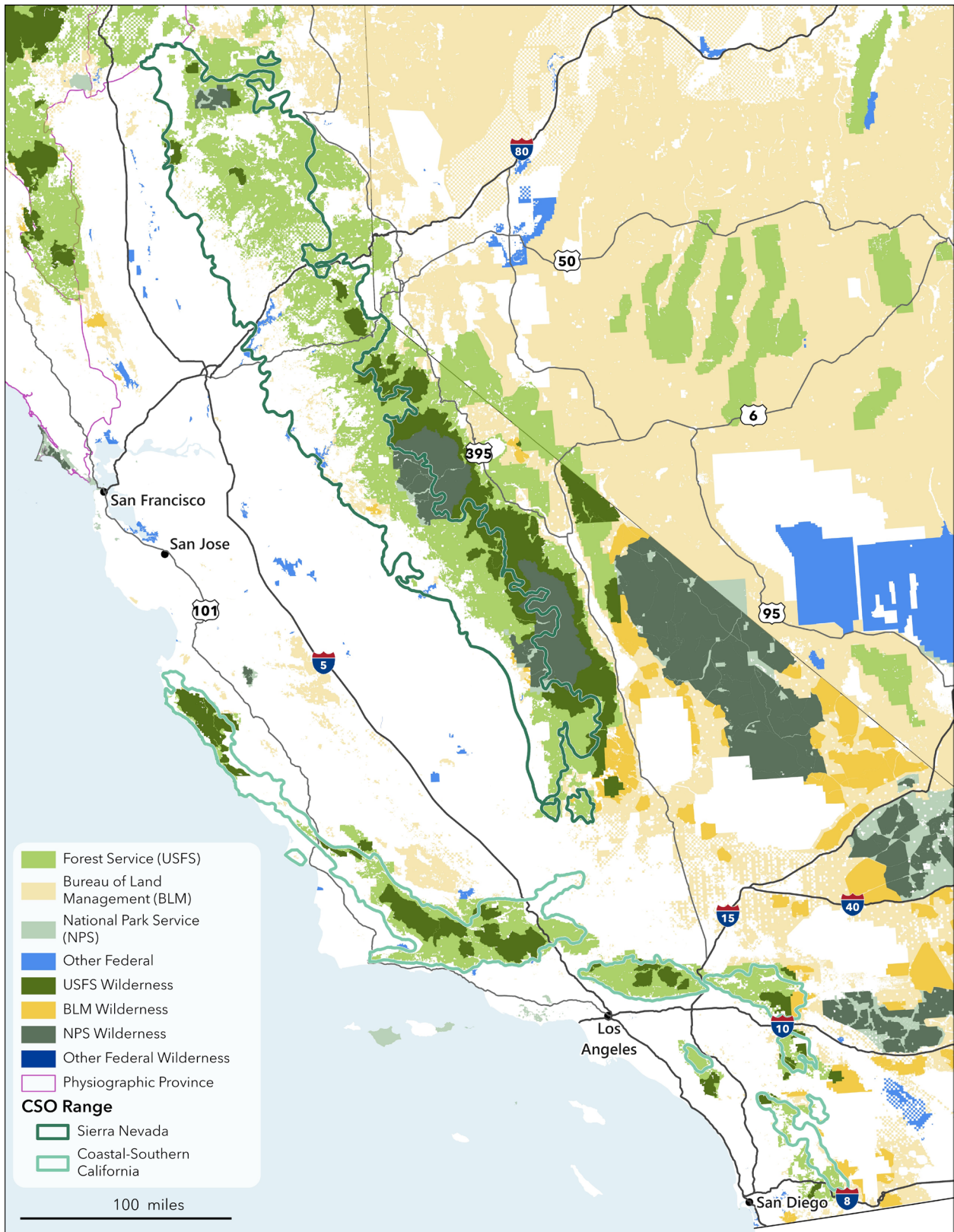
Map 3-2. Wilderness areas within management areas of Alternative 2 – Proposed Action – Strategy Implementation in Washington.



Map 3-3. Wilderness areas within management areas of Alternative 2 in Oregon.



Map 3-4. Wilderness areas within management areas of Alternative 2 in the northern spotted owl range in California.



Map 3-5. Wilderness areas within management areas of Alternative 2 – Proposed Action – Strategy Implementation in California spotted owl range.

Table 3-37. Area of wilderness by management area in Alternative 2 – Proposed Action – Strategy Implementation, northern spotted owl range.

Physiographic Province	GMA or Special Designated Area Name	Acres of Designated Wilderness	Acres Managed for Wilderness Values	Acres of Forest in Wilderness
Olympic Peninsula	Olympic GMA	923,121	0	746,919
	Olympic Hoh-Clearwater SOSEA	0	0	0
Western WA Cascades	Central WA West Cascades GMA	291,873	0	195,521
	South WA West Cascades GMA	115,005	0	89,306
	North WA West Cascades GMA	463,490	0	337,715
	Canadian Connector	689,035	0	384,022
	Central Connectivity Area Washington Cascades West	168,790	0	123,196
	Finney Block SOSEA	0	0	0
	Mineral Block SOSEA	0	0	0
	Mineral Link SOSEA	0	0	0
Eastern WA Cascades	Columbia Gorge SOSEA	0	0	0
	Central WA East Cascades GMA	309,200	14,451	244,753
	North WA East Cascades GMA	270,189	605	166,983
	South WA East Cascades GMA	9,571	0	8,744
OR Coast Ranges	White Salmon SOSEA	0	0	0
	Central OR Coast Ranges GMA	59,225	0	59,196
	North OR Coast Ranges GMA	0	0	0
Western OR Cascades	South OR Coast Ranges GMA	0	580	580
	H.J Andrews GMA	199,595	0	192,950
	South OR West Cascades GMA	97,842	57,082	147,199
	Mount Hood West GMA	157,381	1,001	149,771
	Santiam Connectivity Area	16,019	0	15,855
	Calapooya Connectivity Area	47,987	0	44,386
Eastern OR Cascades	Cascade-Siskiyou Connectivity Area	13,938	0	13,210
	South OR East Cascades GMA	74,514	29,817	93,103
	Deschutes GMA	180,324	0	131,469
OR Klamath	Mount Hood East GMA	104,414	0	91,903
	North OR Klamath GMA	0	0	0
	West OR Klamath GMA	51,599	0	51,275
CA Coast	South OR Klamath GMA	3,789	208	3,989
	North CA Coast GMA	8,347	0	8,327
	Central CA Coast GMA	51,343	0	46,051
	South CA Coast GMA	7,287	0	7,275
	Marin/Sonoma County Management Zone	27,361 ¹	0	14,079 ¹
	Northwest CA Klamath GMA	108,656	0	107,292
	North CA Klamath GMA	28,748	0	27,970

Physiographic Province	GMA or Special Designated Area Name	Acres of Designated Wilderness	Acres Managed for Wilderness Values	Acres of Forest in Wilderness
CA Klamath	Central CA Klamath GMA	15,294	0	15,149
	Northeast CA Klamath GMA	715,090	0	671,375
	South CA Klamath GMA	293,929	635	272,090
CA Cascades	South CA Cascades GMA	11,079	0	8,831
	North CA Cascades GMA	0	0	0
	Central CA Cascades	18	0	18
	Southern Buffer Zone	0	0	0
TOTAL		5,514,053	104,379	4,378,374

¹ The Marin/Sonoma County Management Zone overlaps the South CA Coast GMA. The acres listed here include the overlap and are not included in the total.

Table 3-38. Area of wilderness by California spotted owl population segment in Alternative 2 – Proposed Action – Strategy Implementation, California spotted owl range.

California Spotted Owl Population	Acres of Designated Wilderness	Acres Managed for Wilderness Values	Acres of Forest in Wilderness
Sierra Nevada	1,323,186	32,959	1,168,510
Coastal- Southern California	1,115,558	4,012	931,707
TOTAL	2,438,744	36,971	2,100,217

3.7.7 Alternative 3 – Management Across the Range

Alternative 3 would allow for barred owl management to be implemented anywhere within the range of the northern or California spotted owls or within 15 miles of the range of the subspecies (Map 2.6) on up to 50 percent of the area. For analysis purposes, we assumed that the management would be distributed evenly across the physiographic provinces for the northern spotted owl range, and assumed the 50 percent would be focused largely on the northern portion of the Sierra Nevada. Under this alternative, management would potentially occur in all wilderness within the range of the subspecies and the 15 mile buffer. This includes 12,588,061 acres of designated wilderness and approximately 205,564 acres of wilderness study area. This would represent 100 percent of the wilderness and lands managed as wilderness within the range of the northern and California spotted owls (Tables 3-39 and 3-40).

Alternative 3 would have a negative effect on wilderness character in the following manner. The manipulation of wildlife populations through the removal of individual barred owls would negatively affect the untrammeled quality. The sights and sound of modern human activity, including the presence of additional crews on the landscape for survey, removal, and monitoring, would negatively affect solitude or primitive and unconfined recreation quality. The presence of unnatural soundscapes, including gunfire, and the reduction in the population of non-native species would negatively affect natural quality. The placement of ARUs within the wilderness would have a small but negative effect on undeveloped quality. This alternative would have a positive effect on natural quality of wilderness because native northern and California spotted owl populations would stabilize and potentially increase.

Table 3-39. Area of wilderness by province or population segment in Alternative 3, northern spotted owl range, and 15-mile buffer.

Physiographic Province	Acres of Designated Wilderness	Acres Managed for Wilderness Values	Acres of Forest in Wilderness
Olympic Peninsula	953,230	0	774,254
Western Washington Cascades	1,740,165	0	1,138,785
Eastern Washington Cascades	1,475,574	15,058	933,386
Oregon Coast Ranges	59,241	7,792	61,754
Western Oregon Cascades	768,131	67,032	752,835
Eastern Oregon Cascades	387,794	69,312	354,881
Oregon Klamath	259,193	208	256,261
California Coast	136,217	6,641	120,414
California Klamath	1,291,826	2,146	1,222,571
California Cascades	48,630	0	22,145
15-mile Buffer Area	198,800	25	128,013
TOTAL	7,318,801	168,214	5,765,299

Table 3-40. Area of wilderness by California spotted owl population segment in Alternative 3.

California Spotted Owl Population	Acres of Designated Wilderness	Acres Managed for Wilderness Values	Acres of Forest in Wilderness
Sierra Nevada	1,323,186	32,959	1,168,510
Sierra Nevada 15-mile Buffer	2,471,946	77	783,717
Coastal-Southern California	1,115,558	4,012	931,707
Coastal-Southern California 15-mile Buffer Area	359,240	7,441	106,534
TOTAL	5,269,930	44,489	2,990,468

Barred owl management could occur on all wilderness within the range of the northern and California spotted owls under this alternative, which contains the largest inclusion of wilderness compared to the other action alternatives. The overall effect would be to preserve wilderness character in the long term by preventing the extirpation of a native species in wilderness areas included in Alternative 3.

3.7.8 Alternative 4 – Limited Management by Province/Population

Alternative 4 would allow for barred owl management to be implemented across 100 percent of the highest priority General Management Area or other mapped area in each province within the range of the northern spotted owl (Map 2-7). In the California spotted owl range, barred owl management would be delayed until detections reached 10 percent of surveys in areas within the Sierra Nevada portion of the population, or 5 percent within the southern

California portion of the province. This includes 4,519,085 acres of designated wilderness and approximately 51,422 acres of wilderness study area (Tables 3-41 and 3-42). This would represent 47 percent of the designated wilderness and wilderness study areas within the range of the northern and California spotted owls.

Table 3-41. Area of wilderness by physiographic province and management area in Alternative 4 in the northern spotted owl range.

Physiographic Province	GMA or Special Designated Area Name	Acres of Designated Wilderness	Acres Managed for Wilderness values	Acres of Forest in Wilderness
Olympic Peninsula	Olympic GMA	923,121	0	746,919
Western WA Cascades	Central WA West Cascades GMA	291,873	0	195,521
Eastern WA Cascades	Central WA East Cascades GMA	309,200	14,451	244,753
OR Coast Ranges	Central OR Coast Ranges GMA	59,225	0	59,196
Western OR Cascades	H.J Andrews GMA	199,595	0	192,950
Eastern OR Cascades	Deschutes GMA	180,324	0	131,469
OR Klamath	North OR Klamath GMA	0	0	0
CA Coast	North CA Coast GMA	8,347	0	8,327
CA Klamath	Northwest CA Klamath GMA	108,656	0	107,292
CA Cascades	Southern Buffer Zone	0	0	0
TOTAL		2,080,341	14,451	1,676,353

Table 3-42. Area of wilderness by California spotted owl population segment in Alternative 4.

California Spotted Owl Population	Acres of Designated Wilderness	Acres Managed for Wilderness Values	Acres of Forest in Wilderness
Sierra Nevada	1,323,186	32,959	1,168,510
Coastal- Southern California	1,115,558	4,012	931,707
TOTAL	2,438,744	36,971	2,100,217

Alternative 4 would have a negative effect on wilderness character in the following manner. The manipulation of wildlife populations through the removal of individual barred owls would negatively affect the untrammeled quality. The sights and sound of modern human activity, including the presence of additional crews on the landscape for survey, removal, and monitoring, would negatively affect solitude or primitive and unconfined recreation quality. The presence of unnatural soundscapes, including gunfire, and the reduction in the population of non-native species would negatively affect natural quality. The placement of ARUs within the wilderness would have a small but negative effect on undeveloped quality. This alternative would have a positive effect on natural quality of wilderness because native northern and California spotted owl populations would stabilize and potentially increase.

This Alternative would permit action in less wilderness compared to the other action alternatives. The overall effect in those areas would be to preserve wilderness character in the long term by

preventing the extirpation of a native species in wilderness areas included in Alternative 4. In wilderness where action would not occur, wilderness character would continue to be adversely affected over the long-term by ever decreasing, and eventually extinction of, spotted owl populations in these wilderness areas.

3.7.9 Alternative 5 – Management Focused on Highest Risk Areas

Alternative 5 would focus barred owl management in the northern portion of the northern spotted owl range, where the subspecies is at greatest risk of extirpation from barred owl competition (Map 2-8). Management could be conducted on 100 percent of two GMAs in the Eastern Washington Cascades, Western Washington Cascades, Eastern Oregon Cascades, Western Oregon Cascades, and Oregon Coast Ranges Physiographic Provinces and one GMA in the Olympic Peninsula Physiographic Province. In the California spotted owl range, under this alternative, barred owl management would be limited to the northern Sierra Nevada portion of the subspecies range. This includes 2,725,736 acres of designated wilderness and approximately 101,955 acres in wilderness study areas (Tables 3-43 and 3-44). This would represent 29 percent of the designated wilderness and wilderness study areas within the range of the northern and California spotted owls.

Table 3-43. Area of wilderness by management area in Alternative 5 in the northern spotted owl range.

Physiographic Province	General Management Area	Acres of Designated Wilderness	Acres Managed for Wilderness Values	Acres of Forest in Wilderness
Olympic Peninsula	Olympic	923,121	0	746,919
Western WA Cascades	Central WA West Cascades	291,873	14,451	195,521
	South WA West Cascades	115,005	0	89,306
Eastern WA Cascades	Central WA East Cascades	309,200	0	234,679
	North WA East Cascades	270,189	605	166,706
OR Coast Ranges	Central OR Coast Ranges	59,225	0	59,196
	North OR Coast Ranges	0	0	0
Western OR Cascades	H.J Andrews	199,595	0	192,950
	South OR West Cascades	97,842	57,082	93,603
Eastern OR Cascades	South OR East Cascades	74,514	29,817	67,285
	Deschutes	180,324	0	131,469
OR Klamath	none	0	0	0
CA Coast	none	0	0	0
CA Cascades	none	0	0	0
CA Klamath	none	0	0	0
TOTAL		2,520,888	101,955	1,977,634

Table 3-44. Area of wilderness by California spotted owl population segment in Alternative 5.

California Spotted Owl Population	Acres of Designated Wilderness	Acres Managed for Wilderness Values	Acres of Forest Habitat in Wilderness
Sierra Nevada	204,848	0	193,679
Coastal- Southern California	0	0	0
TOTAL	204,848	0	193,679

Alternative 5 would have a negative effect on wilderness character in the following manner. The manipulation of wildlife populations through the removal of individual barred owls would negatively affect the untrammeled quality. The sights and sound of modern human activity, including the presence of additional crews on the landscape for survey, removal, and monitoring, would negatively affect solitude or primitive and unconfined recreation quality. The presence of unnatural soundscapes, including gunfire, and the reduction in the population of non-native species would negatively affect natural quality. The placement of ARUs within the wilderness would have a small but negative effect on undeveloped quality. This alternative would have a positive effect on natural quality of wilderness because native northern and California spotted owl populations would stabilize and potentially increase.

This Alternative would permit action in less wilderness compared to the other action alternatives. The overall effect in those areas would be to preserve wilderness character in the long term by preventing the extirpation of a native species in wilderness areas included in Alternative 5. Within wilderness not included in the alternative, wilderness character would continue to be adversely affected over the long-term by ever decreasing, and eventually extinction of, spotted owl populations in these wilderness areas.

3.7.10 Alternative 6 – Management Focused on Best Conditions

Alternative 6 would focus barred owl management in the southern portion of the northern spotted owl range, where spotted owl populations have not decreased to the degree they have in the north (Map 2-9). Management could occur on up to 75 percent of each GMA in the Oregon Klamath, California Coast, California Klamath, and California Cascades provinces. In the California spotted owl range, under this alternative, barred owl management would be focused on areas with the best remaining habitat and areas with higher fire resiliency, including 50 percent of the Sierra Nevada portion of the range with the best remaining habitat, and the 75 percent of the Coastal-Southern California portion of the range. This includes 37,814 acres of designated wilderness and approximately 3,761,284 acres of wilderness study area (Tables 3-45 and 3-46). This would represent 39 percent of the designated wilderness and wilderness study areas within the range of the northern and California spotted owls.

Alternative 6 would have a negative effect on wilderness character in the following manner. The manipulation of wildlife populations through the removal of individual barred owls would negatively affect the untrammeled quality. The sights and sound of modern human activity, including the presence of additional crews on the landscape for survey, removal, and monitoring, would negatively affect solitude or primitive and unconfined recreation quality. The presence of unnatural soundscapes, including gunfire, and the reduction in the population of non-native species would negatively affect natural quality. The placement of ARUs within

the wilderness would have a small but negative effect on undeveloped quality. This alternative would have a positive effect on natural quality of wilderness because native northern and California spotted owl populations would stabilize and potentially increase.

This Alternative would permit action in the smallest area of designated wilderness of the Action Alternatives. The overall effect in those areas would be to preserve wilderness character in the long term by preventing the extirpation of a native species in wilderness areas included in Alternative 6. Within wilderness not included in the alternative, wilderness character would continue to be adversely affected over the long-term by ever decreasing, and eventually extinction of, spotted owl populations in these wilderness areas.

Table 3-45. Area of wilderness by management area in Alternative 6 in the northern spotted owl range.

Physiographic Province	GMA or Special Designated Area Name	Acres of Designated Wilderness	Acres Managed for Wilderness Values	Acres of Forest in Wilderness
Olympic Peninsula	none	0	0	0
Western WA Cascades	none	0	0	0
Eastern WA Cascades	none	0	0	0
OR Coast Ranges	none	0	0	0
Western OR Cascades	none	0	0	0
Eastern OR Cascades	none	0	0	0
OR Klamath	North OR Klamath GMA	0	0	0
	West OR Klamath GMA	51,599	0	51,275
	South OR Klamath GMA	3,789	208	3,781
CA Coast	North CA Coast GMA	8,347	0	8,327
	Central CA Coast GMA	51,343	0	46,051
	South CA Coast GMA	7,287	0	7,275
	Marin/Sonoma County Management Zone	27,361 ¹	0	14,079 ¹
CA Klamath	Northwest CA Klamath GMA	108,656	0	107,292
	North CA Klamath GMA	28,748	0	27,970
	Central CA Klamath GMA	15,294	0	15,149
	Northeast CA Klamath GMA	715,090	0	671,375
	South CA Klamath GMA	293,929	635	271,516
CA Cascades	South CA Cascades GMA	11,079	0	8,831
	North CA Cascades GMA	0	0	0
	Central CA Cascades	18	0	18
	Southern Buffer Zone	0	0	0
TOTAL		1,322,540	843	1,232,939

¹ The Marin/Sonoma County Management Zone overlaps with South California Coast GMA. The acres are not included in the total.

Table 3-46. Area of wilderness by California spotted owl population segment in Alternative 6.

California Spotted Owl Population	Acres of Designated Wilderness	Acres Managed for Wilderness Values	Acres of Forest Habitat in Wilderness
Sierra Nevada	1,323,186	32,959	1,168,510
Coastal- Southern California	1,115,558	4,012	931,707
TOTAL	2,438,744	36,971	2,100,217

3.7.11 Summary of Effects by Alternative

Table 3-47 displays the potentially affected wilderness for each alternative.

Alternative 1, the No Action Alternative, would have no effect on the untrammled, undeveloped, solitude or primitive and unconfined recreation, and other features of value qualities of wilderness, but an adverse effect on the natural quality of wilderness because native northern and California spotted owl populations would continue to decline or be locally extirpated while barred owls persist or increase in wilderness.

Because barred owls are a forest species, we used acres of forest lands within designated wilderness and wilderness study areas for this summary. This is the acreage on which potential management activities would occur. Alternative 3 has the highest potential impacts on wilderness, both positive and negative, as it includes potential management across all designated wilderness areas and wilderness study areas within the ranges of the northern and California spotted owl and a 15-mile-wide buffer around their respective ranges. Of the action alternatives, Alternative 6 has the lowest area of designated wilderness areas and wilderness study areas in the northern spotted owl range at 22 percent and Alternative 5 has the lowest for the California spotted owl at 10 percent.

Table 3-47. Summary of effects of the alternatives on wilderness.

Wilderness Effects	Alternative					
	1 - no action	2	3	4	5	6
Northern Spotted Owl						
Acres of forest lands in designated wilderness within management	0	4,378,374	7,318,131	1,676,353	1,977,634	1,232,939
Percent of designated wilderness forest lands under potential management	0	79%	100%	30%	36%	22%
Distribution of designated wilderness management across the range of spotted owl	None	Entire	Entire plus buffer	Entire	North only	South only
California Spotted Owl						
Acres of wilderness forest lands under potential management	0	2,100,217	5,269,930	2,100,217	193,679	2,100,217
Percent of wilderness forest lands under potential management	0	100%	100%	100%	10%	100%
Distribution across range	None	Entire	Entire plus buffer	Entire but delayed	Northern Sierra Nevada only	Entire

3.8 Socioeconomics

Our discussion of the effects of the proposed management of barred owls on socioeconomic resources is focused on the range of the northern and California spotted owls, and adjacent areas described for management where these actions occur. The following documents our evaluation of the potential for barred owl management under the various alternatives to impact timber harvest levels and associated income and employment.

3.8.1 Background and Analytical Methods

3.8.1.1 Costs of Barred Owl Management

We considered the cost of barred owl management under each alternative. The potential cost of barred owl removal is highly variable. Implementation of any of the alternatives would be spread across many different agencies and entities and over a three-state area. Each entity would have their own approach to staffing, ability to absorb the costs, and internal requirements. The cost of

barred owl removal would be heavily dependent on the specific areas chosen for implementation and the conditions of the areas, and would vary widely based on size and habitat condition of the implementation area, the staffing approach for removal, vehicle costs and the location of staff in relationship to the management area, density of barred owls, and accessibility of the management area.

Management areas under all alternatives would vary in size, from small blocks around spotted owl sites or barred owl detections to large focal management areas. Barred owl management across larger areas would cost more than smaller areas, but depending on other conditions, could have a lower cost per unit area due to efficiencies gained with size. Because removal would be generally limited to forested areas, management areas with significant non-forested inclusions would require less work than densely forested management blocks of the same size.

Staffing would be the primary cost component of any barred owl removal. Costs would vary greatly depending on the approach to staffing. Where removal could be done with existing personnel as part of larger work responsibilities, the cost would be lower. Hiring individuals, even seasonal workers, would increase the cost. Contracting would likely increase the cost further. A secondary component of cost would come from vehicle needs. Most barred owl removal would occur at night, and where entities conducted removal with existing staff and existing vehicles costs would be lower than where dedicated crews or contractors needed dedicated vehicles. Vehicle costs would also be affected by the proximity of removal specialists to the removal area.

The density of barred owls would impact the potential cost as well. Where barred owl densities were very low and removal would be focused on detected individual barred owls (e.g. California spotted owl range, Sonoma and Marin Counties), removal over a large area could be accomplished by training existing staff at minimal cost. Where barred owl density was high, removal would require multiple visits per year, increasing the cost for staff and vehicles. The availability of road access would substantially impact the cost of barred owl removal. Where road density was high and roads were easily accessed, individual removal specialists would be able to cover a larger area per night than where road density was lower. In areas where access was limited to trails, the area covered by each removal effort would be lower, but the number of visits per year would likely be lower. Access would also be affected by weather. If barred owl management areas included higher elevation lands, these would remain snowbound into the removal season, shortening the removal period and reducing costs. In general, the removal period for barred owls would range from five to eight months, depending on weather and access.

Given the complexity of factors affecting barred owl removal costs, we did not attempt to estimate costs for each alternative as such estimates would not provide accurate and meaningful information to the public, entities seeking to implement barred owl management, or the decisionmaker.

3.8.1.2 Socioeconomic costs-timber harvest

The proposed action, involving management of invasive barred owls, was developed to support conservation of the native spotted owl. The intended outcome of barred owl management is for

spotted owl populations to stabilize and increase, recolonizing areas where they have been previously excluded by barred owls. We analyzed the effects of this on the economy of the region.

This outcome is unlikely to have any effect on most aspects of the diverse economy of the West Coast (Washington, Oregon, and California), with the possible exception of commercial timber harvest and the revenues, income, and employment associated with that harvest. As stated in Chapter 2.3 and Section 3.8.5, the alternatives in this EIS do not require any entity to implement barred owl management or change any land management plan or agreements, and can generally be applied in concert with existing land management.

Spotted owl colonization of new sites, or the return to areas where they have been previously excluded, could result in a change in the potential forest management of tracts of land in the immediate vicinity of the new or reoccupied site. This is because in general, the take of northern spotted owls is prohibited under Section 9 of the ESA. “Take” includes “harm” which the Service defines to mean “an act which actually kills or injures wildlife” and that can include “significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding or sheltering.” 50 C.F.R. 17.3 (“harm”). Thus, to avoid violating the ESA, non-Federal entities conducting timber harvest need to avoid incidental take unless that take is otherwise authorized (for example, via a Habitat Conservation Plan (HCP)). For Federal actions, incidental take is exempted from the section 9 prohibition, as long as the Federal action has undergone section 7 consultation and it does not violate the prohibition under ESA section 7(a)(2) against “jeopardizing” listed species such as the northern spotted owl, which is discussed further below. However, Federal agencies must minimize the impact of any incidental take. Thus, the effect of increasing the number of spotted owl sites on the landscape would reasonably be expected to result in some change to timber harvest on those forests associated with the newly-occupied or reoccupied spotted owl sites if they were previously open to timber harvest. The level and type of effect would depend on ownership, current laws, and management direction. Timber harvest levels could be impacted if, and to the extent that, the presence of reoccupied or new spotted owl sites required changes in timber management under Federal or State laws, regulations, or rules, or as directed in existing management plans.

Any such effects would be small in the near term, because an increase in spotted owl population resulting from the removal of barred owl would likely be slow and occur over a period of years. For entities that manage large forest tracts, including Federal agencies, a rebounding spotted owl population could actually increase flexibility to harvest timber. As discussed further below, this is because the current declines in northern spotted owl populations mean effects of Federal actions on those declining populations are more impactful than they would be in a healthier population, leading to constraints in Federal actions to ensure jeopardy is avoided and incidental take minimized.

To analyze the potential effect of the alternatives on socioeconomic issues, we make the following assumptions.

- We anticipate that spotted owls would reoccupy historical sites once barred owls are

removed. These sites have proven their ability to sustain spotted owls in the past, and based on earlier barred owl removal experiments, are the first places reoccupied by spotted owls when barred owls are removed (Diller et al. 2016, p. 12-13; Hofstadter et al. 2022, p. 5).

- Spotted owls, when recolonizing areas, would choose those with greater levels of habitat (nesting, roosting, and foraging condition) available in the area. In most areas and provinces, these conditions would be generally better on Federal lands (particularly those areas reserved from commercial timber harvest), State lands where timber harvest is constrained, and other areas that are not open for commercial timber harvest.
- We do not anticipate that any landowner or manager would change their management designations as a result of this action. Likewise, this action would not require or assume any changes in Federal or State regulations as a result of implementing this action.

Potential economic effects would be driven by the location of newly occupied or reoccupied spotted owl sites. These effects on commercial timber harvest would occur as a result of complying with the requirements of State-based forest regulations (described in Section 3.8.5 for State and private lands) and avoidance or minimization of take of spotted owls under the ESA as described above. While we can project the likely number of these sites, we cannot identify their specific location. Thus, the analysis of socioeconomic effects is, by necessity, qualitative and descriptive.

3.8.2 Affected Environment

As described in Chapter 3.6, barred owl management under any of the action alternatives could take place on a variety of land ownerships and managements, including Federal, State, Tribal, and other non-Federal lands. In this chapter, we focus on lands where timber harvest currently occurs; primarily BLM and Forest Service timberlands, State forest lands, and private lands.

3.8.3 Environmental Consequences

The following sections present the potential environmental effects of the no action alternative, proposed action, and alternatives on socioeconomic conditions.

3.8.4 Alternative 1 – No Action Alternative

Under the no action alternative, barred owl populations would continue to increase and displace northern spotted owls, leading to a continuing steep decline in northern spotted owl populations. This would reasonably be expected to lead to an increase in the need for protection of the remaining occupied spotted owl sites, particularly on Federal lands where agencies have species conservation responsibilities under Section 7(a)(1) of the ESA and a requirement to consult with the Service under 7(a)(2). The need for increased protections would likely be especially pronounced in areas where northern spotted owl populations are already greatly reduced. As increased protections became necessary, this would potentially result in additional limitations on commercial timber harvest in and around occupied spotted owl sites, though the degree, location, and duration of the limitation would be dependent on the specific location, surrounding habitat, population condition, and current management direction of those lands.

For Federal actions, this means timber harvest may be increasingly constrained in the vicinity of the few remaining occupied sites because effects to the remaining individuals carry an outsize impact to the subspecies for consideration in an ESA section 7(a)(2) jeopardy analysis. However, Federal lands, including those managed by the U.S. Forest Service under the Northwest Forest Plan, and BLM lands managed under its RMPs, provide significant habitat protection for spotted owls, and so in those areas, the need for protection of remaining individuals may be consistent with existing land management direction. Where northern spotted owl sites remain in protected areas, such as National Parks or land use plan-level reserved areas, no impact on commercial timber harvest would occur. Increased protections would have a greater economic effect on lands currently open for timber harvest and commodity resource uses.

Conversely, on non-Federal timberlands, the declining number of northern spotted owls on the landscape would lead to a lower likelihood of incidentally killing or injuring a spotted owl through significant habitat modification, and thus fewer ESA-related restrictions. For fully non-Federal actions that are not subject to the jeopardy standard, the potential for effects to commercial timber harvest from occupied spotted owl sites could decline as the number of occupied sites continues to decline.

Thus, under the no action alternative, the effect of northern spotted owl protections on commercial timber harvest and associated socioeconomic impacts to communities through loss of revenue and employment may increase, decrease, or remain the same depending on the location of the remaining spotted owl sites. In Washington and northern Oregon especially, where spotted owl populations have declined to low or very low levels, few occupied spotted owl sites remain.

In the California spotted owl range, continuing invasion of barred owls into the range would lead to declines in spotted owl populations. If the proposed listing was finalized, as populations declined over time, additional restrictions related to ESA compliance would be likely.

Based on the above, we anticipate that there would be a small reduction in timber harvest levels under the no action alternative, which would last until spotted owl populations were extirpated from a particular area.

3.8.5. Effects Common to All Action Alternatives

The proposed action and alternatives assume ongoing management of lands within management areas, and do not require landowners or managers to take any specific action. We would not anticipate that any landowner or manager would change their management designations as a result of this action. Likewise, this action would not require or assume any changes in Federal or State regulations.

As explicitly stated in Chapter 2, for all action alternatives, barred owl management would only occur on lands of willing landowners or land managers. We assume that landowners would evaluate the potential impact on timber harvest as part of their decision to engage in or allow barred owl removal. If there are potential economic impacts of concern to a non-Federal

landowner or land manager, including effects on timber harvest, resulting from the potential increase in occupied spotted owl sites in barred owl management areas, they could apply to the Service for incidental take authorization under section 10 of the ESA (e.g. an HCP). In areas of mixed ownership, the actions of one landowner may affect neighboring landowners, at least those within the vicinity of the reoccupied spotted owl site.

Potential effects from barred owl management on timber harvest involves two factors: the reasonably foreseeable changes in spotted owl populations resulting from barred owl management and the effect those changes are likely to have on timber harvest.

Spotted owl population growth and reoccupancy

As described in Section 3.4, the likely potential result of barred owl management under any action alternative would be a relatively slow increase in the number of spotted owls within the managed area, and the reoccupancy of spotted owl sites within those managed areas that were currently unoccupied due to competition from territorial barred owls. Spotted owl populations would be relatively slow to expand because of their slow reproductive rate and high fledgling mortality. Under each action alternative, this population growth would be limited to areas with barred owl management and where barred owls had previously displaced spotted owls from their territories, resulting in the decline of spotted owl populations. Outside of barred owl management areas, spotted owl populations would be expected to continue to decline as a result of barred owl competition.

Within the barred owl management areas, spotted owls would be most likely to reoccupy sites with the highest quality habitat and avoid marginal sites. On barred owl removal experiments conducted across the range of the northern and California spotted owls, recolonizing spotted owls generally reoccupied past known spotted owl sites. There are insufficient data to allow us to predict specifically where individual spotted owls would settle; however, we can estimate the distribution in relationship to the availability of spotted owl habitat on different landownerships (Table 3-48).

In the range of the California spotted owl, barred owls are at the cusp of invasion and have not yet demonstrably impacted spotted owl populations. As a result, management of barred owls in the California spotted owl range would not likely result in an increase in occupied spotted owl sites and would therefore have no reasonably foreseeable impact on timber harvest. Therefore, the remainder of this analysis is limited to the northern spotted owl range.

Table 3-48. Distribution of northern spotted owl suitable habitat by province and land ownership.

Physiographic Province	Northern Spotted Owl Habitat in Acres	Percent of Northern Spotted Owl Suitable Habitat by Ownership				
		Federal	State	Tribal	Other Government	Private
Olympic Peninsula	849,431	85%	9%	2%	<1%	4%
Western Washington Cascades	1,604,611	84%	9%	<1%	<1%	7%
Eastern Washington Cascades	738,379	74%	7%	9%	<1%	10%
Oregon Coast Range ¹	861,739	66%	13%	-	<1%	21%
Western Oregon Cascades ¹	2,302,374	91%	<1%	0%	<1%	10%
Eastern Oregon Cascades	324,234	83%	1%	10%	1%	5%
Oregon Klamath	1,306,674	76%	1%	<1%	<1%	23%
California Coast	1,148,503	11%	11%	1%	5%	72%
California Klamath	1,603,832	79%	<1%	4%	<1%	17%
California Cascades	297,310	57%	1%	<1%	<1%	41%
TOTAL	11,037,087	73%	5%	2%	<1%	20%

¹ For this analysis, the Oregon Coast Range and Western Oregon Cascade provincial data do not include the adjacent Willamette Valley province as this vastly overestimated private forest lands.

Federal timber harvest under the Endangered Species Act

All Federal agencies are required to consult with the Service (or National Marine Fisheries Service) on actions that may affect a species listed under the ESA, such as northern spotted owls. Consultations are based on the status of the species, the environmental baseline, the effects of the proposed action, and cumulative effects as defined in the ESA. Impacts on individuals of a listed species, including any anticipated take, are part of the effects of the action considered in determining if an action could jeopardize the continued existence of the listed species.

“Jeopardize the continued existence” is defined as engaging in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, number, or distribution of that species (50 C.F.R. § 402.02). If the Service determines that a Federal action is likely to jeopardize the species, the Service works with the action agency to develop reasonable and prudent alternatives that meet the purpose of the action without jeopardizing the species. Reasonable and prudent alternatives are consistent with the intended purpose of the action, within the scope of the Federal agency's legal authority and jurisdiction, and economically and technologically feasible (50 CFR 402.02).

Although we cannot predict the results of future consultations regarding proposed Federal timber projects, we anticipate that initially, barred owl management would not substantially change the outcome of consultations because the expected increase in spotted owl populations would be

slow. Given the current status of the northern spotted owl, we expect Federal agencies would continue to design timber harvest projects and active management for fire resilience to avoid jeopardizing the species. Over time, as northern spotted owl subpopulations rebound inside managed areas and the resiliency of these individuals and subpopulations increases, we expect Federal agencies may have more flexibility in where and how land is managed, including the potential to expand timber harvest, without the risk of jeopardizing the species.

Federal timber harvest under Federal land management plans

Most spotted owl habitat in the range of the northern spotted owl is found on Federal lands (73% range-wide) (Table 3-48). On Federal lands, any effect on timber harvest from reoccupancy of spotted owl sites would be based on both individual requirements of existing land management plans of the agencies and requirements under the ESA through Section 7 consultation as described above.

Wilderness Areas, National Park lands and National Wildlife Refuges do not have scheduled commercial timber harvest. Thus, changes in spotted owl populations on these lands would not be expected to affect commercial timber harvest and they are eliminated from further discussion.

In Oregon, BLM's current Resource Management Plans and associated consultations do not allow the incidental take of spotted owls by timber harvest until the BLM and the Service jointly determine that implementation of a barred owl management program has begun. With the implementation of barred owl management, this prohibition against incidental take would end. However, BLM timber harvest levels are determined by the declared Allowable Sale Quantity and that timber harvest level would not change with the end of the take prohibition. Therefore, there would be no reasonably foreseeable positive or negative impacts on timber harvest levels and associated effects to socioeconomic conditions under Oregon BLM land management plans as a result of spotted owl sites reoccupied following implementation of barred owl management.

In northern California, BLM lands in the range of the northern spotted owl have limited commercial timber harvest. These lands are currently managed under the Northwest Forest Plan as adopted in the Redding and Arcata Resource Management Plans (BLM 1993, BLM 1992) which are currently being revised under the Draft Northwest California Integrated RMP (88 FR 67344). No change in forest management would likely occur if new or reoccupied sites were found following barred owl management.

National Forest land use plans do not contain the no-take provision described in the Oregon BLM Resource Management Plans. The National Forest plans do contain significant areas managed as reserved areas, including Congressionally designated wilderness and areas managed as late successional reserves, as well as other reserved lands identified at the regional and National Forest level. Late successional reserves have been managed since 1994 for the development of late successional forest, which provides high quality habitat for spotted owls. Thus, these reserved areas generally contain higher quality and density of habitat and are the most likely place for spotted owl reoccupancy of sites within barred owl management areas, with the exception of areas that have burned in hot, stand-replacing fires within these reserves. While these reserves do not include scheduled timber harvest, timber is occasionally removed,

particularly where it is needed to accomplish fire risk reduction or accelerate the development of late successional forest characteristics. Depending on how individual Forest Plans and Late Successional Reserve Assessments incorporate spotted owl habitat protections, it is possible that an increase in occupied spotted owl sites within reserved areas could result in a small and unpredictable potential reduction in commercial timber harvest in these areas.

Scheduled commercial timber harvest on National Forests in the range of the northern spotted owl is primarily restricted to lands allocated as “matrix.” The reoccupancy of a spotted owl site in the matrix would not change the overall management allocation in existing plans, though it could lead to changes in how specific areas around these sites would be managed. If spotted owls do reoccupy sites on matrix lands, the potential for effects on timber harvest would depend on individual Forest-level decisions and interagency consultation under the ESA, described below. The level of impact would be dependent on the location and number of reoccupied sites. Based on the slow projected growth of spotted owl populations, and the likelihood of reoccupancy on the reserved areas where lands have been managed to provide high-quality habitat, the number of sites reestablished within matrix lands is likely to be small, leading to a small, but unpredictable, reduction in timber harvest in some alternatives.

State land timber harvest

State lands in Washington contain between seven and nine percent of the remaining spotted owl habitat by province. The State-managed lands that are subject to scheduled timber harvest are managed by the Washington State Department of Natural Resources (WDNR). The WDNR completed the State Trust Lands HCP in 1997. This ecosystem-based forest management plan addresses forest management and other activities on the State trust lands WDNR manages for revenue for the respective Trusts, and includes measures for the development and protection of spotted owl habitat. Under this HCP, a small increase in the number of occupied spotted owl sites on these lands would have minimal economic effects on the respective Trusts. The WDNR State Trust Lands HCP is based on providing older forests in various zones to minimize and mitigate the effects of timber harvest to spotted owls and other species utilizing older and more complex forests. The primary potential economic impact of newly reoccupied spotted owl sites would result from a seasonal restriction on timber harvest. This restriction would affect timber harvest within 0.7 miles of active nests during the breeding season on lands defined in the HCP as designated for a conservation role for the spotted owl, and within a 70-acre area around active nests for lands not designated for a spotted owl conservation role. In both cases, the harvest could move forward after the nesting season or following the failure of such active nests. Therefore, the net change in timber harvest and associated economic activity would be minimal. Under Alternative 6, there would be no effect to timber harvest on State lands in Washington, because this alternative does not include barred owl management in Washington.

In Oregon, State lands include 13 percent of the spotted owl habitat in the Oregon Coast Ranges, and 1 percent or less in the other provinces. State lands subject to scheduled timber harvest are managed by the Oregon Department of Forestry (ODF) and Oregon Department of State Lands. Under the current land use plans, the ODF avoids take of spotted owls. Depending on the condition of the landscape, this may, in some cases, result in modification of timber harvest plans and constrain the management of some forest stands within 1.2 to 1.5 miles of the site center

depending on the location. This is dependent on the condition of the surrounding lands, the level of habitat available, and the availability of options for timber harvest. Given the low likelihood of a large increase in the spotted owl population and the ability of ODF to adjust harvest across their large ownership to accommodate the slow increase in spotted owl sites, we would expect only minor potential reductions in timber harvest on ODF lands should they implement barred owl management. In addition, ODF has prepared a draft HCP in support of an application for an incidental take permit from the Service (and the National Marine Fisheries Service) for its forest management activities. If the Service ultimately issued an incidental take permit, this would address forest management in spotted owl sites on ODF lands. In this case, depending on the details of the final HCP and the incidental take permit, it is possible that increases in the number of occupied spotted owl sites on State lands, resulting from implementation of any of the action alternatives, would not result in any change to timber harvest levels.

In California, State lands contain from less than 1 percent to 11 percent of the spotted owl habitat in the provinces. The primary State lands subject to scheduled timber harvest in the northern spotted owl range are in the Jackson State Demonstration Forest, managed by the California Department of Forestry and Fire Protection (Cal FIRE). Potential habitat is surveyed prior to timber harvest and any spotted owl sites are protected. Once sites are established, site-specific management continues, even if the site becomes unoccupied. Given that displaced spotted owls would most likely reoccupy former sites that were cleared of barred owls in areas under barred owl management, and these known spotted owl sites are managed as if occupied, barred owl management under any of the action alternatives would not likely lead to a reduction in timber harvest on these lands. Some timber is removed at times from California State Parks and California Department of Fish and Wildlife lands as part of management for fire protection, improving fire resiliency, and restoring forests, to which the same forest practices management applies. Therefore, we would not expect any of the action alternatives to result in any reduction in timber harvest on these lands, either.

Private land timber harvest

Under the Federal ESA, take of northern spotted owls is prohibited for private individuals, unless it is authorized under section 10 of the ESA (for example, through an HCP). Take of northern spotted owls includes activities which actually kill or injure a northern spotted owl by significantly impairing essential behavioral patterns, including breeding, feeding or sheltering. This impairment can be a result of significant habitat modification or degradation.

As noted above, we anticipate that spotted owls would reoccupy sites with the best remaining habitat. As Table 3-48 demonstrates, with the exception of the California Coast province, where 72 percent of the spotted owl habitat is found on private lands, the majority of suitable habitat is on Federal lands. In the California Cascades, Oregon Klamath, California Klamath, and Oregon Coast Ranges provinces, between 17 and 41 percent of the spotted owl habitat is found on private lands. In all other provinces, 10 percent or less of spotted owl habitat is found on private lands. Outside of the California Coast province, we anticipate that as spotted owls reoccupied sites where barred owls had been removed, under any of the action alternatives, most of these sites would not have their core areas on private lands. This would especially be true in all provinces in Washington and in the Eastern Oregon Cascades and Western Oregon Cascades

provinces, as these are the provinces where private lands encompass less than 10 percent of all spotted owl habitat.

Impacts to private timber harvest from spotted owl reoccupation on private lands would be dependent on many factors, including how individual lands are managed for timber harvest or other uses, State and local regulations, and the conditions of any incidental take permits in the landowner's possession, as well as the distribution and quality of habitat on private lands and any neighboring public lands.

Washington State designated Spotted Owl Special Emphasis Areas (SOSEAs) for demographic and dispersal support of Federal spotted owl management efforts. State regulations related to the protection of spotted owl sites are tied to these SOSEAs. Within SOSEAs, spotted owl sites (known as of July 1, 1996, when the regulations went into effect) continue to be protected (WAC 222-10-041(4)). If spotted owls reoccupied these site centers, there would be no effect on private timber harvest. If spotted owls returned to a site but used a significantly different core areas within the site, the circle defining the area of protection would be shifted, potentially including previously unencumbered lands but also freeing up a comparable amount of land (Buchanan & Swedeen 2005). Given that the released lands would have been protected, it is likely that they would have comparable, if not greater, timber value than the newly protected lands. A totally new site would potentially encumber some timber lands, though the likelihood that habitat remains sufficient to attract a spotted owl outside of currently protected sites is very low. It is much more likely that any new spotted owls would settle on the previously protected sites. Spotted owl sites outside of SOSEAs receive limited protection only during the nesting season (between March 1 and August 31) (WAC 222-10-041(5)), but these areas are for the most part not included in mapped management areas, and even where they are included, are unlikely to retain sufficient habitat to attract spotted owls. Still, there would be potential for a small, but unpredictable, positive or negative impact on timber harvest in alternatives that include Washington provinces (that is, all action alternatives except for Alternative 6).

Oregon Forest Practices Rules protect spotted owls in three ways that may affect private timber harvest: the 70-acre protected area for occupied spotted owl nesting sites, including the area within 300 feet of a nest tree, and seasonal restrictions near active spotted owl sites. Where the nest tree has not been located, the criteria for designation of these 70-acre protected areas include repeated observations of a spotted owl pair and list of features characteristic of high-quality nesting habitat. This often results in the 70-acre areas being designated primarily on adjacent Federal or State land. However, if spotted owl site centers occur on private lands, or along the boundary between private and public lands, and these lands contain spotted owl habitat, some area of private lands may be included in the protected 70-acre core. This is more likely to happen with checkerboard ownership of public and private lands. Finally, seasonal restrictions may be required near spotted owl nest sites between March 1 and September 30. These may be lifted if surveys show that spotted owls are not nesting on the site.

As noted above, we anticipate that spotted owls would reoccupy sites with the best remaining habitat. Based on prior experience analyzing spotted owl site locations in Oregon checkerboard landscapes, most of the known, previously occupied, spotted owl site centers, along with the majority of high-quality spotted owl habitat, is found on Federal or State lands. However, with

the Oregon Coast Range and Oregon Klamath provinces, 21 and 23 percent respectively of suitable habitat is found on private lands. In addition, these provinces contain a large proportion of checkerboard lands. As noted in Chapter 3.4, the growth of spotted owl populations, even with barred owl management, would be slow and the total number of new sites would be low in comparison to the area of these provinces and the availability of habitat on Federal and State lands. Given the potential for reoccupancy of sites to occur near or on private lands with spotted owl habitat, we anticipate there would be a small, but unpredictable, impact on private timber harvest as a result of the action alternatives, particularly in the Oregon Coast Range and Oregon Klamath provinces.

California regulations require Timber Harvest Plans for timber harvest on private lands. This includes surveys of all potential habitat for two years prior to timber harvest. Spotted owl sites located on these surveys are entered into the State's database. Take avoidance is required for all spotted owl sites entered in the State's database, past and present. Thus, the majority of historical and current activity centers in California are afforded protection under California Forest Practices Rules and other guidance. Given that displaced spotted owls are most likely to reoccupy former sites when cleared of barred owls in areas under barred owl management, and most of these known spotted owl sites are currently managed as if occupied, barred owl management would not lead to a reduction in timber harvest in areas where past or present spotted owl sites are known. Reductions in timber harvest would only occur where spotted owls occupied new sites that have not previously been documented. With barred owl management under any of the action alternatives (except for Alternative 5), we would expect spotted owl populations to increase in California, and this could potentially lead to new sites being discovered more often than they are now. We expect that the majority of spotted owl population growth would not be associated with new sites.

There are three HCPs covering northern spotted owls in California, with incidental take permits held by Green Diamond Resources Company, Sierra Pacific Industries, and Humboldt Redwood Company. Green Diamond Resources Company and Sierra Pacific Industries HCPs include barred owl removal studies. In all cases, spotted owls reoccupying sites under these HCPs would not affect timber harvest on these lands. The Green Diamond Resources Company and Humboldt Redwood Company HCPs are in the California Coast province. We do not anticipate reductions in timber harvest on lands under these HCPs would result from implementation of any of the action alternatives. On other private timberlands in the California portion of the northern spotted owl range, we do anticipate a very small, but unpredictable, potential reduction in timber harvest as a result of alternatives that include actions in the California provinces (all action alternatives except for Alternative 5).

3.8.6. Summary of Effects of the Alternatives on Socioeconomics

The potential for socioeconomic effects of the alternatives would be driven by the overlap of barred owl management, spotted owl site occupancy increases on management areas, and the distribution of spotted owl habitat within the provinces (Table 3-49).

Table 3-49. Comparison of the effects of the alternatives on spotted owls.

Physiographic Province	Increase in Number of Spotted Owl Sites at year 30 on Managed Areas by Alternative						Percent Spotted Owl Habitat by Province		
	1	2	3	4	5	6	Federal	State	Private
Olympic Peninsula	0	8	4	6	6	0	85%	9%	4%
Western Washington Cascades	0	12	5	1	5	0	84%	9%	7%
Eastern Washington Cascades	0	4	2	1	2	0	74%	7%	10%
Oregon Coast Ranges	0	28	13	15	19	0	66%	13%	21%
Western Oregon Cascades	0	66	30	16	29	0	91%	<1%	10%
Eastern Oregon Cascades	0	14	6	2	4	0	83%	1%	5%
Oregon Klamath	0	46	22	15	0	26	76%	1%	23%
California Coast	0	273	128	66	0	177	11%	11%	72%
California Klamath	0	162	76	44	0	104	79%	<1%	17%
California Cascades	0	11	6	3	0	6	57%	1%	41%
TOTAL	0	624	290	169	65	313	73%	5%	20%

The projected increases in spotted owl site occupancy would likely be slow in most areas, with the possible exception of areas of northern California with low current barred owl populations. Increases in spotted owl site occupancy would also likely occur where high quality habitat was available. Such habitat is concentrated on Federal lands in most provinces, and often within reserved areas on these lands.

On Federal lands, new sites would be managed according to existing land management plans and land designations, subject to Section 7 consultation. Given the slow projected increase in spotted owl sites under barred owl management, the preponderance of habitat occurring on lands not subject to scheduled timber harvest under current plans, and the history of Federal land management and consultation, we do not anticipate that any of the action alternatives would substantially affect regional timber harvest levels. On State lands, existing land management plans and current HCPs greatly reduce the potential for conflict between timber production and reoccupied spotted owl sites.

The potential for the estimated increase in spotted owl site occupancy/reoccupancy to reduce timber harvest levels and associated income and employment in the Washington provinces would be very low to negligible across all action alternatives, due to the low projected increase in spotted owl occupied sites and the high percentage of spotted owl habitat on Federal lands, including large areas of reserved lands. There would be no impact to timber harvest levels in Washington from implementation of Alternative 6, because this alternative does not include barred owl management in Washington.

In Oregon, the potential for reductions in timber harvest levels and associated income and employment would be generally low due to the low level of increase in in spotted owl occupied sites and the high percentage of spotted owl habitat on Federal lands, including large areas of reserved lands. The potential for some spotted owl sites to impact private land timber harvest would be slightly higher in Alternatives 2 and 4 in the Oregon Coast Ranges province and

Alternatives 2 and 6 in the Oregon Klamath province. The limited requirements for management around spotted owl sites under Oregon Forest Practices Rules would reduce the potential impact to a very low level.

In northern California, a substantially higher percentage of spotted owl habitat is found on private timberlands. On lands included in HCPs with coverage for spotted owls, we anticipate no change in timber harvest levels under any barred owl management alternative. All potential habitat on State and private timberlands is surveyed for at least two years prior to timber harvest and any spotted owl sites are protected according to the California Forest Practices Rules (California Code of Regulations Title 14). Once sites are established, site-specific management continues, even if the site becomes unoccupied.

The majority of historical and current activity centers in California are afforded protection under California Forest Practices Rules and other guidance, and we anticipate that there would be no change in timber harvest levels as a result of spotted owls reoccupying these sites with barred owl management under any alternative. While we anticipate that most spotted owl reoccupancy resulting from barred owl management would occur on historical activity centers, some new sites could be established in areas where spotted owls had not been previously documented. These sites would be covered by California Forest Practices Rules which would likely result in changes to timber harvest plans around these sites. Therefore, there would be a potential for small reductions in timber harvest on private lands in California, but this potential would be limited to situations where spotted owls occupied sites where they were never previously documented.

No barred owl management activity, and therefore no increase in spotted owls due to barred owl management, would occur under Alternatives 1 (no action) and 5 in northern California, therefore there would be no effect on timber harvest. The potential for small reductions in private land timber harvest would be greatest in Alternative 2, specifically in the California Coast province, given the larger increase in occupied/reoccupied spotted owl sites and spotted owl habitat on private lands.

3.9 Climate Change

This section presents a summary of the potential effects of climate change on environmental resources affected by the proposed action and alternatives, including spotted owls. It also briefly discusses how climate change could affect each alternative and its environmental impacts, as well as the potential effects or contribution of the action alternatives to global climate change.

3.9.1. Background and Analytical Methods

The Council on Environmental Quality (CEQ) recommends agencies address climate change impacts by considering both the effects of climate change on a proposed action and its environmental impacts, but also the potential effects of the proposed action on climate change as indicated by changes in greenhouse gas (GHG) emissions (CEQ 2016). CEQ recommends the rule of reason and the concept of proportionality caution against providing an in-depth analysis of emissions regardless of the insignificance of the quantity of GHG emissions that the

proposed action would cause. Given the nature of the proposed action and alternatives analyzed in this EIS, the negligible contribution of additional GHG emissions associated with any of the alternatives, and the data available, Service determined that a quantitative analysis of GHG emissions was not appropriate.

3.9.2 Affected Environment

Scientific measurements spanning several decades demonstrate that changes in climate are occurring and that the rate of change has been faster since the 1950s. There is strong scientific support for projections that warming will continue through the 21st century, and that the magnitude and rate of change will be influenced substantially by the extent of greenhouse gas emissions. Recent forecasts (Mote et al. 2014, entire) indicate that climate change will have long-term and variable impacts on forest habitat at local and regional scales.

Climate change is occurring within the northern and California spotted owls' entire range, the analysis area of this draft EIS. Given the wide geographic range and the sensitivity of climate change to local conditions, projected changes in climate vary across the analysis area, and the effects those changes on species and habitats vary. However, there are underlying trends that apply across the area. Projected continuing changes in climate in the West would result in increasing temperatures over time and changes in precipitation amount, timing, and distribution. Regional warming and consequent drought stress appear to be the most likely drivers of an increase in the mortality rate of trees in recent decades in the western United States. This, in turn, leads to increased fire risk and high severity fires; increased risks from forest pathogens; and changes in forest structure, extent, and species composition. While the rate and impact of these changes may differ between forest types and with local microclimates, the overall potential for these effects throughout the range remains.

Climate change has affected, or is starting to affect, the spotted owls, the focus of the purpose and need for this action, through change in habitat throughout their range (USFWS 2020, section 4.3.2, USFWS 2023b). Climate change forecasts indicate continuing and significant future effects on western forests over the next century, with long-term implications for the composition and structure of those forests for spotted owl habitat. These changes in the climate and forest ecosystems in the West are likely to cause additional direct and indirect stressors for northern and California spotted owls. Changing climatic conditions may have direct impacts on spotted owl physiology, survival, reproduction, recruitment, or population growth through heat stress from extended high temperatures and indirect impacts including changes in habitat and prey distribution, abundance, and quality. Several northern spotted owl demographic study analyses noted associations between northern spotted owl demographic rates and climate suggesting predicted climate change is likely to have negative consequences for northern spotted owls, although the magnitude of these potential impacts is unknown. Habitat loss (see Dugger et al. 2016, p. 98), competition with barred owls (see Wiens et al. 2014, p. 37), and changes in weather patterns predicted to occur in future decades (see Glenn et al. 2010, pp. 2549-2551) have independently been demonstrated to have negative effects on northern spotted owl populations. In combination, these factors are likely to interact and have even greater negative consequences for this subspecies. For more detail on climate change and spotted owls, see USFWS 2023b, USFWS 2020.

3.9.3 Environmental Consequences

Alternative 1, the No Action alternative, would have no effect on climate change, as no comprehensive management actions would be conducted that could contribute GHG emissions.

Under all action alternatives, the primary potential effect on climate change is GHG emissions associated with the use of motorized vehicles for the survey and removal of barred owls. Under all action alternatives these actions would be conducted as part of ongoing forest or land management activities, which already involve the use of vehicles as needed. Vehicle use for barred owl removal is relatively low intensity. Barred owl removal in well-roaded areas would involve use of a vehicle to access multiple barred owl sites per night, covering as much as 3,000 acres per night and repeating this effort three or four times per year per area. Removal in unroaded areas would require vehicle use to access trailheads. Removal would likely occur over six to eight months each year. The addition of barred owl management is not anticipated to significantly increase the vehicle use in management areas beyond the normal variation associated with forest management, and thus increases in vehicle emissions would be very low. Overall, any effects on regional greenhouse gas emissions or global climate change resulting from the proposed alternatives would be negligible. Thus, the Service has not attempted to conduct an in-depth or quantitative analysis of effects of the action alternatives on global climate change.

In Section 3.8 we concluded that there is the potential for a small, but unpredictable, reduction in timber harvest under all alternatives (including the no action alternative), and thus we did not attempt to analyze how potential changes in future forest management activities across different land ownerships would result in subsequent changes in GHG emissions, carbon sequestration, or overall contributions to global climate change.

3.10 Other Resources Issues Dismissed from Detailed Analysis

A number of resources issues identified during scoping were considered but then dismissed from detailed analysis for the reasons described below, either because there are not likely to be significant effects from the proposed action or alternatives, or where effects do not differ between the no action and action alternatives (i.e., that proposed action or its alternatives make no difference). We dismissed these from detailed analysis in order to focus on those consequences that are most significant, of greatest concern to the public, and of greatest relevance to the agency's decision.

3.10.1 Public Health and Safety

Under the no action alternative, no removal would occur, thus there are no public safety issues.

As to the action alternatives, the use of firearms for the removal of barred owls presents potential public safety issues. To avoid safety issues, under all action alternatives all lethal

removal of barred owls would be undertaken pursuant to a strict protocol that includes elements to protect human health and safety (See Appendix 3 for details). Removal would be authorized only if conducted by trained, authorized professionals, and would not be part of a public hunting effort. The protocol includes a minimum no-shooting buffer zone of one quarter mile around occupied dwellings, established open campgrounds, and other locations with regular human use. Prior to and during removals, the area would be assessed for potential human presence (homes, tents, vehicles) and appropriate buffers applied. Removal would conform to any additional safety requirements of participating landowners or land managers. Based on these requirements, which apply to all alternatives, there is no risk of gunshot injury to humans.

Safety of crews conducting barred owl removal, particularly in unroaded areas, is important. Ultimately the implementing entities are responsible for ensuring basic safety and responding to specific concerns from land management agencies about particular areas or conditions where removal would take place.

Various barred owl removal studies have applied this basic protocol since 2009 across all three States. There have been no safety issues for crews or the public during the removal of over 4,500 barred owls during that period. Public safety considerations do not vary significantly across all alternatives, i.e., public safety is a priority across all action alternatives. Therefore, this topic was dismissed from further detailed analysis of environmental consequences as safety protocols would be employed for all of them.

3.10.2 Cultural Resources

For purposes of this document, cultural resources are defined as archaeological resources, buildings, structures, districts, objects, and traditionally important places on the landscape. These resources may be historic properties as defined in 36 Code of Federal Regulations (CFR) Part 800, listed on a State or local historic register, or identified as being important to a particular group.

As a Federal agency, the Service is responsible for complying with laws and regulations designed to protect cultural resources. In general, these efforts focus on the protection of historic and prehistoric artifacts, structures, and landscapes through compliance with section 106 of the National Historic Preservation Act of 1966. Under section 106, the Service must determine whether a proposed action meets the definition of an undertaking that could result in changes in the character or use of historic resources (i.e., districts, sites, structures, or objects) that are eligible for listing on the National Register of Historic Places. The issuance of a Federal permit is an undertaking as defined by the National Historic Preservation Act that triggers consideration of section 106 review.

Our preliminary analysis is that the proposed action has no potential to cause effects, because the proposed action, along with all action alternatives, does not involve any ground disturbing or other activities that might result in direct or indirect effects to known or potential cultural resources. Under all alternatives, the rights reserved by Native Americans in existing treaties and statutes, and access to those areas where said rights are exercised, would remain

unchanged. Therefore, this topic was dismissed from further detailed analysis of environmental consequences.

3.10.3. Impacts to Tribes

In addition to extensive general outreach during scoping, the Service has reached out directly to Native American Tribes potentially affected by the proposed action and action alternatives. The Service recognizes that each Federally recognized Tribe is unique and sovereign and may have different treaties and other agreements with the United States (USFWS 2016). The Service has sought and continues to seek involvement of the Tribes to gain understanding of the Tribes' perspective on potential impacts of the proposed action and alternatives and Tribal management of the resources that may be affected.

The Service is responsible for protecting and complying with the treaty rights and statutes that concern Native American Tribes. This includes the American Indian Religious Freedom Act of 1978, which protects the Native American right to practice religious beliefs. As part of the ongoing commitment to government-to-government relations with Native American Tribal Governments, the Service sent a scoping letter to all Tribal decision makers of Native American groups potentially affected by the proposed action. The purpose of the scoping letter was to reaffirm the Service's intention to work cooperatively with affected and interested Tribes, and to seek Tribal input for preparation of the Draft EIS. In January 2022, Tribes were invited to participate as cooperating agencies on this draft EIS, though none chose to do so. The Service conducted two virtual informational meetings for Tribes in Washington, Oregon, and California on May 1 and 4, 2023.

3.10.4 Ethical Considerations

As part of the implementation process for the 2008 Northern Spotted Owl Recovery Plan (USFWS 2008, entire), the Service established the Barred Owl Stakeholder Group as a recovery implementation team under ESA §4(f)(2). The Service used this group, comprised of forty representatives from relevant government agencies, the forest product industry, Native American Tribes, environmental organizations, and animal welfare and protection groups, to help the agency identify and better respond to ethical issues involved with the proposed barred owl removal experiment. The Service acknowledges the value of this information in the implementation of the Barred Owl Removal Experiment (USFWS 2013) and we considered and continue to rely on this as we progress from research to management.

The primary perspectives from the ethical management of wildlife that were directly pertinent to the removal experiment were identified by Dr. William Lynn as follows:

- A crisis for northern spotted owls is at hand. Act accordingly.
- Use the most humane methods available and continue to develop nonlethal alternatives.
- Establish endpoints for the removal experiment and future management actions.

Based on the discussions of the Barred Owl Stakeholder Group, comments received during the scoping period, and other public input, we note that each individual's reaction to lethal removal of barred owls for the survival of spotted owls is strongly affected by their individual ethical values relative to wildlife and natural resources. For example, some people's values are centered on humans, with animals and nature valued to the extent they provide resources to people. Others' values are centered on individual animals, animal populations, natural communities, or even the broader social community. Few personal value systems include only one of the categories. For the most part, people integrate some elements of all these views, simply placing more or less emphasis on each aspect. For example, a person may be very concerned about killing individual barred owls, but also concerned about saving the northern spotted owl from extinction. We do not consider any of these values right or wrong but acknowledge that they lead people to different judgments about management of barred owls.

We have been asked whether it is ethical to kill one species for the benefit of another. As noted above, individual values will lead to different responses to this question. While we understand the concerns, the Service has an obligation under ESA to recover listed species by addressing the threats to that species. The Service has determined that in order to recover the northern spotted owl, the threat from the invasive barred owl must be addressed.

The Service takes these ethical concerns very seriously. The protocols for barred owl removal (Appendix 3) are specifically designed to be as humane as possible while addressing the need for managing the invasive barred owl to prevent the extirpation or extinction of native spotted owls.

As discussed in Chapter 2, all action alternatives involve the lethal removal of barred owls, and all alternatives that relied on non-lethal management were determined not to be feasible or meet the purpose and need of the action. As ethical considerations around lethal removal are the same across all action alternatives, the Service did not attempt any type of comparison or more detailed analysis of this topic.

3.10.5 Environmental Justice

Environmental justice is defined in Executive Order (EO) 14096 (88 FR 25251) as the just treatment and meaningful involvement of all people, regardless of income, race, color, national origin, Tribal affiliation, or disability, in agency decision-making and other Federal activities that affect human health and the environment so that people: (i) are fully protected from disproportionate and adverse human health and environmental effects (including risks) and hazards, including those related to climate change, the cumulative impacts of environmental and other burdens, and the legacy of racism or other structural or systemic barriers; and (ii) have equitable access to a healthy, sustainable, and resilient environment in which to live, play, work, learn, grow, worship, and engage in cultural and subsistence practices. An environmental justice impact occurs when an adverse impact disproportionately affects an already vulnerable population. This E.O. builds on previous guidance in E.O. 14008, E.O. 13985, E.O. 12898, and other direction to carefully consider potential disproportionate impacts to vulnerable populations from any Federal action, and work to avoid, minimize, or mitigate those impacts.

None of the alternatives analyzed would result in the increase in any pollution risk or other hazards that could impact low income, minority, or other vulnerable populations. For example, the removal protocol specifically requires the use of non-lead shot to ensure no contamination of the environment from lead. Barred owl management is also not anticipated to significantly increase the vehicle use in management areas beyond the normal variation associated with forest management under any alternative, and thus any effects on local air pollution, regional greenhouse gas emissions or global climate change that could further impact low income or minority populations would be negligible (Section 3.9.2). In Section 3.8 we conclude that there are no reasonably foreseeable significant impacts on timber harvest or associated socioeconomic conditions under all alternatives, and therefore there would be no potential disproportionate economic effects on environmental justice populations or communities. Under all alternatives, there is also no effect on access to recreational opportunities or public land as a result of barred owl management that could affect vulnerable populations.

3.10.6 Geology, Soils, Water, Vegetation, and Air

All alternatives involve the use of existing roads or trails and require no ground disturbing activities. All removal under the action alternatives requires the use of non-lead shot, preventing contamination of land or water. Thus, there is no foreseeable effect of this action on geology, soil, water, vegetation, or air resources, and these resource areas were eliminated from further detailed analysis.

Chapter 4: Cumulative Effects

This chapter presents the analysis of potential cumulative effects of the proposed action and action alternatives on the human environment. The Council on Environmental Quality (CEQ) NEPA Regulations provide the following definition: “the effects on the environment that result from the incremental effects of the action when added to the effects of other past, present, and reasonably foreseeable actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative effects can result from individually minor but collectively significant actions taking place over a period of time” (40 Code of Federal Regulations [CFR] 1508.1(g)(3)).

4.1 Past, Present, and Reasonably Foreseeable Actions

For this draft EIS, reasonably foreseeable future actions include the continuation of present management actions of Federal and non-Federal landowners and managers across the range of the analysis area. As it would be speculative for the Service to anticipate site-specific actions that would occur in the future on lands managed by others over the time period analyzed in the draft EIS, the Service based our assumptions about future management on other ownerships on existing and proposed or draft plans, current trends, and the potential effect of existing laws, regulations, and management plans. This analysis includes proposed planning efforts currently underway that the Service considers as reasonably foreseeable actions for analyzing cumulative effects, including HCPs and other management plans that have been released for public review. These assumptions provide context for evaluating the incremental effect of the alternatives when added to the effects of other past, present, and reasonably foreseeable actions.

The analysis area includes the ranges of the northern and California spotted owl, forest areas within 15 miles of these ranges, the Central Valley of California, areas between the range of the northern spotted owl and California spotted owl range, and forest areas between the Sierra Nevada and Coastal-Southern California portions of the California spotted owl range.

4.1.1 Forest and Forest Management

The action alternatives evaluated in this draft EIS occur on forest lands, where barred owls reside and could be managed for the conservation of spotted owls as described in the purpose and need. The action alternatives generally occur within forested landscapes across western Washington, western Oregon, and California. These forest lands have a variety of uses, including but not limited to timber production, wildlife habitat, recreation, conservation, fire management, water supply, grazing, wilderness, and rural housing. The proposed action and associated action alternatives do not require or anticipate any changes in land management. Therefore, these types of forest use and management activities have occurred in the past, are currently occurring, and are expected to continue throughout the analysis period of 30 years.

4.1.2 Federal Lands

National Forest lands within the northern spotted owl range are managed under Land and Resource Management Plans as amended by the Northwest Forest Plan (USDA and USDI 1994a, b). Bureau of Land Management lands are managed under Southwestern Oregon, and Northwestern and Coastal Oregon Resource Management Plans, which have similar land allocations as the Northwest Forest Plan (BLM 2016). These plans include a combination of various land allocations and associated standards and guidelines for management leading to current levels of timber harvest, recreation, and wildlife management on these lands. These plans were developed, in part, to provide contributions to the conservation of northern spotted owls. On National Forest lands, additional large-scale forest management actions are being planned and undertaken as part of the Wildfire Crisis Strategy (USDA Forest Service 2022), but these actions must still be consistent with the Northwest Forest Plan. National Parks and National Recreation Areas are managed under General Management Plans specific to each area. All include conservation measures for native wildlife, including spotted owls.

California BLM lands within the range of the northern spotted owl are managed under the Arcata and Redding RMPs, as amended by the Northwest Forest Plan. The BLM in California is preparing a Resource Management Plan known as the Northwest California Integrated Resource Management Plan with an associated Environmental Impact Statement (EIS) that will replace these. The BLM initiated public scoping for the Northwest California Integrated Resource Management Plan and EIS in April 2022. A public review Draft EIS is expected in late 2023. When completed, this will replace the existing Arcata and Redding RMPs, which currently follow the Northwest Forest Plan provisions.

In California, the U.S. Forest Service has been a part of ongoing conservation efforts for California spotted owls, including the 2004 Sierra Nevada Forest Plan Amendment and the 2005 Southern California National Forest Land and Resource Management Plans. In 2019, the Inyo

National Forest completed its own land management plan. Implementation of these plans results in the current levels of timber harvest, restoration, recreation, and wildlife management on these lands. Revised forest plans for the Sierra and Sequoia National Forests were completed in 2023 (88 FR 34126). Additional large-scale forest management actions are being planned and undertaken as part of the Wildfire Crisis Strategy (USDA Forest Service 2022), which have the potential to significantly impact barred and spotted owl habitat. Conservation measures associated with these planning efforts emphasize the protection and management of California spotted owl activity centers, territories, and 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 completed at different times. The Redding RMP (BLM 1993) and South Coast RMP (BLM 1994) do not mention California spotted owls specifically, but California spotted owls are a BLM sensitive species, and these RMPs include general provisions to minimize the decline of Special Status Species through the mitigation of resource management impacts and promote the enhancement of Special Status Species through positive management of their populations and habitats. The Eagle Lake and Sierra RMPs were completed in 2008. Both contain direction to manage suitable habitat to maintain or increase forest characteristics for California spotted owls, as does the Bakersfield RMP for the Kaweah Area of Critical Environmental Concern.

4.1.3 State and Private Lands

Washington

In Washington, the State Department of Natural Resources (WDNR) completed the State Trust Lands HCP in 1997, which was 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. State Parks and State Department of Fish and Wildlife lands are managed with an emphasis on recreation and wildlife, though small areas of forest may be affected by other management decisions.

There are two local government HCPs and one Safe Harbor Agreement (SHA) that cover spotted owls in Washington. The Green River Water Supply Operations and Watershed Protection HCP includes committing a portion of the lands to no or limited harvest and protection of spotted owl sites with seasonal restrictions and year-round protection in some portions of the area. Seattle's Cedar River Watershed HCP contains substantial forest reserves, forest management to enhance old forest structure and increase resilience in some areas, and protection of active spotted owl sites. The City of Everett SHA includes set asides and deferrals, extended rotation, and tree retention, as well as protection of active spotted owl sites.

Private forest timber lands in Washington are managed under the Washington Forest Practices Act. Management levels are tied to the Washington State designated Spotted Owl Special Emphasis Areas (SOSEAs). Spotted owl sites outside of SOSEAs receive limited protection only during the nesting season (WAC 222-10-041(5)). Within SOSEAs, spotted owl sites known as of July 1, 1996, continue to be protected (WAC 222-10-041(4)).

Eight private landowners in Washington are implementing forest HCPs and SHAs, including Weyerhaeuser (I-90) and CCF subsidiary of The Nature Conservancy (I-90) which include management provisions for landscape levels of spotted owl habitat and buffers around sites; Port Blakely Robert B. Eddy Tree Farm, which includes landscape amounts of forest stages driven by harvesting schedule and active mid-rotation management as well as protection of spotted owl core areas and seasonal protection; and the Sierra Pacific Mineral Tree Farm focused on dispersal habitat and distance between patches to support connection between Federal lands.

The Tagshinny SHA established a designated baseline of forests over 40 years old, and protective provisions for occupied spotted owl nest sites. The Port Blakely Morton Block SHA maintains baseline and improves habitat conditions as well as protecting some owl sites. The Broughton Lumber Co., Lupine Forest LLC, and Series One of Twin Creeks Timber were originally part of the single SDS Lumber SHA and retain the requirements of that SHA. This includes set-a-sides, thinnings, established landscape amounts of habitat that vary by conservation role of the area.

In addition, there are two SHAs covering marbled murrelets, Rayonier Operating Company, LLC and Sierra Pacific Land & Timber Company, both of which protect all existing murrelet occupied sites on their forest lands. Weyerhaeuser Timber Holdings, Inc. has a draft SHA for murrelets, with the same conditions, that was released for public review and comment.

Oregon

The Oregon Department of Forestry (ODF) manages lands throughout the range of the northern spotted owl in Oregon, including the Tillamook, Clatsop, Santiam, Gilchrist, and Sun Pass State Forests. The ODF manages these lands under the 2010 Northwest Oregon State Forests Management Plan (FMP) (ODF 2010a), 2010 Southwest Oregon State FMP (ODF 2010b), 1995 Eastern Region Long-Range FMP (ODF 1995), and district-level implementation plans. The ODF is currently preparing the Western Oregon State Forests (WOSF) HCP (ODF 2022) and a companion FMP is in development and will replace the 2010 Northwest and Southwest Oregon FMPs. The proposed WOSF HCP and EIS were issued for public comment on March 22, 2022 (87 FR 24191). Under the proposed HCP, conservation actions implemented in the habitat and riparian conservation areas are intended to conserve, protect, and enhance habitat for aquatic and terrestrial covered species. Areas outside these conservation areas would be managed for timber production, but would still contribute habitat for covered species at the landscape level.

The Oregon Department of State Lands is developing an HCP for the Elliott State Research Forest in Coos and Douglas Counties. The plan proposes to balance forest research and management activities with the conservation of rare species and their habitat on the forest. The proposed HCP and EIS were released to the public on November 18, 2022.

Oregon State Parks are managed with an emphasis on recreation, though small areas of forest may be affected by other management decisions.

Most private forest lands are maintained as commercial timberlands dominated by plantations composed of relatively young, uniform forest. Private and non-Federal lands must be managed in

accordance with the Oregon Forest Practices Act and associated Forest Practice Administrative Rules. As outlined in Oregon Administrative Rules Chapter 629, the Forest Practice Administrative Rules address requirements for some forest management activities and protection of a 70-acre core area for active spotted owl sites.

Weyerhaeuser's Millicoma Tree Farm HCP was completed in 1995, providing management specific to providing dispersal habitat for spotted owls between State and Federal lands in the area. Port Blakely HCP for the John Franklin Eddy Forestlands in Clackamas County, Oregon covers younger forest without known spotted owl sites on the company's lands. The HCP provides for maintenance of specific foraging habitat using deferred timber harvest and protection of core areas if spotted owls do establish territories.

California

In California, the primary State lands subject to conduct timber harvest in the northern spotted owl range are in the Jackson State Demonstration Forest, managed by the California Department of Forestry and Fire Protection (Cal FIRE). All potential habitat on State and private timberlands is surveyed for at least two years prior to timber harvest and any spotted owl sites are protected according to the California Forest Practices Rules (California Code of Regulations Title 14). Once sites are established, site-specific management continues, even if the site becomes unoccupied.

California regulations require a timber management plan for harvesting on private timberlands. This includes surveys over all habitat and for spotted owl sites, and consideration of all spotted owl sites already entered in the State's database. Take avoidance is required for all spotted owl sites, whether currently occupied or not.

There are three forest HCPs covering northern spotted owls in California, with incidental take permits held by Green Diamond Resources Company, Sierra Pacific Industries, and Humboldt Redwood Company.

Under the Green Diamond HCP, the company creates and maintains a mosaic of high-quality habitat for northern spotted owls. The primary conservation strategy for spotted owls is the designation and management of dynamic conservation areas, the minimization of harm to the species, and long term barred owl removal research commitments. The plan includes the avoidance of marbled murrelets.

The fundamental approach of Sierra Pacific Industries' HCP is the implementation of conservation measures to maintain landscape-scale habitat conditions equivalent to habitat currently used by spotted owls, increase opportunities for spotted owl occupancy, accelerate the recovery of lands degraded by catastrophic events to provide future spotted owl habitat, and minimize and mitigate impacts to spotted owls. The HCP also includes a commitment to addressing barred owls as a stressor on both northern and California spotted owls through the implementation of several barred owl studies that include removal of barred owls.

The Humboldt Redwood Company HCP includes reserve areas and a habitat-based approach, including harvest, retention, and recruitment of potential northern spotted owl foraging, roosting, and nesting habitat in watersheds across the ownership and through the HCP. The HCP also include protection of Marbled Murrelet Conservation Areas.

4.2 Cumulative Effects

The cumulative effects analysis applies a qualitative approach because effects from the alternatives, added to the effects of past, present, and reasonably foreseeable actions, could occur in different timeframes or locations within the analysis area, making quantification of impacts infeasible. We address the cumulative effects for each resource evaluated in Chapter 3, Affected Environment and Environmental Consequences.

4.2.1 Barred Owls

Barred owls are a generalist predator and eastern forest species that invaded the western U.S. in the 1960s. They have continued to invade southward and build large populations in the forests of the Pacific Northwest, overlapping with the native northern spotted owls. Barred owls are now found within the range of the California spotted owl. Competition from barred owls has been identified as one of the primary causes of the precipitous decline in northern spotted owl populations, and a primary threat to both subspecies. While barred owls prefer older forest characteristics, they are found in high density in younger forests. Barred owls, being a generalist in both prey and habitat, have thrived in the forest conditions resulting from past and present actions described above and this trend is anticipated to continue into the foreseeable future in the absence of specific management actions.

As discussed in Chapter 3.3, implementation of barred owl management associated with any of the action alternatives would adversely affect barred owl populations in specified management areas, though the potential for negative effects to barred owls would vary by alternative. However, as the continued forest management described above is not expected to have a significant effect on barred owl at a population scale, there would be no further cumulative impacts from the actions discussed above combined with impacts occurring under the action alternatives. There would also be no cumulative effects under the no action alternative, which would allow the continued expansion of the range and population of barred owls.

4.2.2. Spotted Owls

Habitat loss and competition from barred owls are the primary past and present factors in the continuing decline of northern spotted owls. The northern spotted owl was listed as threatened throughout its range “due to loss and adverse modification of spotted owl habitat as a result of timber harvesting and exacerbated by catastrophic events such as fire, volcanic eruption, and windstorms” (55 FR 26114; June 26, 1990). The 2019 status review noted trends toward increasing loss of habitat to wildfire, and continued loss of habitat to timber harvest on non-Federal lands, though the Northwest Forest Plan slowed habitat loss and allowed for habitat growth on Federal lands (USFWS 2020). These trends continue under the actions described above.

California spotted owls are currently found throughout their known historical range, although there is evidence of a decrease in abundance in parts of the range including both the Sierra Nevada and Coastal-Southern California. Threats currently impacting the Sierra Nevada population include large-scale, high-severity fire; tree mortality; drought; climate change; various impacts from fuels reductions and forest management; competition with barred owls; and rodenticides. Threats currently impacting the Coastal-Southern California population include largescale, high-severity fire; tree mortality; drought; climate change; various impacts from fuels reductions and forest management; and rodenticides. Depending on the method used and how it is implemented, fuels reductions and forest management practices can have both positive and negative influences on the species. The existing regulatory mechanisms and conservation measures do not completely ameliorate the negative impacts of fuels reductions and forest management practices to California spotted owls; however, land management direction, including the Sierra Nevada Forest Plan Amendment, includes protective standards and guidelines that must be adhered to while conducting management activities in California spotted owl habitat (88 FR 11600; February 23, 2023). The 2019 California Spotted Owl Conservation Strategy outlines numerous conservation measures that are being incorporated into ongoing planning efforts, and we anticipate that these measures will continue to guide the current and reasonably foreseeable actions described above.

The cumulative effects on spotted owls from the actions discussed above, including forest management resulting in habitat loss (e.g., timber harvest) and management supporting reductions in habitat loss to wildfire (e.g., fuels reduction), combined with the beneficial effect of the removal of barred owls under the action alternatives could be both positive and negative. Removal of barred owls via any of the action alternatives would likely reduce the overall negative effects. The cumulative effect of the above actions and the no action alternative, with its increasing invasion of barred owls, would be negative.

4.2.3. Other Wildlife

Barred owls are generalist predators that prey on a very wide variety of species including, but not limited to, mammals, birds, amphibians, reptiles, mollusks, crustaceans, and insects. Because barred owls are not native to the ecosystems within the analysis area, these potential prey species are not adapted to this additional and novel source of predation. Barred owls have developed dense populations in some areas and are likely to do so in other areas as they expand, further impacting potential prey, and competing with native predators.

The cumulative impacts on potential prey or competitors (see chapter 3.5) from the forest management actions listed above, combined with the incremental effects of the no action and action alternatives, would vary by location, habitat needs, and the potential for these species to be affected by the ongoing forest management. Removal of this new predator/competitor would reduce the cumulative negative effects for species negatively affected by forest management. For species that benefit or experience neutral effects from forest management, barred owl removal would result in increased beneficial effects wherever barred owl management overlaps with the species' range. The no action alternative would have an adverse effect on potential prey and competitor species by allowing the continuing increase in barred owl populations and invasion of

the California spotted owl range, exacerbating any negative effects from past and ongoing forest management.

4.2.4. Marbled murrelet

Marbled murrelets are threatened by loss of forest nesting habitat (including fragmentation) via harvest and disturbance events (e.g., wildfire and insect and forest disease outbreaks), and climate change, including offshore climate change effects that could result in diminished prey availability. Marbled murrelet can be disturbed by loud noise close to forest nest sites, which can lead to flushing adults or juveniles or preclude adults from feeding young. Given the overlap of barred owl and marbled murrelet nesting habitats, barred owls are likely to prey on murrelet chicks or adults.

The adoption of the Northwest Forest Plan, as described above, greatly reduced, but did not entirely stop, the loss of marbled murrelet habitat on Federal land after 1994. Recent losses are attributed to timber harvest and wildfire (Lorenz et al. 2021, p. 33). The BLM's updated management plans included an additional 31,991 acres of marbled murrelet nesting habitat in Late Successional Reserves/Riparian Reserves beyond what had been included when those BLM units were managed under the Northwest Forest Plan. The marbled murrelet continues to receive some protection under State laws in Washington, Oregon, and California, though at varying levels. Several HCPs and SHAs, described above, include marbled murrelets as a covered species and conservation measures for marbled murrelets.

The cumulative impacts on marbled murrelets from the actions discussed above, combined with to those impacts occurring under the no action and action alternatives, are both positive and negative. Under the action alternatives, where barred owl management actions overlap marbled murrelet habitat during the marbled murrelet nesting season and the removal site is close to a marbled murrelet nest, the resulting disturbance of the shotgun discharge could lead to flushing of the adult or disruption of a feeding effort. Given that that removal at a particular location is dispersed over time, the potential impact at any given nest would be unlikely, but possible, and could have negative effects on the individual marbled murrelets. The removal of barred owls would have a positive effect in reducing the potential for predation of marbled murrelets on their nests. The no action alternative would not result in disturbance but would not reduce the potential for barred owl predation of marbled murrelets.

The potential for both positive and negative effects to marbled murrelets would vary by alternative. This potential for effects would be greatest in Alternative 3, with the largest area of potential management overlapping with marbled murrelet habitat. The least potential impact would be under Alternative 6, with the smallest amount of marbled murrelet habitat overlapping potential barred owl management areas. The incremental effects of the action alternatives, added to the effects of current and reasonably foreseeable forest management, could result in both positive and negative cumulative effects on marbled murrelets.

4.2.5 Recreation and Visitor Use

In National Parks, National Recreation Areas, wilderness areas, and other areas with limited forest management, recreation and visitor use is a primary focus of the land management and anticipated to continue under the current plans. On National Forest and BLM lands, recreation and forest management are one component of management planning. Recreational visitors to these lands expect to encounter forest management activities and their effects. Therefore, we do not anticipate changes in recreation from the actions listed above.

The cumulative impacts on recreation and visitor use from these actions, combined with the incremental impacts occurring under the action alternatives, could affect the recreational experience for some visitors. All action alternatives could result in adverse effects to the soundscapes of forest environments, particularly in areas closed to hunting or target shooting where such noise is unexpected, such as National Parks. Increased sounds of shotgun discharge, particularly outside of the hunting season, could temporarily affect visitor experience on any landscape. The no action alternative would not affect current recreation or visitor use.

The potential for impact to recreation and visitor use would be greatest under Alternative 3 due to the larger area available for management actions. The potential for impact would be least under Alternative 6, with the smallest area of management, or Alternative 5, with the smallest acreage of National Park and National Recreation Areas units. The incremental effects of the action alternatives, added to the effects described above, would result in an adverse cumulative effect on recreation, depending on the location and timing of the removal activity.

4.2.6 Wilderness

Human activities in wilderness areas include hiking, camping, fishing and hunting. Hunting and fishing are regulated by the States. The land management plans described above provide some direction on management of specific wilderness areas, as do the Wilderness Act and associated regulations. We anticipate management of wilderness will continue as described in these plans.

The cumulative impacts from the actions discussed above, combined with those impacts occurring under the no action and action alternatives, may have both positive and negative effects on wilderness areas. While wilderness areas are ideally managed to leave ecosystems unaffected by human manipulation, Federal agencies also have a responsibility to aid in the recovery of Federally listed species and address the impacts of invasive species.

Under all action alternatives, barred owl removal could occur within wilderness areas. Most removal activity would occur along trails and would be less frequent and cover smaller areas than that occurring in well-roaded areas outside of wilderness. The primary, though minor, adverse effect would be from the occasional and dispersed use of shotguns, and the noise they create, on the soundscape. Most removal would occur in the spring through fall. In the fall, this activity would coincide with hunting season and may not be discernable in wilderness areas open to hunting. The primary beneficial effects would be from the reduction in the presence and population of a non-native generalist predator, releasing this additional pressure from native species, including the spotted owl. The incremental effects of the action alternatives, added to the effects described above, could result in both positive and negative cumulative effects on wilderness.

4.2.7 Climate change

The potential effect of the alternatives is presented in Chapter 3.9 Climate Change. Forest management may have both positive and negative effects on climate change. Growth of trees and forests provide for carbon sequestration, while timber harvest leads to emissions and carbon release.

The cumulative impacts from the actions discussed above, combined with the negligible impacts to climate change occurring under the action alternatives, have a negligible effect on regional greenhouse gas emissions or global climate change. The no action alternative has no effect on climate change.

Chapter 5: Summary of Submitted Alternatives, Information, and Analyses

This chapter summarizes the alternatives, information, and analyses submitted by State, Tribal, and local governments and other public commenters during the scoping process for consideration by the lead and cooperating agencies in developing the EIS (40 CFR 1502.17). All comments received during scoping are summarized in additional detail in Appendix 8, Scoping Comments. The full contents of all scoping comments are available on Regulations.gov at <https://www.regulations.gov/document/FWS-R1-ES-2022-0074-0001>. The Service invites public comments on this summary of submitted alternatives, information, and analyses during the public review period of the Draft EIS.

5.1 Alternatives

Comments received during scoping included the following suggestions for inclusion into alternatives in the EIS:

- A no action alternative that includes allowing barred owl to spread and outcompete the northern spotted owl.
- Do not kill either species and protect both species.
- Maintain the California spotted owl's role in ecosystems without managing barred owls.
- Only humane (non-lethal) management.
- Maintain habitat rather than barred owl management.
- Focus on lethal removal to effectively address the threat of barred owl competition.
- Use both lethal and non-lethal approaches, especially in more populated areas.
- Promote research into non-lethal strategies such as birth control that could be integrated into barred owl control efforts over time.
- Ensure quick and aggressive implementation to prevent northern spotted owl extirpation.
- A more gradual approach for barred owl management to slow down and prolong the rate of introgression to avoid genetic swamping for a limited term.
- Use shooting for lethal removal instead of poison to avoid impacts to non-target species.
- Act immediately with lethal removal across all land ownerships, across the range of northern spotted owl.
- Include long term, sustained removal actions required for barred owls to be prevented from expanding their range or kept at such low numbers that they are not a significant threat to the spotted owl.
- Utilize private individuals with extensive training and incentive programs to remove barred owls on multiple land ownership types including private and county lands.
- Describe how non-target impacts will be avoided.
- Conduct further study, including gathering additional genetic/genomic data through full-genome sequencing prior to managing barred owl, as well as if forest management has contributed to barred owl invasion and how forest type affects both species.

We considered these comments during development of the five action alternatives analyzed in detail in this EIS. Many of the above elements and concepts were included in the proposed action or additional action alternatives. Others were considered but eliminated from detailed analysis, as discussed in Section 2.10.

5.2 Information and Analyses

A wide variety of supplemental information and analyses (i.e., supplemental materials or references) from diverse sources including books, technical reports, management plans, scientific papers, academic theses, legal opinions, video files, web-based tools, survey data, and references to Federal and State legislation and regulations were submitted during scoping for consideration by the lead and cooperating agencies or public commenters. Information varied considerably in scope and scale. We considered all information and analyses submitted during development of the EIS.

A detailed list of all information and analyses received is provided in Appendix 8, Scoping Comments. The full contents of all scoping comments are available on Regulations.gov at <https://www.regulations.gov/document/FWS-R1-ES-2022-0074-0001>.

Glossary

Many of these terms have a long history and various meanings in regard to spotted owl biology and management. In this glossary, we define these terms in the context in which they are used in this Final EIS.

Action Area: All areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action 50 CFR 402.02.

Activity Center: Spotted owls have been characterized as central-place foragers, where individuals forage over a wide area and subsequently return to a nest or roost location that is often centrally located within the home range (Rosenberg and McKelvey 1999). An activity center is a location or point within a given core area that represents this central location. Nest sites are typically used to identify activity centers, or in cases where nests have not been identified, breeding season roost sites or areas of concentrated nighttime detections may be used to identify activity centers. *See also Core Area.*

Adaptive Management: A systematic approach for improving resource management by learning from the results of explicit management policies and practices and applying that learning to future management decisions.

Affected Environment: A portion of the NEPA document that succinctly describes the environment of the area(s) to be affected or created by the alternatives under consideration. It includes the environmental and regulatory setting of the proposed action. The environmental setting includes the physical environmental conditions in the vicinity of proposed action, including all natural resources (wetlands, wildlife, etc.), and the built environment (cultural resources, socioeconomics, etc.). Within the regulatory setting, the affected environment would include all applicable laws, regulations, permits, and policies associated with the effects of the proposed action. [40 CFR §1502.15]

Before-After-Impact Experimental Design: Methods for inferring the effects of a management intervention or other potential impact by comparing information collected before and after the intervention or potential impact. As contrasted with Before-After-Control-Impact methods, Before-After-Impact methods lack control areas. *See also Before-After-Control-Impact Experimental Design, Control, and Treatment.*

Before-After-Control-Impact Experimental Design: An experimental method involving a comparison of impact (treatment) areas with control areas, usually with comparison information available prior to the potential impact, and often involving multiple study sites or time periods (Smith 2002, p. 141-148). *See also Before-After-Impact Experimental Design, Control, and Treatment.*

Call-playback Survey Methods: Also “call-broadcast survey methods.” Survey methods in which recorded calls are broadcast in order to elicit responses from the target species, allowing surveyors to document the presence and location of responsive individuals. These methods have been commonly used to detect spotted owls and barred owls. Barred owl removal protocols

embedded in the proposed action include call-playback methods to locate individuals to be removed (see Appendix 2).

Candidate Species: Plant and animal taxa considered for possible addition to the List of Endangered and Threatened Species. These are taxa for which the Fish and Wildlife Service has on file sufficient information on biological vulnerability and threat(s) to support issuance of a proposal to list, but issuance of a proposed rule is currently precluded by higher priority listing actions (61 FR 7596-7613, February 28, 1996).

Capture-Mark-Resight: Experimental or monitoring method in which animals are captured, marked, released, and resighted many times by repeated sampling. The result is a set of capture and resight histories, one per observed animal, informative on survival, recruitment, and the size of the population (from Pradel 1996, entire).

Carrying Capacity: The average population density or population size of a species below which its numbers tend to increase and above which its numbers tend to decrease because of shortages of resources. The carrying capacity is different for each species in a habitat because of that species' particular food, shelter, and social requirements [Encyclopedia Britannica Online].

Checkerboard Ownership: A interspersed pattern of land ownership whereby staggered sections of land are controlled by separate (usually two, one being an agency of the Federal government) landowners, usually on a section (square mile) by section basis, as a result of public land dispersal by the Federal government during the 19th century, such as for BLM lands in western Oregon.

Coefficient of Variation: A measure of variation in a set of measurements, defined by the ratio of the standard deviation in the set of measurements to the mean (average) measurement. Coefficients of variation are usually represented as percentages, with larger values indicating wider variation.

Congressionally Reserved Lands: Lands under the jurisdiction of the Federal governmental that have been reserved by Congress for their unique natural or historical characteristics, including wild and scenic rivers, national parks and monuments, national recreation areas, designated wilderness, and similar lands.

Conservation: The terms "conserve," "conserving" and "conservation" mean to use and the use of all methods and procedures which are necessary to bring any endangered species or threatened species to the point at which the measures provided pursuant to the Act are no longer necessary. Such methods and procedures include, but are not limited to, all activities associated with scientific resources management such as research, census, law enforcement, habitat acquisition and maintenance, propagation, live trapping, and transplanted, and, in the extraordinary case where population pressures within a given ecosystem cannot be otherwise relieved, may include regulated taking (ESA §3(3)).

Control (Experimental Control): In an experimental design, a study area or sample not subject to an experimental treatment, against which treatments may be compared. Under experimental

conditions, the control is assumed to remain unchanged, since it is not subject to any treatment. For this proposed action, a control would be an area within which no barred owls would be removed, although barred owls within control areas may be monitored for occupancy or other biological parameters. *See also Treatment.*

Core Area: May refer to: 1) an area of concentrated use within a home range that receives disproportionately high use (Bingham and Noon 1997, pp. 128-129), and commonly includes nest sites, roost sites, and foraging areas close to the activity center. In this sense, core areas vary in size geographically, and in relation to habitat conditions, or 2) a 70-acre area including known northern spotted owl nest sites or the estimated area where nest sites may occur, as defined by the Oregon Forest Practices Act.

Covariate: In statistics, a variable that is possibly predictive of the outcome under study. Statistical models used in analyses of spotted owl demography data commonly include variables (i.e., covariates) for data describing habitat and weather conditions to determine the effects those conditions may have on spotted owls survival, fecundity, etc. More recent models have included a covariate to assess the presence of barred owls on spotted owl vital rates.

Critical Habitat: For listed species consists of: (1) the specific areas within the geographical area occupied by the species, at the time it is listed in accordance with the provisions of section 4 of the Act, on which are found those physical or biological features (constituent elements) (a) essential to the conservation of the species and (b) which may require special management considerations or protection; and (2) specific areas outside the geographical area occupied by the species at the time it is listed in accordance with the provisions of section 4 of the Act, upon a determination by the Secretary that such areas are essential for the conservation of the species. (ESA §3 (5)(A)) Designated critical habitats are described in 50 CFR §17 and 226.

Cumulative Effects: Under NEPA, the effects of an action that are added to or interact with other effects in a particular place and within a particular time. Cumulative effects include the total effects on a resource, ecosystem, or human community of that action and all other activities affecting that resource no matter what entity (Federal, non-federal, or private) is taking the actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.

Cumulative Impacts: *See Cumulative Effects*

Demographic Study: A field study that is designed to estimate vital rates (e.g. annual survival or reproductive rates). For spotted owls, such studies have historically involved tracking individually marked owls over time.

Demographic Study Area: *See Spotted Owl Demographic Study Area.*

Demography: The study of characteristics of populations including population size, growth rates, density, distribution, and vital statistics.

Direct Effects: In a NEPA analysis, direct effects are caused by the action, and occur at the same time and place (40 CFR 1508.8). *See also Indirect Effects.*

Dispersal Habitat: Juvenile spotted owls often must disperse through a range of forest types prior to finding NRF habitat on which to establish a territory. These forest types include nesting, roosting, and foraging habitat in addition to forest that meets the definition of dispersal habitat. The Interagency Scientific Committee (ISC) defined dispersal habitat as forest stands with average tree diameters greater than 11 inches and conifer overstory trees with closed canopies (greater than 40 percent canopy closure in moist forests and greater than 30 percent in dry forests) and with open space beneath the canopy to allow spotted owls to fly can provide the minimum conditions needed for successful dispersal (Thomas *et al.* 1990, p. 310). We acknowledge that this definition primarily applies to moist forests in Oregon and Washington and may not capture the full range of dispersal habitat conditions in Northern California or drier forests across the range of the spotted owl.

Distinct Population Segment: A listable entity under the Endangered Species Act that encompasses that portion of a vertebrate species population that is discrete from the rest of the population and significant to the species (61 FR 4722, February 7, 1996).

Endangered Species: Any species which is in danger of extinction throughout all or a significant portion of its range, as defined in section 3(6) of the ESA.

Endangered Species Act: The Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq.*). Also referred to within this document as ESA.

Exotic Species: Exotic species are those species that occupy or could occupy park lands directly or indirectly as the result of deliberate or accidental human activities. Exotic species are also commonly referred to as nonnative, alien, or invasive species. Because an exotic species did not evolve in concert with the species native to the place, the exotic species is not a natural component of the natural ecosystem at that place. Genetically modified organisms exist solely due to human activities and therefore are managed as exotic species in parks (NPS 2006).

Extirpate: To cause the extinction of a species on a landscape of interest.

Foraging Habitat: Lands that provide foraging opportunities for spotted owls, but without the structure to support nesting and roosting (USFWS 1992, pp. 22-26). Spotted owls often forage in forest conditions that meet the definition of nesting/roosting habitat, but also use a broader range of forest types for foraging. This definition identifies habitat that functions as foraging habitat, but does not meet requirements for nesting or roosting.

Forest Lands: In the context of this document, 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.

Generalist Species: A species whose ecological strategy relies on adaptation to a relatively wide range of ecological conditions. The barred owl is considered to be a generalist species (especially as compared to the spotted owl), since it is adapted to a wide range of forest habitats. The barred owl utilizes a wide range of mammal, bird, mollusk, crustacean, and other animal species as its primary prey. *See also Specialist Species.*

Habitat Conservation Plan (HCP): Under section 10(a)(2)(A) of the Act, a planning document designed to accommodate economic development to the extent possible while also providing long-term benefits to species and their habitats. If the Service finds an HCP meets the specified list of criteria, it issues an incidental take permit. This allows the permit holder to proceed with an activity that could otherwise result in the unlawful take of a listed species. The HCP describes the anticipated effects of the proposed taking, how those impacts will be minimized or mitigated, and how the conservation measures included in the plan will be funded.

High-Quality Habitat: Older, multi-layered structurally complex forests that are characterized by large diameter trees, high amounts of canopy cover, and decadence components such as broken-topped live trees, mistletoe, cavities, large snags, and fallen trees. This is a subset of spotted owl habitat and specific characteristics may vary due to climatic gradients and abiotic factors across the range.

Historical Site: Sites that contained spotted owls in the past. These may be currently unoccupied or sites where spotted owls were detected in the past, but not surveyed more recently. Also called historical territories or historical activity centers.

Home Range: The area in which a spotted owl conducts its activities during a defined period of time (USFWS 1992, p. 479) that provides important habitat elements for nesting, roosting, and foraging. Home range sizes generally increase from south to north and vary in relation to habitat conditions and prey availability and composition.

Indirect Effects: In an NEPA analysis of effects, indirect effects "... are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable" and may include "... effects related to induced changes in the pattern of land use, population density or growth rate, and related effects on ... ecosystems" (40 CFR 1508.8).

Invasive Species: Under Executive Order 13112, "Invasive species" means an alien species whose introduction does or is likely to cause economic or environmental harm or harm to human health. See Appendix 1 for more details.

Jeopardy (or Jeopardize the continued existence of): To engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species (50 CFR §402.02).

Known Spotted Owl Site: An occupied spotted owl site or a spotted owl site where spotted owls were documented to be present in the past.

Late-Successional Reserve: A major land management allocation established under the Northwest Forest Plan to protect and enhance conditions of late-successional and old-growth forest ecosystems, and serve as habitat for late-successional and old-growth related species including the spotted owl. These reserves are designed to maintain a functional, interacting, late-successional and old-growth forest ecosystem.

Local Colonization Rate: The probability that an owl territory that is not occupied in a given year will become occupied in the following year (MacKenzie *et al.* 2006, pp. 40-41).

Local Extinction Rate: The probability that an owl territory that is occupied in a given year will become unoccupied in the following year (MacKenzie *et al.* 2006, pp. 40-41).

Matrix: Under the Northwest Forest Plan, those lands under the jurisdiction of the Forest Service or BLM within the range of the northern spotted owl not otherwise included within a Late Successional Reserve or Adaptive Management Area land status, or otherwise Congressionally or Administratively Withdrawn. Matrix land may, however, include Riparian Reserves.

Meta-analysis: A statistical technique in which the results of two or more studies are mathematically combined in order to improve the reliability of the results. Studies chosen for inclusion in a meta-analysis must be sufficiently similar in a number of characteristics in order to accurately combine their results. Northern spotted owl researchers have completed several meta-analyses of demography and occupancy data on a minimum of eight demography study areas, with results reported in major research publications in 1996, 2000, 2006, 2011, 2016, and 2021.

Native Species: Under Executive Order 13112, native species means, with respect to a particular ecosystem, a species that, other than as a result of an introduction, historically occurred or currently occurs in that ecosystem. A “non-native” organism is described as “any species introduced by man into an ecosystem outside its native range” (includes exotic plus transplanted species) (McCann 1984, p. 2). *See also Exotic Species.*

Nesting and Roosting Forest Cover: Forest lands that provide nesting and roosting opportunities for spotted owls. Important stand elements may include high canopy closure, a multi-layered, multi-species canopy with larger overstory trees and a presence of broken-topped trees or other nesting platforms (e.g., mistletoe clumps (USFWS 1992, p. 23). The appearance and structure of these forests will vary across the range of the spotted owl, particularly in the dry forest provinces. Also referred to as nesting and roosting habitat. *See also Suitable Habitat.*

Non-Federal Lands: Tribal, State, municipal, or private lands in the United States. This includes any lands not managed by the Federal government.

Northwest Forest Plan: In 1993, President Clinton directed the Forest Ecosystem Management Assessment Team to develop long-term management alternatives for maintaining and restoring habitat conditions to maintain well-distributed and viable populations of late-successional- and old-growth-related species. The analysis of the Forest Ecosystem Management Assessment Team alternatives in a final supplemental environmental impact statement (USDA and USDI

1994a, entire) led to adoption of the land- allocation strategy contained in the record of decision (USDA and USDI 1994b, entire), commonly known as the Northwest Forest Plan.

Northwest Forest Plan Effectiveness Monitoring Program: A program under the Northwest Forest Plan to monitor the Plan's effectiveness in meeting its objectives, including northern spotted owl conservation objectives. The northern spotted owl module includes monitoring of population and habitat status and trends to evaluate the success of the Plan in arresting downward population trends, and in maintaining and restoring the habitat conditions necessary to support viable owl populations on Federal lands. Recently, this program has also included monitoring of barred owl presence on Federal lands in the Northwest Forest Plan area.

Occupancy: The proportion of sites occupied by the species of interest within a study area. In this EIS, site occupancy may refer to 1) for spotted owls, the proportion of known sites (i.e., territories) that are occupied at a specific time or 2) for barred owls and spotted owls, the proportion of passive acoustic monitoring stations where presence is detected.

Occupancy Model: A statistical method used to improve estimates of occupancy by a species of interest, by accounting for imperfect detectability. Occupancy models use repeated sampling to estimate the probability that the areas surveyed are occupied by the species of interest (MacKenzie *et al.* 2006, entire).

Occupied Site: Any location where territorial spotted owls are known to be present.

Park Resources: Within the National Parks and Monuments, wildlife and the processes and conditions that sustain them (NPS 2006, section 1.4.6:11).

Passive Acoustic Monitoring: Monitoring methods using autonomous recording units to record wildlife sounds (in this case, spotted and barred owl calls) for the purpose of detecting presence or collecting other information that can be inferred from audio recordings. The Northwest Forest Plan Effectiveness Monitoring Program has recently adopted these methods for northern spotted owl monitoring, and they are also used systematically to monitor California spotted owls and barred owls.

Physiographic Province: Geographic region with a characteristic geomorphology in which climate and geologic factors have given rise to a variety of landforms different from those of surrounding regions. We use the 12 physiographic provinces used in the Northwest Forest Plan.

Population Growth Rate: In wildlife demography studies, the annual rate of population change, sometimes indicated by the symbol λ . A population growth rate value of 1 indicates a stable population, a population growth rate greater than 1 indicates an increasing population, and a rate of population change less than 1 indicates a declining population, and may be referred to as a negative growth rate.

Provincial: Referring to physiographic province. This is a qualifying term used with home range and core use area to reflect the fact that both vary in size according to latitude, amount of available habitat, prey availability, and forest structure and composition. Typically, home range

and core use area sizes increase from south to north, and decrease as amount of high-quality habitat available to spotted owls increases.

Recovery: Improvement in the status of listed species to the point at which listing is no longer appropriate under the criteria set out in section 4(a)(1) of the ESA (50 CFR §402.02).

Recovery Action: Each recovery plan prepared for a listed species describes the recovery actions found to be necessary to achieve the plan's goal(s) and objectives and the monitoring actions necessary to track the effectiveness of these actions and the status of the species. Recovery actions, when implemented, alleviate known threats and restore the species to long term sustainability. These actions might include (but are not limited to) habitat protection, limitations on take, outreach, research, control of disease, control of invasive species, controlled (including captive) propagation, reintroduction or augmentation of populations, and monitoring actions.

Recovery Plan: Section 4(f) of the ESA directs the U.S. Fish and Wildlife Service to develop and implement recovery plans for threatened and endangered species, unless such a plan would not promote conservation of the species. According to the statute, these plans must incorporate, at a minimum, a description of site-specific management actions necessary to achieve recovery of the species; objective, measurable criteria which, when met, would result in a determination that the species be removed from the list; and estimates of the time and costs required to achieve the plan's goal. The Service completed a recovery plan for the northern spotted owl in 2008 (USFWS 2008, entire), and revised that plan in May, 2011 (USFWS 2011, entire). The Revised Recovery Plan for the Northern Spotted Owl (USFWS 2011, pp. III-62 to III-68) identifies nine recovery actions specific to addressing the threat that barred owls represent to conservation and recovery of the northern spotted owl.

Recruitment: In spotted and barred owl biology, the addition of individuals into the territorial population at the start of each breeding season. An individual owl is considered recruited into the population if it is alive at the beginning of the first breeding season *after* its year of birth (i.e., it is nearly one year old).

Removal: In this proposed action, removal is the killing of territorial barred owls, via shooting or capture and euthanasia, for the purpose of reducing barred owl populations or preventing their establishment.

Safe Harbor Agreement: A voluntary agreement involving private or other non-Federal property owners whose actions contribute to the recovery of species listed as threatened or endangered under the Endangered Species Act. In exchange for actions that contribute to the recovery of listed species on non-Federal lands, participating property owners receive formal assurances from the Service that if they fulfill the conditions of the SHA, the Service will not require any additional or different management activities by the participants without their consent, and may return the enrolled property to the baseline conditions that existed at the beginning of the SHA.

Section 7: The section of the Endangered Species Act of 1973, as amended, outlines procedures for interagency cooperation to conserve Federally listed species and designated critical habitats. Section 7(a)(1) requires Federal agencies to use their authorities to further the conservation of listed species. Section 7(a)(2) requires Federal agencies to consult with the Services to ensure that they are not undertaking, funding, permitting, or authorizing actions likely to jeopardize the continued existence of listed species or destroy or adversely modify designated critical habitat. Other paragraphs of this section establish the requirement to conduct conferences on proposed species; allow applicants to initiate early consultation; require USFWS and NMFS to prepare biological opinions and issue incidental take statements. Section 7 also establishes procedures for seeking exemptions from the requirements of section 7(a)(2) from the Endangered Species Committee (16 U.S.C. 1531 *et seq.*).

Section 7 Consultation: The various section 7 processes, including both consultation and conference if proposed species are involved (50 CFR §402).

Section 106: Section 106 of the National Historic Preservation Act of 1966.

Sensitive Species: In this document, we will generally refer to sensitive species, a term we use to encompass the variety of at-risk species in the study areas. This term includes various State and Federal designations such as species of concern, special status species, and sensitive species.

Specialist Species: A species whose ecological strategy relies on adaptation to a relatively narrow range of often stable ecological conditions. The spotted owl is considered to be somewhat of a specialist species, as it is adapted to older forest habitats, and relies substantially on a few rodent species as its primary prey. *See also Generalist Species.*

Species of Concern: Federal species of concern is an informal term, not defined in the ESA, and commonly refers to species that are declining or appear to be in need of conservation. States may also use this term.

Spotted Owl Demographic Study Area: Study areas that are part of a long-term monitoring program assessing spotted owl demography. Study areas are located across the owl range and have relatively large sample sizes of spotted owl sites. Ongoing northern spotted owl demographic study areas referenced in this EIS are the Cle Elum, Rainier, Olympic Peninsula, Oregon Coast Ranges, Tyee, HJ Andrews, Klamath, South Cascades, Hoopa, and Willow Creek (part of the NW California study area). These areas are considered ongoing spotted owl demographic study areas because annual monitoring continues to occur and has occurred on all of these areas since at least 1990, with some sites having been monitored since 1988. California spotted owl study areas are located in Lassen National Forest, Eldorado National Forest, Sierra National Forest, and Sequoia/Kings Canyon National Parks in the Sierra Nevada, and in the San Bernardino National Forest in Coastal-Southern California.

Spotted Owl Site: Any location where territorial spotted owls are known to be present, were historically present, or may be present in unsurveyed habitat. Spotted owl sites can be identified through surveys where spotted owls were detected (e.g., USFWS 2012, entire). In cases where survey data are unavailable, spotted owl sites can be identified by 1) conducting surveys, or 2)

using a modeling approach that uses habitat and landscape characteristics to identify areas with a high probability of being occupied by spotted owls.

Status Review: A periodic analysis of a [listed] species' status conducted to ensure that the listing classification of a species as threatened or endangered on the List of Endangered and Threatened Wildlife and Plants (List) (50 CFR 17.11 – 17.12) is accurate. A status review is required every five years by section 4(c)(2) of the Endangered Species Act of 1973, as amended.

Suitable Habitat: In this EIS, northern spotted owl nesting and roosting forest conditions as modeled by the 2023 Cover Type Suitability GIS layer (Davis et al. 2023a). Suitable northern spotted owl habitat described in this document includes lands with suitable and highly-suitable nesting and roosting forest cover types as defined by Davis et al. (2022).

Survey Protocol: A standardized and often specialized survey method designed for application to certain species, to ensure efficient and scientifically credible results from data collected during those surveys.

Survival: Annual survival (or “apparent survival”) is probability that an owl that is alive and present in a monitoring area in one year survives and stays within the monitoring area until the next year (Williams et al. 2001, p. 478). A less technical definition is the probability that a spotted owl will live for at least one more year, following the time it is located as a live animal.

Take: Take is defined differently under different laws. Take of barred owls is specific to the definition of take in the Migratory Bird Treaty Act (MBTA). Take of listed species, including northern spotted owls, is defined under the Endangered Species Act.

Under the MBTA, take means to pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to pursue, hunt, shoot, wound, kill, trap, capture, or collect. (50 CFR §10.12

Under section 3(19) of the ESA, take is defined as “To harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect or attempt to engage in any such conduct.” per. Harm is further defined by USFWS to include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavior patterns, including breeding, feeding, or sheltering. (50 CFR §17.3).

Territorial: With respect to barred and spotted owls, describes an individual owl or pair of owls that is repeatedly present in an area (i.e., a territory), and defends that territory from other barred or spotted owls using territorial calls and/or physical confrontation. *See also* **Territory**.

Territory: In barred and spotted owl ecology, an area used by a mated pair of owls or an unmated territorial individual, within which the owl(s) obtain the necessary resources (e.g., prey, shelter, nest sites) to survive and (for pairs) reproduce. A territory is usually defended against conspecifics. With respect to spotted owls, a home range, usually somewhat larger than a territory, may include areas of overlap with adjacent spotted owl territories. A spotted owl core area is typically smaller than, and located within, the territory. *See also* **Core Area, Home Range, and Territorial**.

Threatened Species: Any species likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range, as defined in section 3(20) of the ESA.

Translocation: The movement of an animal to a different area for release into the wild.

Treatment: In an experimental design, a study area or sample subject to some form of experimental manipulation, for comparison with study areas or samples not subject to manipulation, to test a hypothesis regarding the treatment (manipulation) applied. More generally, treatment refers to a management intervention (for example, barred owl removal) applied in order to achieve management goals. *See also* **Control**.

Turnover: The replacement of territorial owls with new individuals of the same species at a given spotted owl territory.

Unacceptable Impacts: Within the National Parks and Monuments, unreasonable interference with an atmosphere of peace and tranquility or the natural soundscape (NPS 2006, section 1.4.7:12).

Unoccupied Site: Site where spotted owls were detected in the past, but more recent surveys have not detected owls.

UTM (Universal Transverse Mercator): A geographic coordinate system that uses a 2-dimensional Cartesian coordinate system to give locations on the surface of the Earth, and commonly used to identify specific locations during wildlife studies.

Viable Population: A self-sustaining population with a high probability of survival despite the foreseeable effects of demographic, environmental, and genetic stochasticity and of natural catastrophes.

Vital Rates: In wildlife ecology, the rates of reproduction and survival of a species of interest over a period of time, used in the estimation of population growth rates. For demography studies of the spotted owl, vital rates include survival and recruitment.

List of Acronyms and Abbreviations

Acronym or Abbreviation	Name
ARU	Autonomous Recording Unit
BLM	Bureau of Land Management
Cal FIRE	California Department of Forestry and Fire Protection
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CSO	California Spotted Owl
dB	decibel
DPS	Distinct Population Segment
EIS	Environmental Impact Statement
E.O.	Executive Order
ESA	Endangered Species Act
FMA	Focal Management Area
FMP	Forest Management Plan
FR	Federal Register
GHG	Greenhouse Gas
GIS	Geographic Information System
GMA	General Management Area
HCP	Habitat Conservation Plans
MBTA	Migratory Bird Treaty Act
NEPA	National Environmental Policy Act
NOI	Notice of Intent
NPS	National Park Service
NSO	Northern Spotted Owl
ODF	Oregon Department of Forestry
PAM	Passive Acoustic Monitoring
RMP	Resource Management Plan
SHA	Safe Harbor Agreement
SOSEA	Spotted Owl Special Emphasis Area
USC	United States Code
USDA	United States Department of Agriculture
USDI	United States Department of Interior
USFS	United States Forest Service
USFWS	United States Fish and Wildlife Service
WAC	State of Washington Administrative Code
WDNR	Washington State Department of Natural Resources
WOSF	Western Oregon State Forests

List of Preparers and Acknowledgements

Draft Environmental Impact Statement Team:

Robin Bown, USFWS

EIS and Barred Owl Management Strategy Team Lead
Fish and Wildlife Biologist,
MS in Wildlife Biology, 35 years of experience

Katherine Fitzgerald, USFWS

Assistant EIS and Barred Owl Management Strategy Team Lead, Northern Oregon
Geographic Team Lead, Technical Editor
Northern Spotted Owl Recovery Coordinator
PhD in Biology, 15 years of experience

Randi Riggs, USFWS

Washington Geographic Team Lead, Barred Owl Management Strategy Team
Fish and Wildlife Biologist
MS in Zoology, 10 years of experience

Kate Freund, USFWS

NEPA Technical Expert
Pacific Regional Office; Conservation Planning Branch Manager
MEM in Environmental Management, 15 years of experience

Other primary contributors:

David Wiens, PhD, USGS Forest and Rangeland Ecosystem Science Center

Monitoring Subteam Lead, Barred Owl Management Strategy Team
Supervisory Research Wildlife Biologist
PhD in Wildlife Science, 30 years of experience

Bruce Hollen, BLM

Southern Oregon Northern California Geographic Team Lead, Barred Owl Management
Strategy Team
Threatened and Endangered Species Program Lead
B.S. General Biology, 32 years of experience

Shannon Skalos, CDFW

California Spotted Owl Geographic Team Co-lead, Barred Owl Management Strategy Team
Senior Environmental Scientist – Avian Specialist
PhD Ecology, 15 years of experience

Christine Jordan, USFWS

California Spotted Owl Geographic Team Co-lead, Barred Owl Management Strategy Team
Fish and Wildlife Biologist

Dr. John J. Keane, Pacific Southwest Research Station, USDA Forest Service
Research Ecologist
PhD Ecology, 26 years of experience

Scott Gremel – NPS
Wildlife Biologist

Barred Owl Management Strategy Development Team:

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Jim Peterson (USGS Cooperative Fish and Wildlife Research Unit, Oregon State University)
Adam Duarte (USDA Forest Service), **Raymond Davis** (USDA Forest Service), **Damon**

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Dedication

The draft EIS and Strategy are dedicated to Lowell Diller, Senior Wildlife Biologist for Green Diamond Resource Company and the original proponent of the need for barred owl management. Lowell's early research on barred owl removal proved the effectiveness and feasibility of the technique and set the standards we use today and include in the Strategy. He is greatly missed.

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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.

A1.1 Invasive Species Definitions

Direction: Executive Order 13112 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 west an invasive species as defined under E.O. 13112?

To determine the correct characterization under the E.O. 13112, we compare the components and definitions of the Executive Order to the situation with the barred owl in western North America.

Under E.O. 13112, “Invasive species” means an alien species whose introduction does or is likely to cause economic or environmental harm or harm to human health (emphasis added).

These terms are further defined as follows (emphasis added):

“**Alien species**” means, with respect to a particular ecosystem, any species, including its seeds, eggs, spores, or other biological material capable of propagating that species, that is not native to that ecosystem (*hereafter referred to as non-native in this document*).

“**Ecosystem**” means the complex of a community of organisms and its environment.

“**Native species**” means, with respect to a particular ecosystem, a species that, other than as a result of an introduction, historically occurred or currently occurs in that ecosystem.

“**Introduction**” means the intentional or unintentional escape, release, dissemination, or placement of a species into an ecosystem as a result of human activity.

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 mountains and the coastal mountains of southern California, and its historic 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, 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 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 CO₂ levels in the atmosphere rose, with pronounced warming periods in the early to mid-1900s (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 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.

Great Plains Potential Route

The changes brought to the 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, 1977:16). 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).

Conditions within the Northern Boreal Forest have 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. (Shindler 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.

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 mountains 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. 13112, "Invasive species" means an alien species whose introduction does or is likely to cause economic or environmental harm or harm to human health (emphasis added).

Alien Species: *means, with respect to a particular ecosystem, any species, including its seeds, eggs, spores, or other biological material capable of propagating that species, that is not native to that ecosystem.* To address this we must define the ecosystem and examine whether barred owls are native to the ecosystem described above.

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.

Native Species: *means a species that, other than as a result of an introduction, historically occurred or currently occurs in that ecosystem.*

Barred owls did not historically occur in the western US. They were historically found in eastern North America, generally east of the Mississippi River, with a subspecies in central Mexico, separated from the western US 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 20th 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.

The definition of a native species specifically excludes occurrence of that species as a result of an introduction.

Introduction: *means the intentional or unintentional escape, release, dissemination, or placement of a species into an ecosystem as a result of human activity.*

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.

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. 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 Great Plains and Northern Boreal Forest as a result of European settlement and potential effects of early climate change on winter conditions in these areas are the most likely and reasonable explanations for the breakdown of the barrier, as described above.

Invasive species: are defined, in part, as a species that *causes or is likely to cause environmental harm*.

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. 13112. The barred owl is an alien species, not native to 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 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.

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Appendix 2: Methodology for the Removal of Barred Owls from the Draft Barred Owl Management Strategy

The following is the protocol developed for removal under the draft Barred Owl Management 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 this Barred Owl Management 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. 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. 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 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, 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.

A2.1. 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), before beginning barred owl removals, each individual or group authorized to implement the Strategy would 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:

- 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 changes to the above information should be submitted with the annual report. Changes 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 this Strategy, each individual requesting authorization will 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 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 above information. The Service must approve the request before the individual is authorized to remove barred owls.

A2.2. Considerations Prior to Conducting Removal Activities

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

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.

A2.2.1. Identification of Barred Owls Prior to Removal

Positive identification of barred owls prior to removal would 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 should 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. Those not experienced with such identification should receive training and testing in owl identification prior to removal activities (see training section below).

A2.2.2. Preparation for Accidental Injury of Barred Owls or Non-Target Species

While the protocol is designed to avoid injury to non-target species, such injury may still occur. Prior to conducting barred owl removal activities, parties responsible for removal should 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 would be humanely euthanized. 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, there should be positive identification of the barred owl, confirmed by either two observers or by a single individual 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 should 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.

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 northern 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 should 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. "Quiet" shotguns (e.g. www.quietgun.com) 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 should be made to locate any injured barred owls and euthanize it quickly and humanely. All personnel should 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 should 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 should be described in a written incident report sent to the designated Service contact within 3 business days of the incident; this information should 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. Capture should be accomplished using techniques that minimize the risk of injury and stress to barred owls yet prove effective in capture. Any technique should be designed to secure the barred owl quickly and with the minimum potential for injury. Any captured animal should be removed immediately from the capture device. Personnel

responsible for barred owl capture should 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 possible after capture.

Carcass Recovery: 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) (see Baumbusch 2023). 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 may be buried on site or transmitted to an entity that has indicated interest and holds the appropriate MBTA and state permits to receive or dispose of the specimen.

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 should be employed to ensure the safety of all involved.

All personnel involved in lethal removal will receive specific training and must demonstrate knowledge of proper firearm safety prior to conducting removal activities. They should also demonstrate skill and accuracy with the shotgun to be used. 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 are responsible for obtaining all applicable state 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 and local) 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 area will be assessed for potential human presence (homes, tents, vehicles) and appropriate buffers will 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” shotgun may be used in areas where people may be disturbed if allowed under state 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 and Federal agency biologists for the area where the removal will occur. Consider contacting local landowners to minimize public concern.

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 target of this Strategy but have the same effect on spotted owl populations and can 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 very 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. If in doubt, removal specialists should not remove the individual 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 should 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 shooters 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 should 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

We recommend that all suspected hybrids be submitted for genetic testing to confirm their hybrid status. Retain all carcasses and check with the Service contact for a decision on testing.

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.

A2.4. Guidelines and Precautions for Nonlethal Removal

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 can 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 should be accomplished using techniques that minimize the risk of injury or mortality to barred owls, yet prove effective in capture. Any technique should be designed to secure the barred owl quickly and with the minimum potential for injury. Any captured animal should be removed immediately from the capture device. Personnel responsible for barred owl capture should 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 possible after capture.

Any non-target species inadvertently or incidentally captured during the attempted capture of a barred owl should 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 should 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 should 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 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 and 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 field training and may include a visual and auditory owl identification test.
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.

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:

- Observe at least 3 separate successful barred owl removals by an approved trainer.
- Correctly identify and successfully remove at least 4 barred owls under supervision of an agency-approved trainer.
- 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 include individuals under the Service MBTA permit.

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: Calculation of Barred Owl Population and Removal Numbers

Most of the range of the northern and California spotted owls has not been surveyed for barred owls using a protocol that supports a precise estimate of the number or density of territorial barred owl sites over this landscape. Conditions differ between the subspecies ranges; therefore, barred owl density and potential removal are calculated differently. We used the following approach to estimate the number of barred owls removed under each alternative, and to estimate the barred owl population in each area, province, the West Coast, and rangewide for the analysis of potential effects on barred owls.

A3.1 Northern Spotted Owl Range

Four study areas associated with the Barred Owl Removal Experiment (USFWS 2013) provide specific data on territorial barred owl densities, derived from barred owl specific surveys conducted on the control areas in each study area (where barred owls were not removed). This provides data for the Eastern Washington Cascades province (Cle Elum Study Area), Oregon Coast Ranges province (Oregon Coast Ranges Study Area), Oregon Klamath province (Union/Myrtle-Klamath Study Area) and the California Klamath Province (Willow Creek Study Area) (Table A3-1).

Table A3-1. The estimate of the density of territorial barred owls on study areas with extensive barred owl surveys, on areas without barred owl removal. This does not account for floaters or dispersing barred owls.

Study Area	Physiographic Province	Control Area Acres	Estimated Number of Territorial Barred Owls in Control Area for Highest Year	Number of Territorial Barred Owls Detected per 1,000 Acres
Cle Elum	Eastern Washington Cascades	134,672	182	1.35 ¹
Oregon Coast Ranges	Oregon Coast Ranges	219,924	635	2.89 ¹
Union/Myrtle-Klamath	Oregon Klamath	150,734	384	2.55 ¹
Willow Creek	California Klamath	56,241	31	1.19 ²

¹ For the Cle Elum, Oregon Coast Ranges, and Union/Myrtle Study Areas, territorial barred owl densities were estimated for the years 2021-2023 using extrapolation of the linear annual time trend from the survey years (Wiens pers comm. 2023).

²For the Willow Creek, the estimate represents adjusted territorial barred owl densities from 2019, the last year of barred owl surveys on the study areas. (Franklin pers comm. 2023).

Territorial barred owl density data from these study areas can be extrapolated across the

province in which they lie. For provinces without past barred owl surveys, we can extrapolate from the known barred owl site density estimates in Table A3-1. We used data from the most similar study area to estimate the number and density of barred owls on forest lands for the provinces in the range of the northern spotted owl (Table A3-2) and on management lands in each alternative. These results represent our best estimate of the initial number of territorial barred owls within the area potential subject to management under each alternative.

Table A3-2. Physiographic Provinces and data applied in the range of the northern spotted owl.

Physiographic Province	Study Area Data Applied	Estimated Number of Barred Owls Detected per 1,000 Acres
Olympic Peninsula	Oregon Coast Ranges	2.89
Western Washington Cascades	Oregon Coast Ranges	2.89
Eastern Washington Cascades	Cle Elum	1.35
Washington Lowlands	Oregon Coast Ranges	2.89
Oregon Coast Ranges	Oregon Coast Ranges	2.89
Western Oregon Cascades	Oregon Coast Ranges	2.89
Eastern Oregon Cascades	Cle Elum	1.35
Oregon Klamath	Union/Myrtle-Klamath	2.55
California Coast	Willow Creek	1.19
California Klamath	Willow Creek	1.19
California Cascades	Willow Creek	1.19

There are no existing estimates of barred owl population size across the range of the northern and California spotted owls. Until recently, we did not have the capability to realistically provide such an estimate, even in a general sense. While data are still limited, we have attempted to determine the potential current barred owl population size by province.

Barred owls use a wide variety of forest types, and there is no barred owl habitat GIS layer available at this time. In the past we used spotted owl habitat as the surrogate for barred owls, but this likely substantially underestimated the available barred owl habitat. For this EIS, within the range of the northern spotted owl, we are utilizing a GIS layer that identifies areas capable of supporting forest landscapes (forest-capable lands) as the surrogate habitat base on which to extrapolate potential barred owl populations. Using the densities from Table A3-1, and the acres of forest-capable land in each province, we estimated the potential barred owl population in each province (Table 3-1). These estimates are based on the maximum number of barred owls detected per survey site (500-ha hexagon plot) per year, averaged across survey sites for each area and do not account for imperfect detection rates of barred owls during survey. Therefore, even though the resulting numbers appear precise, these should be considered general estimates.

Table A3-3. Estimate of potential barred owl populations by physiographic province.

Physiographic Province	Study Area Data Applied	Estimated Number of Barred Owls Detected per 1,000 Acres	Acres of Forest Lands	Estimated Initial Population of Barred Owls
Olympic Peninsula	Oregon Coast Ranges	2.89	2,721,994	7,862
Western Washington Cascades	Oregon Coast Ranges	2.89	5,259,617	15,191
Eastern Washington Cascades	Cle Elum	1.35	4,213,859	5,695
Western Washington Lowlands	Oregon Coast Ranges	2.89	4,529,737	13,083
Oregon Coast Ranges	Oregon Coast Ranges	2.89	5,492,609	15,864
Western Oregon Cascades	Oregon Coast Ranges	2.89	6,547,882	18,912
Eastern Oregon Cascades	Cle Elum	1.35	2,097,231	2,834
Oregon Klamath	Union/Myrtle-Klamath	2.55	3,619,558	9,219
California Coast	Willow Creek	1.19	3,915,313	4,676
California Klamath	Willow Creek	1.19	5,531,309	6,606
California Cascades	Willow Creek	1.19	1,976,883	2,361
TOTAL			45,905,992	102,304

A3.1.1 Factors Influencing the Number of Barred Owls Removed under Each Action Alternative

Starting with the estimated initial population of territorial barred owls in each management area, we then estimated the number of barred owls that would likely be removed on areas under management for each alternative, considering three factors:

- Rate at which territorial barred owls would be removed from each area.
- Source for, and rate of, barred owl reoccupancy of sites after the initial territorial barred owls had been removed, thereby recruiting to the territorial population.
- Rate at which barred owls recolonizing the management areas would themselves be removed.

A3.1.2 Annual Rate of Removal of Territorial Barred Owls

Initial results of work done on lands of the Green Diamond Resource Company, under a separate scientific collecting permit, provide evidence that removal of territorial barred owls in management areas with good access, and employing experienced, trained shooters, can achieve rates exceeding 90 percent per year. Results from the Barred Owl Removal Experiment showed

that the per visit removal success rate, defined as the mean number of barred owls removed per visit divided by the mean number of barred owls detected, ranged from 57 percent in Oregon to 78 percent in Washington (D. Wiens pers comm), with the cumulative removal success rate across three visits greater than 92 percent.

Removal rates can approach 100 percent if repeated removal visits to each sample site are conducted, or in areas with excellent access if intensive surveys are done prior to initiating removal; however, removal rates are likely lower in areas with restricted access (e.g., wilderness areas or parks) or extended periods of snow cover, or during winter months when barred owls are likely to be less responsive.

Although our goal for territorial barred owl removal would be 100 percent in most cases, we anticipate an overall rate closer to 90 percent and use this for assessing the effects of removal of barred owls. We will continue to collect additional information to improve on our understanding of removal success.

A3.1.3 Source of Barred Owls That May Recruit into Sites within Management Areas

Similar to spotted owls, territorial barred owls tend to remain within their home ranges as long as they can defend a territory, and maintain a pair bond, or attract a mate. We anticipate that very few territorial barred owls will leave their territories and move into the management areas from adjacent suitable habitat unless they are displaced or are unsuccessful in establishing a pair bond in that territory. For sites along the border of management areas, territorial barred owls may adjust their territories to include areas within the removal footprint. We anticipate that adults moving into the management areas would be removed at the same rate as any other territorial barred owl.

We evaluated two primary sources of barred owls that may repopulate sites once the territorial barred owls are removed, thereby recruiting to the territorial population: “floaters” and dispersers. Floaters are non-territorial, transient, barred owls that persist in an area. Dispersers may come from outside the management area or residual reproduction from within the removal area.

Floater Barred Owls

“Floater” barred owls are defined as adults or subadults that have not been able to achieve pair or territorial status. Floaters do not have established territories but may persist within the landscape as potential replacements for territorial individuals. Floaters may not disperse great distances, yet typically are not restricted in their annual movements to a home range associated with a single territory. We anticipate that floaters will occur within suitable habitat in or near barred owl management areas, especially where barred owls are currently at or near carrying capacity within a landscape. Such individuals, as differentiated from dispersing barred owls, would tend to move shorter distances and remain within a more localized landscape. We are unaware of data or numeric information that would allow us to precisely quantify the extent of this population, or that would allow us to estimate the distances such individuals may travel in search of a potentially vacant territory or available mate.

We anticipate that the number of floaters would be highest in populations where territorial pairs approached saturation densities (i.e., near carrying capacity), and low in populations where territorial densities were not fully saturated, potentially with unpaired mates or empty territories available in suitable habitat. Removal of territorial barred owls in management areas would create vacant territories or unpaired potential mates where floaters may attempt to establish a territory or pair up with unmated barred owls. Removal of territorial individuals would likely result in the floaters rapidly establishing territories, and themselves being subject to removal. We anticipate the number of floaters would decline during the early years of the experiment, with few floaters remaining in the management areas in later years. However, based on the results of the experiment, where removal numbers did not decline appreciably during the four to five years of the study, this may take a decade or more. Floaters may continue to move into the management areas from areas near the boundary and be removed themselves, either later in the initial removal period or in subsequent removal periods.

We anticipate that most “floaters” would become territorial individuals after the removal of the initial territorial barred owls. The number of floaters coming to occupy vacated sites would be limited by (a) the number of available floaters in or immediately adjacent to the management area and (b) the number of territorial individuals removed during the prior year, thereby creating empty territories for recolonization by floaters. The number of floaters that became territorial would likely not exceed the number of available territories in the management area.

Between the start of the first and second years of removal, we anticipate that a relatively high proportion of the territorial barred owls that had been removed would be replaced by adult and subadult floaters already present in the management area or immediately adjacent untreated area. The number of barred owls in the floater pool would depend on two factors: (a) the current density of territorial barred owls compared to the overall carrying capacity of the area; and (b) the number of years that the area may have been at or near carrying capacity, producing young who survived as non-territorial floaters on the landscape. In areas substantially below carrying capacity, floaters would have many opportunities to establish a territory, so few individuals would have to remain floaters (non-territorial and moving around the landscape). In these cases, the number of floaters on the landscape would be low. Conversely, we anticipate that landscapes already at carrying capacity would have a high number of available floaters that would reoccupy vacated territories soon after removal of territorial barred owls.

Dispersing Barred Owls

We define dispersing barred owls as individuals emigrating from their natal area. These individuals may travel over large areas, potentially up to 50 miles or more, in search of suitable habitat and available mates before attempting to become territorial. Based on our knowledge of spotted owl dispersal, we anticipate barred owl dispersal begins in early fall, and a large proportion of the total distance moved during the animal’s lifetime occurs during the first 6 months to 1 year following fledging, though some may continue to disperse for 2 or more years. As many as 50 to 90 percent of dispersing juvenile spotted owls may die during their first year of life as a result of starvation, avian predation, and other natural causes. We

anticipate similar rates for juvenile barred owls and suggest their rate of natural mortality during the initial dispersal period is likely quite high. We anticipate that some dispersing individuals from within the management areas and the surrounding, untreated landscapes would move into suitable habitat within the management areas from which barred owls have been removed.

After the first year of removal, we anticipate lower barred owl reproduction within the management areas themselves, as there would be few pairs to nest. If we achieved our anticipated 90 percent removal of territorial barred owls within the management areas, very few barred owl sites would be occupied by a stable pair during management efforts; therefore, reproduction within the management areas would be low. We expect some pairs would be successfully re-established during the management efforts, but since removal may occur during the breeding season, we anticipate that few of these pairs would successfully nest. In addition, since most dispersers entering the management area would likely be young-of-the-year juveniles or immature subadults, their ability to form pair bonds prior to the breeding season may be substantially less than that of territorial adults.

We anticipate that a lower proportion of barred owl sites within the management areas would be occupied by territorial adult or subadult barred owl pairs while management efforts were underway. Intensive barred owl removal is intended to reduce the number of breeding barred owls in the management areas to very low levels. However, results from the barred owl removal experiment indicate that this may be overly optimistic in the short term in areas with well-established barred owl populations. Still, a high rate of removal of territorial adult barred owls and the follow-up removal of barred owls reoccupying those sites annually should ensure fewer fledglings would be produced within the management areas.

Recruitment or Immigration Rate

Whether the source be floaters or dispersing barred owls, we anticipate that some level of cleared sites within the management areas would become occupied by barred owls before the following removal period. The rate of recruitment into the territorial population for this period is anticipated to be relatively high (60 percent) in most areas, though lower (35 percent) in the eastern Cascades of Washington and Oregon and the California Cascades, based on data from the Barred Owl Removal Experiment (Wiens, D. 2023. pers. comm.). This did not vary substantially from year to year during the study, which ran for 4-5 years. We anticipate that this recruitment rate may eventually decline as surrounding barred owl population stabilize and fewer young or floaters are available to move into the nearby management areas, but we have no data on which to base such a declining function. Therefore, we have, for this analysis, used the values above throughout the analysis.

A3.1.4 Rate of Removal of New Territorial Individuals and Pairs

Following the removal of territorial pairs or individuals, and the consequent availability of suitable habitat and unpaired mates, we anticipate that barred owls would reoccupy some of these vacated sites and recruit into the territorial population. Based on the results of the barred owl removal experiment, we anticipate recruitment would reach 60 percent in most areas where

barred owl populations are well established, and 35 percent in the drier forests of the Eastern Cascades provinces in Washington and Oregon. These levels did not vary substantially from year to year during the study. Individuals that did establish territories would themselves be subject to removal in subsequent efforts. Therefore, we anticipate they would be removed at the same rate as the original territory holders. Individuals on newly established territories may be less responsive to survey calls. Hence, the removal rate for newly territorial or younger individuals may be lower than for well-established territorial barred owls.

For the analysis we assumed a constant rate of recruitment into the area, and a constant rate of removal of these individuals. We acknowledge that this approach simplifies the annual variation in removal that may occur in any management area. The actual rate of recruitment would likely vary from year to year, in response to highly variable annual breeding success, that itself would be subject to climatic and other stochastic influences. Our example attempts to estimate removal numbers based on averaged conditions over several years and we believe it represents a reasonable scenario of removal conditions and numbers.

A3.1.5 Estimate of the Annual Number of Barred Owls Removed under Each Action Alternative

We estimated the number of barred owls that would be removed under each alternative in Section 3.4 of this draft EIS. We consider the impacts to the barred owl from this level of removal in Section 3.x of this Final EIS. To develop these estimates, and evaluate their effects, we evaluated the initial population estimates for potential levels of management and the number of barred owls removed under each alternative. Below we describe how we estimated the number of barred owls removed under each alternative and option.

First Year of Removal

At the start of removal, the initial barred owl population would include many territorial individuals who typically respond well when surveyed, allowing us to locate a high proportion of the occupied barred owl sites. We assume that nearly all territorial individuals would be members of territorial pairs. We anticipate we would be able to remove approximately 90 percent of those individuals during the first year of removal.

In addition to the territorial individuals, we anticipate that the barred owl population in the management area would include floaters or dispersing juvenile and subadult barred owls that were not yet territorial, as described above. We anticipate that some of these floaters would quickly attempt to establish territories where barred owls were removed. We anticipate a recruitment rate of 60 percent of the initial number of territorial barred owls annually in most provinces, with 35 percent recruitment in the Eastern Cascades of Washington and Oregon. Some of these individuals may become territorial and be removed during the first year and themselves be removed. Therefore, we estimate the number of barred owls removed during the first full season of removal to be approximately 1.05 times the number of initial barred owls in the management area.

Second and Subsequent Years of Removal

At the start of the second removal year and each year thereafter, we assume approximately 10 percent of the territorial barred owls individuals from the previous year and approximately 75 percent of the re-colonizers would remain (holdover population) on each management area. We anticipate the removal of approximately 90 percent of these territorial barred owls during the removal effort.

In each year, we anticipate barred owls would recruit to the territorial population at a rate of 60 percent of the initial number of territorial barred owls annually in most provinces, with 35 percent recruitment in the Eastern Cascades of Washington and Oregon.

A3.2 California Spotted Owl Range

Barred owl populations are not yet well established in the range of the California spotted owl. A small population that was initially established in the northern Sierra Nevada was effectively removed during experimental removal between 2018 and 2020 (Hofstadter et al. 2022, entire). Seventy-six barred and barred/spotted hybrid owls were removed, resulting in barred owl site occupancy declining from 0.19 to 0.03. Monitoring in the area indicates that the barred owl population have not yet become re-established in the area at this time.

Most barred owls that become territorial, and therefore potentially subject to removal, in the California spotted owl range are likely the result of dispersal and invasion from the range of the northern spotted owl where reproductive barred owl populations exist, rather than local reproduction. Individual dispersing barred owls may travel very long distances, as shown by the first records for barred owls in western Washington (1972), Oregon (1974) and California (1976). At the time of the records, the closest breeding population of barred owls was likely in British Columbia or northeastern Washington.

While barred owl populations in the northern spotted owl range will continue to be a source of barred owls invading the California spotted owl range, the rate of re-occupancy or territorial establishment is likely to remain low and relatively easily controlled by removal of barred owls, if monitoring and removal continue across the potential colonization area.

As described above, after removal of the initial established population in the northern Sierra Nevada in 2018-19, removals continued under scientific taking permit at the rate of 10 to 15 barred owls per year. Because this is based on detected and reported barred owls, and not all areas are well surveyed, this may represent low estimate of the annual territorial population. Therefore, under full removal alternatives, we will consider the potential annual removal rate at the start of management as 30 barred owls for the Sierra Nevada. We anticipate these removal levels would continue at this rate for the next 10 years if extensive monitoring and removal continued. This is generally consistent with the reported number of new individual barred and barred/spotted owl hybrids reported between 2007 and 2017 (Keane et al. 2018), again based on incomplete surveys.

As barred owl populations in the range of the northern spotted owl continue to increase, we

expect dispersal/invasion rates into the California spotted owl range will increase. Barred owl densities on the Willow Creek study area (California Klamath) are 1.19 barred owls per 1000 acres. On the Oregon Coast Range study area, where barred owl populations are approaching full occupancy, the density is 2.89 barred owls per 1000 acres. In the absence of a model or methodology to estimate barred owl carrying capacity in the California Klamath, we used the difference in these values to estimate the potential invasion rate for the California spotted owl range and used this as a surrogate for the increase in invading barred owls over time. Therefore, we anticipate the level of removal would increase by a factor of 1.2 in the second decade and 2.4 in the third decade.

For the southern California portion of the range, we note that to date no barred owls have been detected, though this may be due in part to limited survey efforts. Still, we anticipate that birders and other interested parties would be reporting some sightings if there were more than a very few individuals in the area. Given the early stage of invasion and the smaller area of barred owl management related the southern California range, we anticipate a maximum annual removal in the first decade of 5 barred owls per year, increasing at the same level described for the Sierra Nevada.

The calculation of the number of barred owls removed in management areas under each alternative derives from the proportion of the range that would be involved in removal. Based on the past invasion history, we anticipate that barred owls will be more common in the areas nearer the source population, and therefore, where an alternative includes management would be applied on only a portion of the Sierra Nevada, we assume 75 percent of the population, and removal would occur in the northern third of the province. Where alternatives include additional area beyond the range of the California spotted owl, to address the invasion before it reaches the range, we will adjust these values by the area increase.

Example: If we assume initial removal in the Sierra Nevada 30 barred owls per year average over the first decade, the estimate for the second decade would be 66 per year, and the third decade would be 102 per year. Over the three decades, this would result in a maximum removal of 1,980. For the southern California population this would be 5 per year in the first decade, 11 per year in the second decade, and 17 per year in the third decade for a total of 330. For the entire range of the California spotted owl, over the three decades of the analysis, this would yield an estimate of 2,310 barred owls removed.

A3.3 Barred Owl Population

There are few population estimates for barred owls across their range and no wide-ranging systematic monitoring, such as breeding bird surveys. Range-wide population estimates are limited and rely on data not specifically designed to detect owls. However, these remain the best available information. The Partners in Flight Population Estimate Database² estimates the global population at 3.5 million (95 % confidence limits of 3.0 to 3.9 million). As this is the only population estimate available, we have used this to put the effects of each alternative in context. In addition, to provide another approach to describe range-wide effects to barred owls, we

² <https://pif.birdconservancy.org/population-estimate-database-scores/> - accessed September 27, 2023

estimated the proportion of the entire North American barred owl population (based on range maps) affected by each alternative. For example, the range of the northern spotted owl is estimated to represent approximately 3 percent of the total range of the barred owl, so if 50 percent of the NSO range is potentially under management, the effect to the barred owl range wide would be 1.5 percent.

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Appendix 4. Monitoring Plan for the Barred Owl Management Strategy

This section includes the **Implementation** and **Effectiveness Monitoring Plans**. 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 data contributed by designated implementers. 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.

A4.1. 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 aegis of the Barred Owl Management Strategy (Strategy) were 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 Migratory Bird Treaty Act (MBTA).

The implementation monitoring plan was developed by reviewing the requirements in the removal protocol and information required to document those requirements, as well as the required for the annual reporting forms associated with Special Purpose MBTA permits.

A4.1.1 Annual report information required during implementation of barred owl removal.

Each group or individual implementing the Strategy shall submit annual reports including the information described below.

A4.1.1.1 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.

A4.1.1.2 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.

A4.2 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 (Lint et al. 1999, Davis et al. 2022, Lesmeister et al. 2021, Lesmeister and Jenkins 2022). Use of this passive acoustic monitoring (PAM) network as a platform for evaluating Strategy effectiveness 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 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, pp. 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), barred owl removal experiments (Diller et al. 2014, 2016, Wiens et al. 2021, Hofstader et al. 2022), and existing monitoring of spotted owls (Lesmeister and Jenkins 2022, Kelly et al. 2023).
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.

A4.2.1 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 habitats 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.

A4.3 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, pp. 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; Duchac et al. 2020 entire, Appel et al. 2023 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 p 13), breeding dispersal and pair status (Jenkins et al. 2019 entire, 2021 entire, Wiens et al. 2021 p 2, 7, 8).
- 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. Targeted 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-km² survey hexagons (e.g., PAM by Lesmeister and Jenkins 2022, entire)
- For California spotted owls, sites have been defined as 4-km² 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; Royle 2004 entire, Duarte et al. 2018 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 McCrea, 2021, 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, 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. 2019 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 (Noon and Biles 1990, Dugger et al. 2016, Franklin et al. 2021, Diller et al. 2016, 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, b 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).

A4.4 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 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 recorder 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 increased inference on management effectiveness.

Range-wide scale

Includes all provinces 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.

A4.5 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 satisfy permitting requirements while providing inference 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 (Fig. 1; Lesmeister et al. 2021 entire, Lesmeister and Jenkins 2022 entire). The monitoring design uses autonomous recording units (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-km² hexagons for northern spotted owls, 4-km² 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% 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 demographic study areas, and 2% coverage of Federal forest lands across the entire northern spotted owl range within the U.S. (Lesmeister and Jenkins 2021, entire, Figure 1).

The PAM sampling design for northern spotted owls (Lesmeister et al. 2021) 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. 2022 entire) or barred owls.

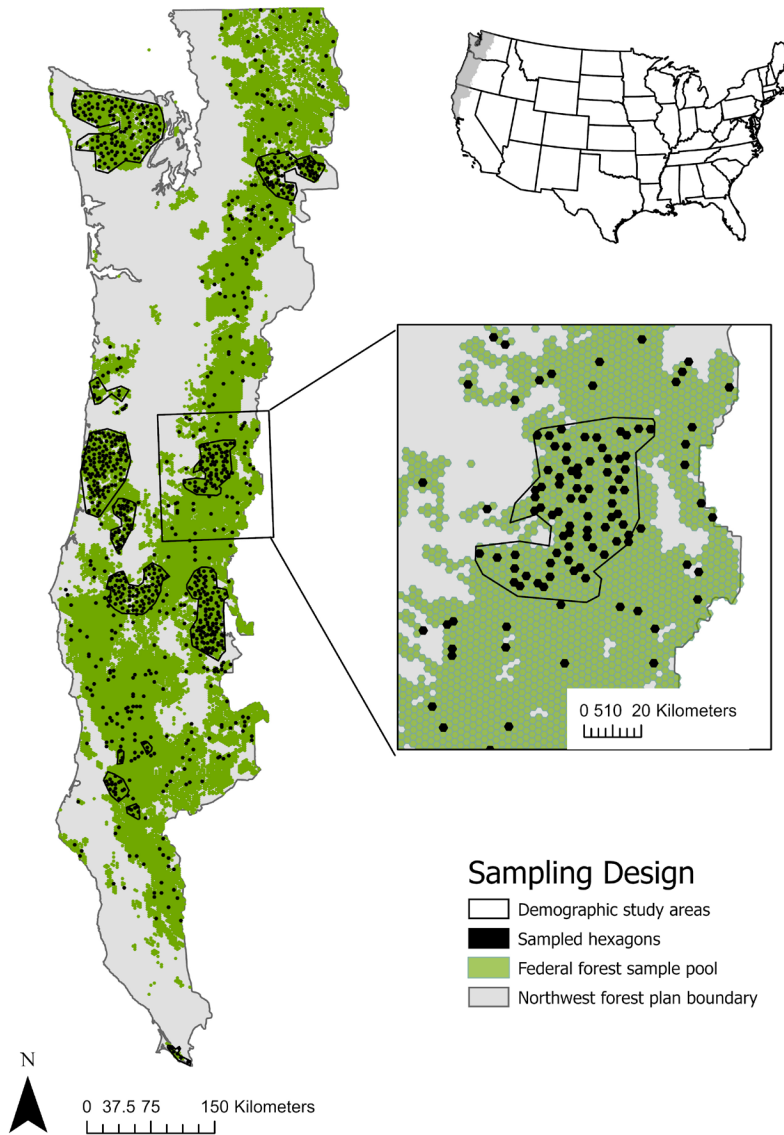


Figure 1 (from Lesmeister and Jenkins, 2021). Map of the planned passive acoustic monitoring network for northern spotted owls, barred owls, and other species in the Northwest Forest Plan area. Green area is the pool of 5-km² hexagons that are >50% forest cover and >25% under Federal land management. Black outlines are historical study areas for northern spotted owl demographic and territory occupancy monitoring. Black 5-km² hexagons are randomly selected from pool of green hexagons. Within historical study areas, 20% of hexagons were randomly selected, and outside those study areas 2% 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. 2020 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 barred owl management if the landowner or land manager chooses 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% 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 (<20%), 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 (>20%).

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 pp. 165, Bailey et al. 2007, entire). Once this information is obtained, it is recommended to follow guidelines outlined for a standard occupancy study design in MacKenzie et al. 2006 (see pp. 167–173; 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%).

A4.6 Data Analysis and Reporting

Periodic assessments of monitoring data for barred owls and spotted owls

- Annual assessments: 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 that 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: 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 subpermittee 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 Yackulic et al. 2014, Dugger et al. 2016, and Franklin et al. 2021). 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, Yackulic et al. 2014, Franklin et al. 2021). 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-km² 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 (λ_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.

A4.7 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 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 Wiens et al. 2021, Hofstadter et al. 2022).

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Personal Communications:

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Appendix 5: Scoping Comment Summary

This report describes the public noticing and engagement efforts undertaken by the U.S. Fish and Wildlife Service (Service) during the scoping period and summarizes comments received during the scoping period. The full text of comments received during scoping are available at the following web address: <https://www.regulations.gov/document/FWS-R1-ES-2022-0074-0001>.

A5.1 Public Notices

The Notice of Intent (NOI) was published in the Federal Register on July 22, 2022. The NOI provides background information on the Barred Owl Management Strategy, the purpose and need for the proposed action and potential alternatives, as well as information on the NEPA process and how to participate in the scoping process. The NOI is available at <https://www.govinfo.gov/content/pkg/FR-2022-07-22/pdf/2022-15739.pdf>

Notifications were distributed to interested parties including local state and Federal congressional representatives, tribes, and federal and state offices and departments, as well local counties and conservation organizations in Washington, Oregon, and California. The Service distributed a public scoping news release to the media announcing the availability of the NOI, the opportunity to attend a virtual public meeting, and explained how provide comments on July 22, 2022.

A5.2 Virtual Public Scoping Meeting

A virtual public meeting was held virtually on July 28, 2022, from 6 to 8 p.m. Pacific time. The meeting was held using Zoom as the webinar platform and included a presentation by the Service and a question-and-answer session. The purpose of the meeting was to provide information to the public about the NEPA process and the proposed action, and to allow participants to ask clarifying questions.

The virtual public meeting was attended by 47 individual stakeholders, with a presentation followed by a question-and-answer period. All questions were answered live during the webinar by members of the presentation team. During the virtual public meeting, the Service did not solicit, collect, or record oral public comments. Participants were provided detailed explanations on how to submit written comments online via www.Regulations.gov or via mail to FWS headquarters.

A5.3 Summary of Public Scoping Comments Received

During the scoping period a total of 37 comments were received: 3 from a federal agency, 1 from a state agency, 4 from a county, 14 from nongovernmental organizations and businesses, and 15 from members of the public. As noted above, copies of all comments are available online at: <https://www.regulations.gov/document/FWS-R1-ES-2022-0074-0001>. Additionally, Chapter 4 of

this EIS provides a summary of the alternatives, information, and analyses submitted by state, tribal, and local governments and other public commenters during scoping. Below is a summary of all comments received, by topic.

A5.3.1 General Support or Opposition

Multiple commenters expressed support for the Barred Owl Management Strategy, stating that they believe the Barred Owl Management Strategy was necessary to prevent extinction or extirpation of the Northern Spotted Owl, and was needed for survival and recovery for Northern Spotted Owl across its range.

Other commenters expressed opposition to the Barred Owl Management Strategy, including the following specific concerns: (1) lethal removal of barred owls was unfair to barred owls and inhumane, (2) if barred owl removal was not successful in the delisting of northern spotted owl, some commenters expressed concerns that more northern spotted owl could mean more limitations on logging which could have economic effects on rural communities.

A5.3.2 Scope of EIS Analysis

Commenters made the following suggestions regarding including in the EIS a full analysis of the effects of the effects of the proposed action and alternatives on the following:

- Costs of implementing the proposed strategy
- Impacts to rural economies/communities, environmental justice, and public safety
- Impacted resources
- Impacts on barred owls and hybridization
- Potential impacts to northern spotted owl from misidentification
- Trophic cascade impacts to prey species (rodents, amphibians, invertebrates, also pygmy and screech owls)
- Impact to non-target species including other wildlife species such as raptor species, and non-target species, habitat connectivity and wildlife movement
- Effects on water quality, pesticides
- Effects on threatened and endangered species
- Ecosystem services
- Noise
- Coordination with land use plans

Commenters requested the following financial logistics of the proposed action and alternatives be addressed in the EIS:

- Address how long-term actions would be supported if considerable funding and support will be required for federal and non-federal implementers.
- Consider scope and costs. Provide regulatory and financial support to willing federal and non-federal land managers or all efforts should be managed by USFWS.

- Commenters requested the EIS address the long-term strategy for continuous funding for implementation on all land ownerships, including for staff and training.

A5.3.3 Approach to EIS Analysis

Commenters made the following comments, suggestions, and questions regarding the approach to the EIS analysis:

- Include Baseline Environmental Conditions, an Alternatives Analysis, a full Climate Change Analysis, Cumulative Impacts Analysis and Public Review of the NEPA Document.
- Include Consultation with Tribal Governments. Incorporate any input on the stewardship of lands included in the program from their original inhabitants, including tribal members and indigenous communities.
- Include an analysis for a monitoring program designed to assess implementation of the Barred Owl Management Strategy.
- Expand the scope of the EIS to include an analysis of minimizing adverse impacts of barred owl on native ecosystems and food webs including barred owl prey such as rodents, small mammals, amphibians, invertebrates, pygmy and screech owl.
- Do not include trophic cascade impacts of barred owls on northern spotted owl in this EIS. Focus on reducing barred owl impacts to northern spotted owls within the scope of this EIS. Include in the scope of the EIS a summary of the unknowns associated with this effort in terms of scope, scale, timing, duration, cost, unintended and non-target impacts, and the potential ability of spotted owls to adapt and evolve over time to coexist with barred owls.
- Include analysis of different strategies across the range of California and northern spotted owls because a one-size-fits-all approach may not be the most successful strategy in different parts of the ranges.
- An adaptive approach should be recommended in the EIS, and the EIS must explore ways to adjust Service's practices based on the success—or lack of success—of the program.
- Will the EIS assess the feasibility of expecting federal agencies to have the resources, funding, and commitment needed to sustain the barred owl removal program?
- Discussion of the ethical dilemma inherent in the lethal control of one species of wildlife to conserve native wildlife.

Commenters recommend that the Service fully analyze the difficulties and limits of implementing a barred owl management strategy. Such analysis should consider at least the following:

- How will each of the alternatives support habitat connectivity and wildlife movement?
- Which species are likely to experience benefits or harm as a result of the program?
- How will the program address the potential difficulty of differentiating a barred owl from a spotted owl or potential hybridization between the two species?
- How will the program be designed to be as efficient and effective as possible, i.e., by removing as few owls as necessary to support goals of spotted owl population maintenance? How will high-priority management areas be identified?
- What population baselines are being used to design the program? Are they accurate and/or are additional surveys needed?
- What monitoring processes will be needed to track program outcomes? Does the program allow for flexibility in case changes are needed?

- What are the definitions and/or parameters of ‘success’ for the management program and what hinges on achieving such success (e.g., issuance of incidental take permits)?
- Will there be any direct, indirect, or cumulative resource impacts (such as impacts to habitat, air, and water quality) associated with program implementation?
- What will program implementation training and certification requirements entail? Are there any safety precautions that should be taken during implementation?

A5.3.4 Purpose and Need

Commenters suggested that the Service expand the purpose and need of the project to include the following objectives.

Expand the Scope of the Barred Owl Management Strategy to include additional protections for northern spotted owl including:

- northern spotted owl habitat protections/northern spotted owl habitat conservation and restoration in addition to barred owl removal
- fewer incidental take permits
- reduced salvage logging
- increased rodenticide monitoring
- include habitat protections, avoid any further incidental take,
- mandate barred owl removal for future Section 10 permit decisions.

Commenters suggested that the Service expand the scope of the purpose and need (and proposed action) to focus on the following areas.

- improving forest health to reduce the threat of catastrophic wildfire to spotted owls
- directing human actions that impact northern spotted owls such as preventing clear cutting instead of addressing the threat of barred owl competition
- increasing northern spotted owl populations in a way that improves the economic health of rural communities or ensures no negative impacts to rural economies
- supporting barred owl removal projects while the permanent strategy is under development.

Commenters requested that any strategy not prohibit federal timber harvest or place additional limitations on timber harvest, but rather focus on barred owl management to recover spotted owl.

Commenters requested that the Service incorporate barred owl removal into all facets of the Service’s work, from permitting to funding to wildlife recovery, to ensure a coherent and consistent approach. Consistently support barred owl removal as a component of federal projects including Section 10 permitting, such as mandating barred owl removal for Safe Harbor Agreements, Habitat Conservation Plans, and other permit systems and work to revise existing plans to incorporate barred owl removal. Regulate wildlife rehabilitation facilities, to ensure that injured barred owls are not released back into spotted owl territory.

A5.3.5 Alternatives

Commenters suggested that the following alternatives or elements of alternatives be analyzed in the EIS:

No Action Alternative

- Analyze a no action alternative that includes allowing barred owl to spread and outcompete the northern spotted owl.

Proposed Action

Commenters asked that the Service modify the proposed action to include:

- Only humane (non-lethal) management.
- Promote research into non-lethal strategies such as birth control that could be integrated into barred owl control efforts over time.
- a focus on maintaining California spotted owl habitat rather than barred owl management.
- Using both lethal and non-lethal approaches, especially in more populated areas
- Discussion of the ethical dilemma inherent in the lethal control of one species of wildlife to conserve native wildlife.
- Funding for implementation across multiple landowners, reducing the cost and improving effectiveness, consistency and longevity of implementation for all participants.

Commenters recommended that the proposed action:

- Maintain habitat for spotted owls, in places and climates where that habitat is likely to persist and reoccur under future conditions.
- Work with land management agencies and private or collaborative groups to support a mosaic of seral states that includes old and structurally complex forests, and allowing fire where possible, while potentially limiting fire entry in areas where old forest is severely limited and similar structures would not recover for many decades to centuries if fire were to occur.
- Review Northwest Forest Plan provisions and static habitat designations to reflect current conditions, with the goal of maintaining fire refugia and supporting a shifting mosaic of habitat types and ages to the extent feasible, at least on public land.
- Habitat management strategies should not expect dry areas to produce wet-forest conditions, expect total fire exclusion to be effective, or expect individual reserve areas to remain unchanged over time.
- Support broader ecosystems in all species-focused actions to the extent possible, while recognizing the USFWS is constrained by the single-species focus of the Endangered Species Act.
- Focus resources on maintaining diverse ecosystem states and patterns to support as many species and interspecies relationships as possible.
- Combine barred owl management with a commensurate reduction in habitat degradation and removal, especially on public lands where federal land management agencies continue to remove older habitat.
- In combination with barred owl management, adequately and aggressively address the threat, loss and fragmentation of mature and old growth forests.
- Continue to utilize the 1994 Northwest Forest Plan to restore northwest forest ecosystems and recover the spotted owl.

- Expand upon the Northwest Forest Plan and protect all spotted owl nesting, roosting and foraging habitat in mature and old growth forests on federal lands and increasing protections on state and private lands.
 - Increase habitat protections in the habitat conservation plans (HCPs) that are currently under development.
 - Protect more habitat in order to both compensate for habitat lost to barred owl occupation.
 - Prioritize habitat retention and connectivity in combination with a barred owl management program.
 - Minimize human impacts to owl habitat.
 - Barred owl management must be combined with meaningful reductions in habitat degradation and removal, especially on public lands where federal land management agencies continue to remove older habitat.
 - Do not authorize timber harvest or development in suitable spotted owl habitat in exchange for barred owl removal. Include both habitat conservation and barred owl removal to conserve spotted owls.
 - Reaffirm the conclusions of the 2011 Recovery Plan that habitat protection and restoration is a necessary recovery action for the species.
 - Until an active barred owl management plan is in effect, the Service should ensure that habitat modification does not further harm spotted owls and their habitat.
- Recommendations:
- Until barred owl management stabilizes local spotted owl populations, commenters requested that the Service and other federal partners not allow any incidental take of northern spotted owl, California spotted owl, or removal of designated critical habitat for either species.
 - Commenters requested that the Service not authorize the loss of any suitable habitat for either northern or California spotted owls until a permanent barred owl control program is operational and showing positive results across most control areas or sites.

Ensure the proposed action includes management for barred owl in the following areas:

- Non-federal lands; include funding for management on non-federal land.
- Marin County, the California Coast Range, and the Sierra Nevada and adjacent foothills.
- Northern California.
- Include Elliott State Forest and adjacent areas.
- Include barred owl removal in Oregon State University's research on the new proposed Elliott Management Reserve Watersheds) or Conservation Reserve Watersheds.
- Include the Weyerhaeuser Millicoma Tree Farm Adjacent to the Elliott with a 1995 northern spotted owl HCP.
- Include Roseburg Forest Products lands, adjacent to Millicoma Tree Farm, and adjacent private lands where the landowner commented they supported barred owl removal on their property.
- Include Cle Elum, Rainier and other demographic study areas where long-term data can be used to evaluate success.
- Immediately initiate barred owl removal in large Washington landscapes across multiple jurisdictions, including the Olympic peninsula and other parts of Washington that have resilient spotted owl populations or pairs, or significant tracts of suitable habitat to support recovering populations.

- Request that the Service devote substantial management strategy programming and resources to the Olympic Peninsula of western Washington State across multiple land ownerships on the Olympic Peninsula Including the Olympic Experimental State Forest under the Washington State Trust Lands Habitat Conservation Plan, Forest Service and National Park land.
- Include federal lands within the vicinity of ongoing removal studies in Del Norte, Humboldt, Trinity, and Mendocino Counties as well as non-federal lands.
- Include Sierra Pacific lands in California and include neighboring lands to provide a defensible area.
- Include areas surrounding and designated as critical habitat for northern spotted owl.
- Include large scale removal across all land ownerships.
- Include high priority management sites that would complement ongoing removal efforts on Green Diamond's California Timberlands and lands of the Hoopa Valley Tribe.
- Prioritize removal on federal lands within the vicinity of ongoing removal studies in Del Norte, Humboldt, Trinity, and Mendocino Counties.
- Prioritize areas where federal land management agencies, private landowners with HCPs, and academic researchers have initiated barred owl removal studies in the range of the California spotted owl.
- Barred owl management on BLM managed land should be focused on those acres currently designated as Late Successional Reserve to meet the to meet the requirement of the BLM Resource Management Plan and permit appropriate management of the Harvest Land Base in the near-term.
- Prioritize early removal of barred owls in California spotted owl territory and at the southern end of the northern spotted owl range.

Include the following considerations when selecting areas for barred owl management:

- Prioritize barred owl removal where localized extinction of northern or California spotted owls from barred owl invasion may be most likely. No area of spotted owl territory should be lost to barred owl invasion.
- Emphasize removal efforts across large blocks of land and at the edges of the California spotted owl range, to attempt to prevent additional barred owl encroachment into occupied California spotted owl habitat.
- Establish agreements before identifying management areas. De-prioritize areas where wildfire is likely.
- Prioritize removal near breeding pairs of spotted owl and barred owls.
- Prioritize wilderness/best habitat for barred owl removal.
- Management should be long-term/in perpetuity.
- Focus on areas of known occupancy.
- Include wilderness and other roadless areas.
- Focus on areas with biotic and abiotic features that are important to northern spotted owl survival and fitness.
- Prioritize areas where "large, continuous blocks" capable of supporting "a minimum of 20 northern spotted owl territories" occur.

- Consider areas selected for long term barred owl management as effective northern spotted owl sanctuaries.
- Consider long-term ability of land managers to manage a sustainable population based on land allocation and configuration.
- Designated wilderness areas with contiguous late-successional habitat that lack stable northern spotted owl populations could be candidates for spotted owl reintroduction.
- Focus on areas with higher concentration of barred owls with more severely declining populations of spotted owls to immediately benefit northern spotted owl populations.
- Focus on areas with declining northern spotted owl populations/higher concentration of barred owls.
- Focus management in areas with long-term northern spotted owl population data.
- Focus Initial management sites in areas with preexisting long-term northern spotted owl population data to minimize resources and establish data monitoring to evaluate success of strategy implementation.
- Focus management on high-quality habitat including Late Successional Reserves and designated Critical Habitat and the edge of California spotted owl range.
- prioritize management at the edge of the California spotted owl range.
- Focus on large blocks of high-quality habitat and at the edges of the California spotted owl range, to attempt to prevent additional barred owl encroachment into occupied California spotted owl habitat.
- Include areas where long term commitments are secured prior to implementation.
- Avoid areas where catastrophic wildfire would likely occur in the foreseeable future by utilizing maps and data for wildfire risk.
- Include state and local partners to assist in barred owl removal efforts.
- Under the management strategy do not require additional monitoring/reporting requirements to not cause additional burden for landowners that already have monitoring/reporting requirements in place for spotted owls and/or barred owls under a federal permit (i.e., 10 (a)1(B)).
- Maximize removal efforts by prioritizing large-scale removal of barred owls across large removal areas to maximize the conservation benefit and to establish efficiencies of scale.
- Maximizing removal efforts by including removal on public and private lands with coordination between public and private entities. Costs and time expenditures can be distributed among different entities.
- Include a monitoring plan as part of the Barred Owl Management Strategy that includes adaptive management.
- Include analysis of different strategies across the range of California and northern spotted owls because a one-size-fits-all approach may not be the most successful strategy in different parts of the ranges.
- An adaptive approach should be recommended in the EIS, and the EIS must explore ways to adjust FWS's practices based on the success—or lack of success—of the program.
- Incorporate strong adaptive management and expert review components that ensure the efficacy of this strategy will be regularly reviewed and refined over time in order to maximize efficacy, minimize harm and is ensure that the strategy is substantially improving the spotted owl's chances for survival.

- Track progress of barred owl removal program. Continuously track the success of the barred owl removal program to determine whether it is having a long-term positive impact on northern spotted owl populations. Use a demographic study approach rather than an occupancy study approach.
- Ensure review, evaluation, and procedures for modifying or terminating control strategies as warranted...
- Include triggers for determining success at meeting the purpose and adaptive management needs after 15 years.
- Track program impacts on rural economies and adaptively manage or terminate the program if rural economies experience negative impacts from implementation of the Strategy.
- Aligning monitoring/reporting requirements for BOMS with existing efforts under S10 permits and other ESA regulatory compliance.

Commenters asked that the following questions be addressed:

- How will the strategy identify high-priority areas?
- Will these be only on public lands?
- What would be the buy-in process for private landowners? How will the management areas effect adjacent lands and what effects will be considered detrimental to the neighboring properties?
- What options will the adjacent properties have with barred owl management?
- Did past barred owl removals result in any documented mortality of spotted owls through either misidentification of owls or through accidental take of spotted owls? If so, how does the new proposed action aim to avoid any mortality of non-target species?
- Over the years of the Removal Experiment, were any significant impacts to the environment documented by any of the agencies involved in the Experiment? Did the Experiment result in the disturbance of raptors during the breeding season such that northern goshawks or spotted owls or other at-risk raptor species abandoned their nests or left young on the nest unprotected and thus vulnerable to predators? If so, how will the new strategy aim to avoid those impacts?
- What potential adverse impacts have been identified as possible outcomes if barred owls are lethally removed, but no spotted owls replace them in the territory over time?
- Have any documented accidents occurred in past barred owl removals that resulted in significant effects for humans?
- Will the EIS assess the feasibility of expecting federal agencies to have the resources, funding, and commitment needed to sustain the barred owl removal program? In a scenario where ideal resources have been allocated for this project, how many barred owls would be expected to be taken per year?
- The results of an EIS are not intended to be used indefinitely. At what point in the long-term management's lifespan will another EIS be conducted to readdress this projects direct and indirect ecosystem impacts?

Action Alternatives

Scoping comments included proposed modifications or additions to the proposed action for inclusion in action alternatives:

- an action alternative that does not kill either species and protects both species.
- A quick and aggressive implementation to prevent northern spotted owl extirpation.
- Take a more gradual approach for barred owl management to slow down and prolongs the rate of introgression to avoid genetic swamping for a limited term.
- Focus on lethal removal to effectively address the threat of barred owl competition.
- Use shooting for lethal removal instead of poison to avoid impacts to non-target species.
- Act immediately with lethal removal across all land ownerships, across the range of northern spotted owl.
- Include the eradication or reduction in number of barred owls across the ranges of California spotted owl and northern spotted owl range to prevent extirpation in portions of the ranges and to prevent a loss of genetic diversity and adaptability to a range of current and future conditions.
- Include long term, sustained removal actions required for barred owls to be prevented from expanding their range or kept at such low numbers that they are not a significant threat to the spotted owl.
- Explore utilizing private individuals with extensive training and incentive programs to remove barred owls on multiple land ownership types including private and county lands.
- Emphasize commitment to utilizing highly trained personnel to conduct barred owl removal actions. Describe whether it will be practicable from an economic, logistical and technical perspective to maintain these standards in a large-scale approach.
- Describe how non-target impacts will be avoided.
- Develop a plan to study and humanely manage the barred owl without lethal removal after in depth studies and subsequent proposals by specialists in the subject field.
- Conduct further study, including gathering additional genetic/genomic data through full-genome sequencing prior to managing barred owl.
- Research if forest management has contributed to barred owl invasion. Determine if barred owl populations can grow in dense forests and forests where large fires have occurred. Research if spotted owl populations can grow in forests treated for fire resiliency.
- Focus on spotted owl habitat instead of managing barred owls, or in combination with barred owl management.
- Analyze an alternative that maintains the California spotted owl's role in ecosystems without managing barred owls.

A5.4 Summary of Submitted Information and Analyses

The following supplemental information (i.e., supplemental materials or references) was submitted during scoping for consideration by the lead and cooperating agencies in developing the EIS.

The book entitled *Wild Souls: What We Owe Animals in a Changing World* by writer Emma Marris that presents philosophical ideas related to the ethical challenges of managing interactions between introduced and native species in conservation science.

The CNN series titled *Patagonia* that presents how the Puma is managed in a non-lethal way.

The Northwest Forest Plan, a land management plan that provides standards and guidelines for forest management on federal lands and has guided the management of federal forest lands within the range of the northern spotted owl since 1994.

Spotted owl and barred owl location and survey data in the *BIOS database* (from spotted owl surveys by North Coast Resource Management, Inc. and others) managed by California Department of Fish and Wildlife.

Research paper entitled *Advancing effects analysis for integrated, large-scale wildfire risk assessment* (2010) prepared by Thompson et al. presents maps and data for wildfire risk that can be used as a tool for assessing risk for land management decisions.

Thesis entitled *Age-Specific and Lifetime Reproductive Success of Known Age Northern Spotted Owls on Four Study Areas In Oregon and Washington*. (2008) by Peter Loschl presents research demonstrating that a small percentage of female spotted owls are responsible for the majority of reproductive output.

A research article entitled *Genomic Variation and Recent Populations Histories of Spotted (*Strix occidentalis*) and Barred Owls (*Strix varia*)* (2021) by Fujito et al. presents an estimated divergence time of the two species using genomic data and notes that results could have resulted from limited sample size and barred owl populations in central and eastern North American not being included in the sample.

Oregon Department of Forestry (ODF) Forest Activity Electronic Reporting and Notification System (FERNS) data which includes reports of rodenticide applications on private industrial forest land within 300 feet of northern spotted owl nests.

The Elliott State Research Forest Draft Habitat Conservation Plan, July 2022. Page 2-32 which includes spotted owl survey results and decreasing spotted owl populations as barred owl populations increased.

The Habitat Conservation Plan for the Weyerhaeuser Millicoma Tree Farm (1995).

Videos of two spotted owls and several videos of multiple barred owls on private land west of Roseburg were provided by the private landowner:

- Spotted owl:
<https://youtu.be/2F-3b64RXbo>.
https://youtu.be/f-Oi_sYzGU8.
- Barred owls:
<https://youtu.be/W2LFw4s2rmA>,
https://youtu.be/_2uZrwEOFc8,
<https://youtu.be/EWQeYMcJPRc>, juvenile barred owl,
<https://youtu.be/CniEn9WlQIY>, barred owl eating a frog,
<https://youtu.be/ppKCZwbGmXE>

<https://youtu.be/J-uczEoGhwM>, barred owl eating a giant salamander.
<https://youtu.be/Fb6vHx6HKdg>, two barred owls together.
<https://youtu.be/eRtlGNLEM7E>, barred owl eating Townsend's mole.

Research paper entitled *Megafires: an emerging threat to old-forest species* (2016) prepared by Jones et al. presents evidence of different responses of spotted owls to low and high severity fires.

The federal regulation entitled 40 CFR 1502.14, which directs agencies to quantify the potential direct, indirect, and cumulative environmental impacts of each alternative in an EIS.

The federal regulation entitled 40 CFR 1508.1(g)(1), which directs agencies to include resources directly impacted by the project footprint within the geographic scope of analysis, as well as the resources indirectly (or secondarily) impacted by the project.

The resource *Wildlife Carcass Disposal. Wildlife Damage Management Technical Series*. (2018) by Vantassel S.M. and M.A. King at USDA, Animal and Plant Health Inspection Service (APHIS), Wildlife Services National Wildlife Research Center that reviews best practices for safe carcass handling and disposal methods.

The Assembly Bill 17882 signed on September 29, 2020, by California Governor Gavin Newsom, which prohibits the use of second-generation anticoagulant rodenticides (SGAR) until the Department of Pesticide Regulation's Director certifies that specific measures have been taken to reevaluate, restrict (in consultation with the California Department of Fish and Wildlife), and only use SGARs when necessary in accordance with (Section 12978.7(g) of the Food and Agricultural Code that specifies when use of second generation anti-coagulant rodenticides is allowed and necessary.

The Executive Order 13045, *Protection of Children from Environmental Health Risks and Safety Risks* (April 1997), which directs that each Federal agency shall make it a high priority to identify and assess environmental health and safety risks that may disproportionately affect children, and shall ensure that its policies, programs, activities, and standards address these risks.

The research article entitled *Noise Pollution: A Modern Plague* (2007) by Goines and Hagler, which presents evidence for how communities are affected by noise pollution.

The resource entitled *Guidelines for Community Noise* (1999) provided by the World Health Organization that presents guidelines for reducing the effects of noise to communities.

The Executive Order 12898 entitled *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations* (1994), which directs federal agencies to identify and address, as appropriate, disproportionately high and adverse human health or environmental effects of their actions on minority and low-income populations.

The Environmental Protection Agency (EPA)'s EJSCREEN tool (an environmental justice screening and mapping tool) and/or the most recent American Community Survey from the U.S.

Census Bureau (i.e., Five-Year Data Profile Estimates for 2013-2019), both of which are tools that can be used to determine the presence of minority and low-income populations within the project area of an EIS.

The presidential *Memorandum on Government-to Government Relations with Native American Tribal Governments* (1994) which outlines principles for interactions with tribal governments, including how to summarize the results of tribal consultation and incorporate feedback from the Tribes when making decisions regarding projects.

Section 106 of the National Historic Preservation Act, which requires that federal agencies consider the effects of their actions on cultural resources, following the regulation at 36 CFR 800.

Section 304 of the National Historic Preservation Act which specifies that specific information about archeological sites and Traditional Cultural Properties (TCPs) that are sensitive and protected is redacted in an EIS and mitigation measures to these sites will be included in the EIS.

The Executive Order 13007, *Indian Sacred Sites* 1996, which requires federal land managing agencies to accommodate access to, and ceremonial use of, Indian sacred sites by Indian religious practitioners, and to avoid adversely affecting the physical integrity, accessibility, or use of sacred sites.

The guidance document entitled *Forty Most Asked Questions Concerning CEQ's National Environmental Policy Act Regulations*, which reviews the parts of the NEPA process that most often prompt questions.

The federal regulation entitled 40 CFR 1502.1 which states that an EIS “shall be concise, clear and to the point” () and “written in plain language...so that decisionmakers and public can readily understand them”.

The federal regulation entitled 40 CFR 1502.8 which describes how document organization is an important aspect to the navigability and readability of the EIS and is important to fulfillment of the requirement to write in concise, plain language and use concepts that are easily understandable for the public.

The court cases below were provided as examples where federal courts recognized that the barred owl is driving northern spotted owl population declines:

- Klamath Siskiyou Wildlands Ctr. V. United States Fish & Wildlife Serv., No. 1:21-CV-00058-CL, 2022 WL 856035, at *10 (D. Or. Mar. 23, 2022);
- Friends of Animals v. United States Fish & Wildlife Serv., 879 F.3d 1000, 1001–02 (9th Cir. 2018);
- Klamath-Siskiyou Wildlands Ctr. V. Nat'l Oceanic & Atmospheric Admin., 99 F. Supp. 3d 1033, 1041 (N.D. Cal. 2015);

- Friends of Animals v. Sheehan, No. 6:17-CV-00860-AA, 2021 WL 150011, at *1 (D. Or. Jan. 15, 2021), aff'd sub nom. Friends of Animals v. United States Fish & Wildlife Serv., 28 F.4th 19 (9th Cir. 2022);
- Conservation Cong. V. Finley, 774 F.3d 611, 620 (9th Cir. 2014);
- Cascadia Wildlands v. Thrailkill,
- 806 F.3d 1234, 1241 (9th Cir. 2015);
- Friends of Animals v. United States Fish & Wildlife Serv., 28 F.4th 19, 23 (9th Cir. 2022).

The research article entitled *The invasion of barred owls and its potential effect on the spotted owl; a conservation conundrum* (2007) by Gutierrez et al. which proposed barred owl removal experiments be conducted thoughtfully and in long term demographic study areas to assess the impacts of invasive barred owls on threatened spotted owls and suggest mitigation measures to reduce the threat based on best available science.

The research article entitled *Scientific Review of the Draft Northern Spotted Owl Recovery Plan and Reviewer Comments* (2008) by Sustainable Ecosystems Institute's (SEI) and Courtney et al. which supported replicates of a barred owl removal experiment in existing long term demographic study areas to assess the threat of barred owls and the effectiveness of removal in areas where long term demographic baseline data could be used.

Comments submitted by Douglas County and the American Forest Resources Council on the federal register notice entitled *Revised Designation of Critical Habitat for the Northern Spotted Owl* – 86 FR. 38246, which analyze the economic impact of the northern spotted owl's revised critical habitat designation on rural communities.

The textbook entitled *Structured decision making: Case studies in natural resource management* by Runge et al. (2020). which describes the use of Structured Decision Making as a management framework that allows for an organized analysis of management decisions, which includes making decisions based on management objectives, while recognizing scientific predictions, uncertainty, and societal values. The book also describes adaptive resource management as a special case of SDM where decisions are linked over time and incorporates learning over time to improve management.

The research article entitled *An introduction to adaptive management for threatened and endangered species* (2011) by Runge, M. C. which describes how in adaptive management for threatened and endangered species, a formal, quantitative framework includes monitoring, which is explicitly linked to the management objectives.

The online article entitled *Structured decision making* (2018) by the US Geological Survey Eastern Ecological Science Center. which describes the use of Structured Decision Making as a management framework that allows for an organized analysis of management decisions, which

includes making decisions based on management objectives, while recognizing scientific predictions, uncertainty, and societal values.

The book entitled *Adaptive management: The U.S. Department of the Interior Applications Guide* (2012) by Williams, B. K., and E. D. Brown., Adaptive Management Working Group, Washington, DC. which describes adaptive resource management as a special case of SDM where decisions are linked over time and incorporates learning over time to improve management.

The research article entitled *Range-wide declines of northern spotted owl populations in the Pacific Northwest: A meta-analysis* (2021) by Franklin et al. which includes analysis of lengthy past records of estimating demographic parameters for northern spotted owl populations across their range and the effects of barred owls on those parameters. It assessed population trends for northern spotted owls using 26 years of data from 11 study areas and concluded that northern spotted owl populations “potentially face extirpation if the negative effects of barred owls are not ameliorated while maintaining northern spotted owl habitat.”

The report entitled *Barred owl experimental removal: Hoopa study area report to U.S. Fish and Wildlife Service* (2020) by Higley, J. M., and P. C. Carlson Hoopa Tribal Forestry, which described successful barred owl removal and included a description of how when resident barred owls are removed in particular areas, they are quickly replaced by new recruits, therefore addressing potential sources of recruitment and reduce barred owl populations in those areas while simultaneously reducing barred owl populations in the target areas can be more successful than barred owl management in a single area.

The research article entitled *Invader removal triggers competitive release in a threatened avian predator* (2021) by Wiens et al. which describes successful barred owl removal and included a description of how when resident barred owls are removed in particular areas, they are quickly replaced by new recruits, therefore addressing potential sources of recruitment and reduce barred owl populations in those areas while simultaneously reducing barred owl populations in the target areas can be more successful than barred owl management in a single area. The authors concluded that removal of barred owls had a strong, positive effect on survival of sympatric spotted owls and a weaker but positive effect on spotted owl dispersal and recruitment. The results demonstrated that the most substantial changes in population dynamics of northern spotted owls over the past two decades were associated with the invasion, population expansion, and subsequent removal of barred owls. The study provided experimental evidence of the demographic consequences of competitive release, where a threatened avian predator (northern spotted owl) was freed from restrictions imposed on its population dynamics with the removal of a competitively dominant invasive species (barred owl).

The research article entitled. *On territorial behavior and other factors influencing habitat distribution in birds* (1970) which described a theory of how birds colonize and distribute themselves on the landscape which could be used to help in identifying the source populations of barred owl recruits by initially assumed that the areas where barred owls first colonized and established breeding populations during the invasion process will be primary sources of barred owl recruits.

The research article entitled *The barred owl (Strix varia) invasion in California*. (1998) by Dark, S. J., R. J. Gutiérrez, and G. I. Gould, Jr. which included a description of how during the invasion of barred owls into northern California, barred owls seemed to initially established breeding populations in the redwood region of northern California, such as in Redwood National and State Parks.

The research article entitled *Scientific evaluation of the status of the Northern Spotted Owl*. (2004) by Courtney et al., Sustainable Ecosystems Institute, which included a description of how during the invasion of barred owls into northern California, barred owls seemed to initially established breeding populations in the redwood region of northern California, such as in Redwood National and State Parks.

The research article entitled *Range expansion of barred owls into Redwood National and State Parks: management implications and consequences for threatened northern spotted owls* (2005) by Sakai, H., which included a description of how during the invasion of barred owls into northern California, barred owls seemed to initially established breeding populations in the redwood region of northern California, such as in Redwood National and State Parks.

The research article entitled *Exploring ecological relationships in survival and estimating rates of population change using program MARK*. (2001) by Franklin, A.B., in the book entitled *Wildlife, land, and people: Priorities for the 21st century*. by Field et al., The Wildlife Society, which describes population rates of change (λ) can be decomposed into apparent survival (ϕ) and recruitment (f) as $\lambda = \phi + f$.

The NEPA documents for the Big Pines project on the Rogue River-Siskiyou National Forest were shared as an example of a project designed to improve fire resilience, forest health, structural health, and important wildlife habitat using timber harvest as a tool to reduce stand density and achieve these desired outcomes, where the project was modified to retain habitat and for northern spotted owl and late successional habitat.

The 2011 Revised Recovery Plan for the northern spotted owl and 2019 Species Assessment by the USFWS that both recognized competition from barred owls as the primary threat to northern spotted owl survival and recovery.

The research article entitled *Reserve Design for Territorial Species: The Effects of Patch Size and Spacing on the Viability of the Northern Spotted Owl* (1994) which describes that for territorial species such as the spotted owl, size, spacing and shape of reserved areas all had strong influence on population persistence, and reserves that could support a minimum of 20 spotted owl territories were more likely to maintain spotted owl populations than smaller reserves.

US Forest Service Manual guidance including Section 2323.3 of FSM 2300 – Recreation, Wilderness, and Related Resource Management, includes objectives and policy guidance related to wildlife management including the objective to “provide protection for known populations and aid recovery in areas of previous habitation, of federally listed threatened or endangered species and their habitats.” and gives Regional Foresters the authority to “approve other wildlife damage

control projects on a case-by-case basis if necessary to protect federally listed threatened or endangered species or for public health and safety.” It includes language related to “predator control projects” that “remove the offending individuals.”

US Forest Service Manual guidance including Section FSM 2323.33a which provides guidance to “Reintroduce wildlife species only if the species was once indigenous to an area and was extirpated by human induced events. Favor federally listed threatened or endangered species in reintroduction efforts.”

The biological opinion issued by the U.S. Fish & Wildlife Service associated with the BLM Resource Management Plan (RMPs) (2016) which stated that “the positive contributions of barred owl management offset the adverse impacts of the [Proposed RMP] to spotted owls and enable long-term spotted owl recovery on BLM lands” and describes how sustained yield timber management as described in the RMPs is contingent on these contributions.

The court case entitled *Am. Forest Res. Council v. Hammond*, 422 F.Supp.3d 184, 191 (D.D.C. 2019), appeal docketed, Nos. 20-5008, 20-5009 (D.C. Cir. Jan. 24, 2020) (holding “BLM must ensure that the timber produced on O&C land is sold, cut, and removed in conformity with the principle of sustained yield” and that the 2016 RMPs violated the O&C Act by reserving land from sustained-yield timber production).

The research article entitled *Arresting the spread of invasive species in continental systems* (2022) by Hofstader et al. paper, which the authors describe as a rare conservation success: the regional-scale removal of an invasive predator – the barred owl (*Strix varia*) – to benefit the spotted owl (*Strix occidentalis*) in California. In the study barred owl site occupancy declined sixfold, from 0.19 to 0.03, following 1 year of removals, and site extinction (0.92) far exceeded colonization (0.02). Spotted owls recolonized 56% of formerly occupied territories within 1 year, contrasting starkly with removals conducted after barred owls achieved high densities in the Pacific Northwest. The authors concluded that the study therefore averted the otherwise likely extirpation of California spotted owls (*Strix occidentalis occidentalis*) by barred owl competition. Collectively, leveraging technological advances in population monitoring, early intervention, targeting defensible biogeographic areas, and fostering public–private partnerships will reduce invasive species-driven extinction of native fauna in continental systems.” The study concluded that removal of barred owls as a management strategy will likely require long term sustained removal actions if barred owls are to be either prevented from expanding their range or kept at such low numbers that they are not a significant threat to the spotted owl.

The comments of the Olympic Forest Coalition (OFCO) on the Habitat Conservation Plan for the Washington State Department of Natural Resources’ (DNR) Trust Lands including the Olympic Experimental State Forest made on July 29, 2022 which note “The northern spotted owl biological opinion [for DNR’s Trust Lands Habitat Conservation Plan] contains no mention of the impacts of invasive barred owls. Since 1997, the Service has repeatedly determined that barred owls are a leading threat to the continued existence of northern spotted owls.” The comments note that the Service should reevaluate the protections of the HCP in light of the pressing threat of barred owls.

The Habitat Conservation Plan for Northern and California Spotted owl. Sierra Pacific Industries (SPI), Forestland Management Program in the Klamath, Cascade and Sierra Nevada Mountains, California (2020, updated via minor modification in 2021) by SPI and USFWS, which includes conservation measure #8 that addresses barred owl as a stressor on spotted owls for the 50 year life of the HCP. Multiple scientific studies on barred owl removal have been conducted under this HCP and state and federal permits since 2018 and has maintained very low densities of barred owl while maintaining stable to increasing populations of spotted owls (both northern spotted owl and California spotted owl). The initiation of lethal collections of barred owls within the range of northern spotted owl under the HCP project area has helped maintain one of the last few stable populations of northern spotted owl and has likely delayed or prevented future extirpation of California spotted owl according to the study by Hofstader et al. 2022 (referenced earlier in this document).

The Master's thesis entitled *A model to evaluate barred owl removal strategies for the conservation of northern spotted owls* (2016) by Baumbusch, R. C. which described how larger removal areas afford greater conservation benefits to spotted owls. Larger removal areas also means cumulatively fewer barred owls need to be removed to achieve the same conservation benefit.

The research article entitled *Removing barred owls from local areas: techniques and feasibility* (2014) by Diller et al., which described lethal barred owl removal as both feasible and effective in addressing barred owl invasion. The study reported on initial barred owl removal experiments by Green Diamond, and noted that “Most barred owls were collected within one-half hour of arrival at a site. Lethal removal of barred owls was rapid, technically feasible, and cost-effective.”

The research article entitled *Demographic response of northern spotted owls to barred owl removal* (2016) by Diller et al. which describes how northern spotted owls demonstrated the greatest demographic response when barred owl invasion was arrested before widespread and high-density occupation of an area. The paper also described how the northern spotted owls that were formerly residents but had been pushed into non-resident status or “floater” status by barred owl competition, often would reoccupy historic activity centers and begin to reproduce again once barred owls were removed,

The report entitled *Barred Owl removal report 2007–2016. Prov. B.C., Victoria, B.C. Tech. Rep. 128* (2020) by Gillis, J. and F.L. Waterhouse, which describes non-lethal removal as both more difficult, more expensive, and less effective.

The research article entitled *Potential trophic cascades triggered by the barred owl range expansion* (2016) by Holm et al., which cautions that barred owl invasion impacts other native wildlife, so much so that barred owls may trigger a “trophic cascade” by increased predation pressures on both primary and secondary prey populations.

The report entitled *Threats to the viability of California Spotted Owls. USDA Forest Service Technical Report PNW-GTR-254* (2017) by Keane, J. J. which describes that although range expansion of the barred owl into California spotted owl territory is more recent, data suggests

that California spotted owls will be negatively impacted in a manner similar to its cousin, the northern spotted owl.

The research article entitled *Early detection of rapid Barred Owl population growth within the range of the California Spotted Owl advises the Precautionary Principle* (2020) by Wood et al. which describes that although range expansion of the barred owl into California spotted owl territory is more recent, data suggests that California spotted owls will be negatively impacted in a manner similar to its cousin, the northern spotted owl.

A letter in *Science* entitled *Maximizing Endangered Species Research* (2012) by Rosenberg et al. describing comments on the Draft Environmental Impact Statement for Experimental Removal of Barred Owls to Benefit Threatened Northern Spotted Owls. This letter largely criticized the proposed experimental removal due to cost and scale and proposed that it would be ineffective and unnecessary. The letter also noted that it is important to implement management at a scale that benefits spotted owls.

The research article entitled *Transient dynamics of invasive competition: Barred Owls, Spotted Owls, habitat, and the demons of competition present* (2011) by Dugger et al. which noted that “some Spotted Owl pairs retained their territories and continued to survive and successfully reproduce during our study even on territories where Barred owls were present, meaning that the potential for northern spotted owl to exist in refugia was thought to be a possibility at that time, but that was prior to additional research being conducted on the extent of overlap in habitat between northern spotted owl and barred owl.

The National Environmental Policy Act (1970) enacted by Congress, and all federal regulations pertaining to NEPA, which requires an agency to prepare an environmental impact statement (EIS) prior to taking action significantly affecting the quality of the human environment.

87 Fed. Reg. 43888 which required description of a “No Action Alternative.”

The court cases below which reiterated the need for an agency to take a “hard look” at the impacts of an action prior to making a final decision whether it prepares an Environmental Assessment (EA) or an EIS:

- *Baltimore Gas & Elec. Co. v. Natural Res. Defense Council*, 462 U.S. 87, 97-98 (1983);
- *Kootenai Tribe of Idaho v. Veneman*, 313 F.3d 1094, 1115–16 (9th Cir. 2002), overruled in part on other grounds,
- *Wilderness Soc'y v. United States Forest Serv.*, 630 F.3d 1173, 1178–79 (9th Cir. 2011).

Federal regulation 42 U.S.C. § 4332(2)(C) which requires agencies to adequately evaluate all potential environmental impacts of proposed actions in the NEPA process.

The court case *Idaho Sporting Congress v. Thomas*, 137 F.3d 1146, 1149 (9th Cir. 1998). Which determined that the agency must provide “a reasonably thorough discussion of the significant aspects of the probable environmental consequences.

Federal regulations 42 U.S.C. § 4332(2); see also 40 C.F.R. §§ 1508.7-1508.8. that specified agencies must identify and disclose to the public all foreseeable impacts of the proposed action, including direct, indirect, and cumulative impacts.

The federal regulation 16 U.S.C. § 703. a part of the MBTA which makes it illegal to "pursue, hunt, take, capture, [or] kill . . ." any migratory bird or "any part, nest, or egg of any such bird ..., by any means or in any manner."

The federal regulation 16 U.S.C. § 704 (b). a part of the MBTA which authorizes the Secretary of Interior to adopt regulations that permit the limited killing of protected birds “subject to the provision and in order to carry out the purpose of the Conventions . . . with due regard to the zones of temperature and to the distribution, abundance, economic value, breeding habits, and times and lines of migratory flight of such birds . . . if at all, and by what means, it is compatible with the terms of the Conventions . . .”

The court case ruling from *Alaska Fish & Wildlife Federation & Outdoor Council, Inc. v. Dunkle*, 829 F.2d 933, 940, (9th Cir., which concluded that a take of migratory birds covered by the MBTA is allowed only when consistent with the Conventions underlying the MBTA 1987).

The MBTA and the Conventions, which were enacted for the very purpose of promoting the protection and conservation of migratory birds, examples follow below:

- The Convention between the U.S. and Great Britain (for Canada) for the Protection of Migratory Birds, U.S.-G.B., preamble, Aug. 16, 1916, T.S. No. 628, Preamble (entering Convention “for the protection of migratory birds. . . being desirous of saving from indiscriminate slaughter and insuring the preservation of such migratory birds”);
- The Convention Between the U.S. and the United Mexican States for the protection of Migratory Birds and Game Mammals, U.S.-Mex., preamble, Feb. 7, 1936, 50 Stat. 1311, Preamble (which acknowledges “it is right and proper to protect the said migratory birds, whatever may be their origin”);
- The Convention between the U.S. and Japan for the Protection of Migratory Birds and Birds in Danger of Extinction, US-Tokyo, March 4, 1972, 25 U.S.T. 3329, Preamble (entering Convention “for the protection of migratory birds and birds in danger of extinction”);
- The Convention Between the U.S. and the Union of the Soviet Socialist Republics Concerning the Conservation of Migratory Birds and Their Environment, Nov. 19, 1976, U.S. –U.S.S.R, 29 U.S.T. 4649, Preamble (“desiring to cooperate in implementing measures for the conservation of migratory birds and their environment”).

The decision from the court case *Missouri v. Holland*, 252 U.S. 416, 434-35 (1920); see also *United States v. Richards*, 583 F.2d 491, 495 (10th Cir. Utah 1978). where the Supreme Court found that the Conventions and the MBTA involve “a national interest of very nearly the first magnitude.”

The Japan Convention, Art. III; Soviet Convention, Art. I. In applying the conservation mandate of the MBTA, the terms of the Conventions explicitly limit the circumstances in which it is permissible to issue a permit to those situations “not inconsistent” with the objectives of the parties to the Conventions, which includes the United States and its agencies, such as FWS.

Canadian Convention, Art. II. As an example, the Amended Canadian Convention provides that “the taking of migratory game birds may be allowed at any time of year for scientific, educational, propagative, or other specific purposes consistent with the conservation principles of the Convention.”

The federal regulation 50 C.F.R. § 21.12(a). which includes an exception to the permitting requirement when Department of Interior employees performing their official duties.

The Federal registration notice 87 FR. 43886, in which the FWS states in the Notice that the purpose of the Barred Owl Management Strategy is to protect the populations of spotted owl species in Washington, Oregon and California.

The court case *United States v. Smith*, 499 U.S. 160, 167 (1991); *Far West Fed. Bank, S.B. v. Director, Office of Thrift Supervision*, 951 F.2d 1093, 1097 (9th Cir. 1991). supported that the purpose of the MBTA, which is to promote action that is “consistent with the conservation principles of the Convention” without exceptions beyond those specifically listed.

The research article entitled *Demographic response of northern spotted owls to barred owl removal*. *Journal of Wildlife Management* (2016) by Diller et al. which found that removal of barred owls at low densities from areas occupied by northern spotted owls found a positive change to the area.

The research article entitled *The past and future roles of competition and habitat in the range-wide occupancy dynamics of Northern Spotted Owls*. (2019) by Yackulic et al., which describes substantial evidence showing the negative impacts to northern spotted owl populations by barred owls and notes that in areas with high barred owl populations, the probability of northern spotted owl persistence is low without management intervention.