Wildlife

Affected Environment

Riparian ecosystems are defined as the three dimensional zones of direct physical and biotic interactions between terrestrial and aquatic ecosystems. Boundaries of the riparian zone extend outward to the limits of flooding and upward into the canopy of streamside vegetation. These areas generally occupy a small proportion of the landscape within the Pacific Northwest Region, but they are very important for wildlife. Functioning riparian areas have high species diversity, provide unique vegetation assemblages both in composition and structure, provide key movement corridors especially in fragmented environments, provide key microclimates and refugia, and provide many key ecosystem characteristics for reproduction, foraging, nesting, burrowing, hiding, resting, denning, and roosting (Johnson and O'Neil 2001).

Affected Habitat

Habitat within riparian ecosystems vary across the Pacific Northwest but there are key ecosystem characteristics that are important to wildlife regardless of this variability. The quality, quantity, and distribution of these characteristics are critical to many wildlife species for one or more of their life requisites. These include surface water, soil moisture and function, fine organic debris like leaves, needles, fine wood and lichens, course large wood and roots, large trees and snags, vegetation canopy, vegetation structure, macro-invertebrate and invertebrates, microbial populations and the greater landscape heterogeneity and connection of all of these to the drier, upland systems. They also provide habitat for keystone species like beaver (Kaufman et al. 2001 *in* chapter 14 Johnson and O'Neil 2001).

Riparian habitat provides a higher density of wood decay elements that provide for more than just wildlife habitat. They provide resources and help transform, cycle, and decompose nutrients. This can greatly contribute to overall ecosystem health, soil productivity, and growth of desired tree species. Riparian areas have a particularly important role in fungi persistence. Fungi play a number of ecological roles in forest ecosystems. Such roles include mycorrhizal associations with plants, pathogens of tree species, decomposers of coarse organic material, and food resources for wildlife (Marcot 2017).

A number of papers report use of standing and down wood-decay elements by invertebrates [literature summarized in Marcot 2017 and many other examples can be found in the DecAID Advisor (Mellen-McLean et al 2017)]. Furthermore, a number of species including fungi, rooted plants, microbes, invertebrates, birds, and mammals serve as "ecosystem engineers" when they fell live trees to create down wood (such as beavers), create, break down, and chew wood fiber, and engage in chemical and nutrient transformation of decaying wood. Cavity nesters can create feeding and exploratory cavities in snags that eventually disintegrate and decompose. This decomposition and the associated shredded woodpile can serve as habitat for a variety of insects and provide food for birds, reptiles and amphibians (Marcot 2017).

It is estimated that over 85 percent of the 59 native reptiles and amphibians in the Pacific Northwest breed in riparian areas. Most of these species forage in riparian at least 50 percent of the time. Loose bark, leaves, burrows near root wads and stumps, and down wood and snags are particularly important for reptiles and amphibians.

Avian diversity is particularly high in riparian versus upland ecosystems. Over 70 percent of birds use freshwater, riparian and wetland habitats and close to 80 percent of inland birds of the Pacific Northwest breed in riparian and wetlands (Kaufman et al, 2001 *in* chapter 14 Johnson and O'Neil).

Mammals use vegetation, down wood and snags for denning and cover. Native mammals in the Pacific Northwest use riparian areas 50 percent of the time for some critical life requirement stage. Furthermore, keystone species like beaver have illustrated that they influence the health and function of riparian habitat by creating and maintaining wetlands, influencing water and sediment movement, modifying hydrology and geomorphology, influencing nutrient cycling and decomposition, retaining sediment and organic matter, and influencing plant community composition. It has been reported that small mammal densities were three times higher in willow-dominated habitats influenced by beaver ponds than in adjacent non-beaver habitat (Medin and Clary 1991). Riparian corridors also play an important regional role in providing connectivity between upland terrestrial areas and aquatic systems. These areas help to maintain large blocks of continuous habitat used by animals to disperse and migrate.

Riparian habitats are subject to a multitude of environmental and human-caused threats and stressors such as recreational use, livestock grazing, wildland fires, and climate change. Of these stressors, climate change has the largest potential to affect viability and persistence of wildlife species across the region. In addition to the discussion about increased air and water temperatures, decreased snowpack, increased potential for large, high-intensity fire and flooding described in the Watershed and Fisheries section of this analysis, climate change is expected to affect vegetation and wildlife species ranges. Historic climate change is known to have caused shifts in the geographic ranges of many species and future climate change is expected to result in even greater redistributions of species (Langham et al. 2015). Dominant species in the subalpine zone may experience increased competition from species that are currently dominant at lower elevations. Earlier snowmelt and longer growing seasons are likely to increase tree growth but will also lengthen the summer dry period. Moist and mesic forests in the region will likely continue to be dominated by early-seral species with increasing temperature and disturbance rates. Fire- and drought-intolerant species, are likely to decrease in abundance in moist forests. Mesic forests could transition to more xeric forests limited by summer drought stress and maintained by more frequent fires. Shifts from dry forest to woodlands or shrublands may occur in the driest portions of the current dry forest range. Drought stress and large, high-severity fire patches may impede forest development in some locations. Conversion to shrubland would likely occur with increasing loss of mature forest in high-severity fire, and increasing frequency of short-interval high-severity re-burns will likely kill more regenerating conifers and potential seed trees with each successive fire. Tree growth will likely be reduced for dry forest species. Tree mortality may also increase in some locations because of the interacting effects of drought, disturbance, and insects.

Projected increases in temperature, particularly reduced frequency of below-freezing temperatures in winter, and hotter, thermal-stressing temperatures in summer, will contribute to changes in patterns of animal movement, behavior, and habitat associations. Changes in food availability (such as changes in plant food or prey abundance) and loss of habitat structures that provide thermal refugia (such as burrows, cavities, large logs and snags, or shading vegetation) may be particularly important. Maintaining heterogeneous habitat conditions and providing opportunities for animals to move (habitat connectivity) at a variety of scales are likely to be key principles for allowing animals to adjust to changed conditions. The consequences to wildlife

from the anticipated shifts in vegetation across much of the region are uncertain. Widespread change in this landscape may be slow due to the long life span of vegetation, although change may be rapid in areas where disturbances occur. Future wildlife habitat structure and configuration will be determined to a large degree by disturbance processes (including high-severity fire, insects, and disease) that are projected to increase in frequency and area impacted. A potential increase in forest net primary productivity could contribute to more rapid development of some wildlife habitat characteristics (such as increased tree growth or early-seral shrub development), but may also contribute to higher fuel loads and increased area of wildfire with consequent loss of old-forest habitat structure and landscape heterogeneity. Increased temperature and reduced snowpack in higher elevation, cold vegetation types could lead to a loss of high, cold focal wildlife habitats (subalpine forests, woodlands, and meadows). Wildlife dependent on deep snow for protection of food caches, predator avoidance, and winter thermal refugia may be particularly vulnerable (Halofsky et al. 2017).

Creating opportunities to restore or create more resilient riparian ecosystems is a high priority, as riparian reserves and riparian habitat conservation areas can serve to buffer some effects of climate change (Seavy et al. 2009). Riparian ecosystems create thermal refugia for wildlife, constant water sources, and linear habitat connectivity for dispersal. This is most evident when understanding that the largest biodiversity of wildlife species is found in riparian ecosystems (National Research Council 2002).

Affected Species

Federally Listed Species

There are multiple threatened and endangered wildlife species within the Pacific Northwest Region (refer to the Wildlife Species List tables on the project website[1]). Only a subset of these species (marbled murrelet, northern spotted owl, Canada lynx, gray wolf, grizzly bear, woodland caribou) and their designated critical habitats were analyzed in the biological assessment "Fish Habitat Restoration Activities Affecting ESA-Listed Animal and Plant Species and their Designated or Proposed Critical Habitat and Designated Essential Fish Habitat under Magnuson-Stevens Act found in Oregon, Washington and parts of California, Idaho and Nevada" (USDA Forest Service et al. 2013). Consultation with the U.S Fish and Wildlife Service on these species and their designated critical habitats are covered by the programmatic Biological Opinion for Aquatics Restoration Activities in the states of Oregon, Washington, and portions of California, Idaho, and Nevada – ARBO II (U.S. Fish and Wildlife Service 2013). Only the federally listed species covered by ARBO II are addressed in this environmental analysis. The remaining federally listed species (wolverine, western snowy plover, yellow-billed cuckoo, Oregon spotted frog, pacific fisher, Taylor's checkerspot butterfly, and Oregon silverspot butterfly) are currently not covered by ARBO II and are not analyzed here. Analysis of these species should be conducted on a case-by-case basis in project planning and may trigger separate Endangered Species Act consultation.

Regional Forester Sensitive Species

There are numerous wildlife species designated as Regional Forester's sensitive species within the Pacific Northwest Region (refer to the Wildlife Species List tables on the project website[1]). Only the sensitive species that use riparian habitat for part or all of their lifecycle are included in this analysis. These species' habitats are managed so that populations maintain viability across the

[1] https://www.fs.usda.gov/main/r6/landmanagement/projects

species' range and so it does not become federally listed. The list used in for this analysis is current as of 2018. In addition, the list for sensitive species may change periodically depending on new information on population and habitat trends, threats, and rarity. For example, in the last decade the bald eagle was de-listed under the Endangered Species Act and is now considered a Pacific Northwest Region sensitive species. Not all species displayed in the table occur within riparian reserves or riparian habitat conservation areas.

Management Indicator Species

During the preparation of land and resource management plans between 1986 and 1990, certain wildlife species were identified as management indicator species for each national forest because their populations were believed to be influenced by forest management activities. They were chosen because they: (1) are designated as proposed, endangered, threatened, or sensitive on Federal or Oregon state lists, (2) have special habitat needs that may be influenced significantly by planned management activities, (3) are popular for hunting or trapping, (4) are nongame species of special interest, or (5) indicate the effects of management for other species within major biological communities. The management indicator species' welfare can be used as an indicator of other species dependent upon similar habitat conditions. Indicator species can be used to assess the impacts of management actions on a wide range of other wildlife with similar habitat requirements.

Numerous wildlife species are designated as management indicator species within the Pacific Northwest Region (refer to the Wildlife Species List tables on the project website[2]). Species that are identified as indicators specific to aquatic and riparian habitats by each forest plan are discussed in this analysis. Species that are identified by other habitat indicators that potentially occur in riparian reserves, riparian habitat conservation areas and/or non-system road decommissioning projects but are not typically characterized as "riparian" are discussed by highlighting the specific project design criteria incorporated into the proposed action that would minimize the effect. The remaining management indicator species are not analyzed further because the proposed action has no bearing on the reason for which the species is an indicator. Additionally, forest-level supplemental analysis will also be conducted. This forest level analysis will ensure that:

- a localized look be taken if there are changes in vegetation after this decision is signed (i.e. wildfire),
- determine if there are new or local concerns about species viability and
- determine if the project is located in a special area that was not previously analyzed.

The 2012 and 1982 Planning Rules and associated directives contain language describing the scope of taxa to be considered, the role of the Forest Service in conserving species diversity and viability, and guidance for monitoring progress toward species conservation goals. The 1982 Planning Rule provided a framework for species conservation that focused on both the broad ecological system and species-specific factors. However, the science and practice of ecosystem management was less developed when the 1982 Rule and Directives were drafted, and the planning process focused more on the status of habitats of individual species (threatened and

[2] https://www.fs.usda.gov/main/r6/landmanagement/projects

endangered species, sensitive species, and management indicator species) than on the condition of the ecosystems upon which they rely.[3]

Our current land and resource management plans were prepared under the 1982 Planning Rule (except for the recently revised forest plans for the Colville, Umatilla, Wallowa-Whitman, and Malheur National Forests), therefore, the five-step management indicator species analysis process in the following paragraph is still included in the analyses due to that 1982 requirement.

For management indicator species where viability is a concern, the analysis using habitat as a proxy, includes: (1) a clear relationship between the species and its habitat based on habitat relationship that utilize the best available science; (2) the amount of habitat available at the national forest scale; (3) species presence in the project area; (4) the amount of habitat being impacted at the project level in terms of both quality and quantity; and (5) a determination of the project impact on viability at the national forest scale. This process has been supported where population monitoring data are not available, due to lack of funding or feasibility of monitoring populations (Lands Council v. McNair 2010).

Issues for Analysis

Issue 1: Project activities cause disturbance (noise and human presence) that could alter the behavior of wildlife individuals.

Description: Equipment used to implement instream, side-channel, and floodplain areas, aquatic organism passages, riparian vegetation, and road decommissioning actions and the presence of personnel during critical breeding and nesting season could cause disturbance to wildlife, causing nest abandonment and failure for that breeding season, and flushing from nesting and denning habitat. These actions could result in reduced reproductive output and survival for that breeding season. Physical disturbance (presence of equipment and personnel) may be perceived as physical threats to animals in the area and cause avoidance of the area resulting in animals to be temporarily displaced.

Issue Indicator for Analysis: Amount, duration and timing of noise created by the operation of equipment and personnel during the critical nesting/breeding season.

Measure: Decibel levels of noise created by equipment and the personnel running the equipment, the timing of the noise (time of year), duration of the noise (length of time) and proximity of noise to occupied habitat would determine the effect on wildlife individuals.

Methodology: Qualitative observations of minimal noise disturbance as a result of how well design features were used to minimize effects. Refer to the wildlife project design criteria in appendix 2, ARBO II and additional measures and/or analysis taken by the implementing forest will minimize the effect. A summary of these criteria include:

- Avoidance of nesting/breeding time periods to reduce exposure of wildlife to noise created by equipment and personnel.
- Buffers will be put in place to minimize effects by reducing visual sight distance to nests and dens. Auditory buffers will be used to minimize the duration of noise generated by

[3] Federal Register Vol. 77, No. 68, 4/9/2012

equipment and personnel. Sounds above ambient or background levels should not be heard or felt at the nests/dens.

- Landscape features and vegetation will be used to determine needs for, width and timing of buffers. Hills, water features or dense vegetation between the nest/den and the project will help to lessen the buffer width.

Issue 2: Project activities cause habitat alterations that could change the availability, distribution, and function of resources used by wildlife.

Description: Implementation of aquatic restoration actions that result in changes in riparian habitat function could affect the amount of available resources (forage/cover/nest and dens sites), the spatial distribution of those resources (habitat), and the ability of animals to disperse and move through those habitats which results in reduced effectiveness of habitats for species life requisites.

Issue Indicator A for Analysis: Habitat alteration as a result of restoration activities.

Measure: Estimated acres of habitat altered.

Methodology: Utilize the estimated acreages per year and per 10 years in Table XX.

Issue Indicator B for Analysis: Productivity and function of restored habitat.

Measure: Subwatershed condition rating of habitat restored. See Soils and Aquatic Species and Watershed sections for a description of the measure.

Methodology: See Soils and Aquatic Species and Watershed sections for how to measure habitat restored.

Issue Indicator C for Analysis: The change in turbidity and stream temperature and its effect on amphibian (frogs, salamanders) and invertebrate life history.

Measure: Refer to issues 2 and 3 of the Aquatic Species and Watershed section for a description of the measure.

Methodology: Refer to the Aquatic Species and Watershed section for a description of how turbidity and stream temperature would be measured, monitored and how it affects aquatic resources.

Spatial and Temporal Boundaries

Increased noise level and changes in habitat availability, productivity and function can affect an individuals' ability to complete its life history. Measuring these indicators at the appropriate spatial and temporal scale effectively assess wildlife responses to these proposed activities.

Spatial: The appropriate spatial boundary for assessment of wildlife environmental effects include the immediate project area, associated routes and areas needed to implement the project within the home ranges where a species spends the majority of their life requirements. Home ranges vary by species. Home ranges can be much smaller than the stand level, or can be much larger than a national forest boundary, depending on the species' life history requirements. Indicators of noise and habitat alterations can be measured at multiple spatial scales. This is the appropriate scale since this analysis looks at effects of projects across the Pacific Northwest

region, and because this spatial boundary captures crucial life requirements for all the wildlife species included.

Temporal: The temporal boundary for assessment of wildlife environmental effects include both short- and long-term effects. For the purposes of this analysis, short-term effects are defined as those that occur approximately within 1 to 5 years following proposed restoration activities. Short-term impacts represent annual loss of reproduction and recruitment of individuals into the local population and the following year's reproductive output. Long-term effects are defined as those that occur approximately 5 years and beyond following the proposed restoration activities. Long-term effects represent the population's contribution to viability at the national forest scale and its potential contribution to species viability at the species' range.

Current Condition Directly Related to the Issue Indicators

Currently, riparian habitats throughout the Pacific Northwest are heavily influenced by both natural processes, natural threats and stressors and human-caused threats and stressors. Natural disturbances such as flooding, wildfires, insect and disease outbreaks, and beaver-created habitat features all contribute to changes in riparian function. These disturbances are not considered long-term modifications and are often important to maintain the function of a riparian area (Montgomery 1996). However, human-created modifications such as infrastructure construction (such as roads, trails, and culverts), water developments, recreation developments like campgrounds and picnic areas), livestock grazing, timber harvest, and use of National Forest System lands within the region have altered the long-term productivity and composition of riparian areas.

Habitat alteration, noise, and disruption associated with those actions have the ability to change the plant associations, corresponding wildlife diversity, and ecological processes. Wildfire, and insect and disease outbreaks can reduce overstory vegetation diversity. Repeated wildfires can result in vegetation type conversion and reduced wildlife biodiversity over time. Water developments can reduce the availability of reproduction habitat for aquatic wildlife species. Wildlife individuals that inhabit these areas are subject to the current activities and management actions that occur there. Animals may occupy these disturbed areas, but at lower diversity, density and/or productivity. Slabbekoorn and Ripmeester (2008) indicated that avian diversity and density were reduced near highways and other areas of high noise. Ambient noise affects individuals' (in particular birds) ability to communicate with other individuals, defend territories, and detect predators. Road avoidance, due to noise has large ecological impacts. Roads can create a barrier effect, subdividing individuals in a population, which can result in demographic consequences. Road density and network structure can indicate habitat fragmentation (Forman and Alexander 1998).

It is notable that some animals can habituate to disturbance from human presence and developments. More adaptable species may adjust behavior and habitat use around man-made developments such as culverts, roads and trails (Bolger et al. 2002). However, fragmented and disturbed habitats is not considered highly suitable. Use of disturbed habitats may indicate that man-made noise eventually becomes ambient noise, and that animals become habituated to the visual stimuli. The proposed action will increase both noise disturbance and habitat disturbance above current conditions and above ambient noise levels.

Much of the riparian habitat condition in priority and focal watersheds and where national forests are proposing aquatic restoration activities need some level of restoration due to past management

practices altering physical condition and function (such as dams, incised channels, and water diversions).

Environmental Consequences

Estimated acreages used for potential wildlife habitat impacted were based on the soils analysis since assumptions for detrimental soil condition calculate actual ground disturbed. The ground disturbed correlates to potential wildlife habitat impacted both from the standpoint of habitat removal and habitat or species disturbance. The calculations for aquatic acres impacted only include new ground disturbance and, therefore, does not correlate to potential wildlife habitat impacted. For example, the aquatics report estimated acreages impacted for nonsystem road decommissioning as only 80 acres per decade. This acreage does not include the miles of nonsystem roads decommissioned, but only the staging areas created in order to restore the roads. Average terrestrial habitats impacted would be 15 acres per year from implementation of aquatic organism passage projects; 217 acres/year from instream, side-channel and floodplain projects; 16 acres per year from riparian vegetation projects; and 273 acres per year from nonsystem road decommissioning projects for a total of 521 acres annually. Over the 10-year period, habitat impacted is not expected to exceed 5,214 acres. This is approximately 0.02 percent of national forest lands in Oregon and Washington. The scope and scale of these acreages is extremely small when taken in context of the region. Even if all 5,214 acres were completed in one year, all projects would not occur spatially in the same area. The projects would be of relatively small acreage and distributed across the Forest Service units at various times within the 15-year life of this decision.

Restoration in any habitat type is a long-duration process. Some components of riparian zones recover rapidly (such as herbaceous regrowth) whereas other features may require decades to centuries for recovery (such as deciduous colony or gallery establishment, large and small wood recruitment and retention, or shade inputs). In the middle of this spectrum are features that take about 5 to 20 years to start recovering (sediment retention, infiltration and root mass, willow establishment and reproduction, and channel and habitat changes; Kaufman et al 2001 *in* Chapter 14 Johnson and O'Neil). These long duration timeframes combined with other stresses and threats could mean even more time to recovery. The proposed actions are intended to shorten existing time frames by giving the system a "jumpstart." Additionally, the project design criteria and assumptions described regarding laws, policies, applicable consultations, and procedures for implementation (e.g. checklist) would help minimize negative effects.

Effects Common to All Species

In general, aquatics restoration activities would have short-term negative effects and long-term positive effects on most wildlife species and their habitats. This is because the goal of aquatics restoration activities is to restore the ecological function of the aquatic corridor, which contributes the overall health of the riparian ecosystem. Improvement of impaired watersheds is expected to result in improved resiliency of riparian habitat and continued support of wildlife dispersal and diversity and habitat connectivity (Seavy et al. 2009). However during the implementation of restoration activities it is expected that there will be some amount of disturbance to wildlife individuals and their habitats. Noise can flush animals or cause temporary avoidance of the project area. Noise may alter an animal's behaviors, and may even prevent individuals from communicating with each other due to the high noise levels (Slabbekoorn and Ripmeester 2008). Animals may abandon nests or young when repeatedly disturbed, thereby reducing reproductive output. Project design criteria that restrict the timing of implementation to outside of the critical

nesting and breeding season and keeping noise to ambient levels may allow animals to engage in normal reproductive behavior.

The physical presence of equipment and personnel (unfamiliar visual stimuli and scents) can cause an avoidance behavior in animals. Projects such as log and boulder placement may cause animals to temporarily avoid the area due to unfamiliar visual cues. Avoiding known nest and den sites would reduce nest or den abandonment. Keeping equipment and personnel to previously disturbed sites to the greatest degree possible, such as on existing roads and trails would reduce flushing, trampling of individuals, and compaction of habitat.

Other direct effects of the proposed action could include crushing, trampling, burning and death of wildlife individuals. Animals may be accidentally killed under motorized vehicles and equipment. Equipment can drive over and crush burrows, dens, or nests. Ground nesting birds, fossorial small mammals, mollusks, and reptiles are susceptible to crushing and trampling. During aquatic organism passage projects, such as small dam or culvert removal, or instream, side-channel and floodplain projects, such as channel reconstruction or relocation, amphibian salvage would be required (see appendix 1, project design criterion B.1. Work Area Isolation & Aquatic Organism Capture and Release). Excessive handling and containment of amphibians can cause stress, resulting in reduced slime coat and increased susceptibility to diseases and pathogens. Riparian vegetation projects such as prescribed burning will result in direct impacts to animals unable to escape the flames, heat, and smoke. Mobile species such as larger terrestrial animals and avian species generally move ahead of the flames. Animals may become disoriented and confused. Burrowing species, such as reptiles, will generally seek shelter underground. Other species seek shelter in rock crevices, rocky outcrops, streams and other habitat types less likely to burn. Aquatic species may be directly affected by an accumulation of ash in water (water clarity) and from changes in water quality. Animals that cannot easily escape from the project area could die.

Effects to wildlife habitats include fragmentation, soil erosion and compaction, and introduction of nonnative species. Activities such as riparian vegetation manipulation, operation of large equipment to implement many of the restoration projects, and restoring areas that are now forested habitat to stream channels are largely contributors to wildlife habitat effects. Soil erosion may result in temporary stream turbidity and a reduction in available dissolved oxygen. This may reduce the suitability of habitat for egg-laying frogs and salamanders. Soil compaction may prohibit or prevent the growth of native vegetation and the availability of forage, host or nectar plants and cover for animals. Compacted soils could reduce the ability to excavate burrows and channels. Changes in habitat quality can occur as a result of the introduction of nonnative plant species (weeds) from equipment and release of their seed bed following prescribed burning. Vehicles and equipment (motorized and nonmotorized) could carry nonnative plant seeds in tires and undercarriage and accidentally disperse them while traveling through the forest. Diseases, such as *Chytridiomycosis* and white nose syndrome, have been accidentally spread into the environment causing significant declines in wildlife populations of amphibians and bats, respectively. Equipment cleaning and disinfection would help reduce the spread of non-native plant material and minimize the spread of disease (see appendix 2, project design criteria: related to pathology and invasive species).

Some aquatic restoration projects would result in short-term adverse impacts, including direct mortality (such as through trampling of individuals and eggs masses or crushing of burrows) from equipment and people, and short-term habitat modification (by falling trees within the riparian

area into the stream and during riparian vegetation treatment, which includes controlled burning and removal of native and nonnative vegetation that could compete with plantings). Even though the goal is to restore plant species composition and structure that would occur under natural fire regimes, short-term effects could occur. Other instream, side-channel and floodplain projects such as fencing would have longer-term adverse effects, as fencing can prohibit dispersal, access to water and forage and cause avoidance of riparian areas (Cozzi et al. 2013; Wakeling et al. 2105). The use of project design criteria (see appendix 2) and guidance of experienced biologists during these activities would help reduce impacts to a very low level. Indirect effects or prescribed burning during riparian vegetation projects could include losses of habitat for species dependent on mature habitats, loss of vegetative cover, and impacts to particular habitat components from post-fire erosion, sedimentation, and other factors. Beneficial impacts especially for species using fire edge areas, forest openings, or early successional habitat include habitat changes, flux of early serial plant species, nutrient cycling and a flux in early seral species. "Wildland Fire in Ecosystems: Effects of Fire on Fauna" (Smith 2000; https://www.fs.fed.us/rm/pubs/rmrs_gtr042_1.pdf) is an excellent source describing typical responses of animals to wildfire (both during the fire and during post-fire ecosystem recovery).

Species Specific Effects for Federally Listed Wildlife and Critical Habitats

Effects to federally threatened and endangered, and proposed species and critical habitats were addressed in the Programmatic Biological Assessment (USDA Forest Service et al. 2013). Section 7 consultation was completed, and the action agencies (Forest Service, Bureau of Land Management and Bureau of Indian Affairs) were issued a Programmatic Biological Opinion (U.S. Fish and Wildlife Service 2013). The biological assessment and biological opinion are incorporated by reference and are available as part of the project record.

For all threatened and endangered species considered, aquatics restoration projects would affect individuals. For two bird species, the marbled murrelet and northern spotted owl, the aquatic restoration projects may affect or are likely to adversely affect these species and their habitat. For all other listed terrestrial plant and wildlife species, aquatic restoration activities conducted may affect, but are not likely to adversely affect those species. Implementation of the species-specific project design criteria would reduce the possibility of adverse effects to an extent that is discountable for both the species and their critical habitats (see appendix 2). Pages 248-250 of the biological assessment summarize the following effects to threatened and endangered wildlife species.

Birds

The biological assessment concluded that the marbled murrelet and the northern spotted owl could be affected by noise disturbance during critical breeding times. Other actions were determined to take place outside of critical nesting periods and therefore could avoid adverse effects.

Marbled Murrelet: Potential effects of the aquatic restoration projects on the marbled murrelet are associated with disturbance associated with activities that would occur during the critical nesting period from April 1 through August 6. Project design criteria are intended to schedule activities outside the breeding season or during the late breeding season (August 7 to September 15).

Harassment could occur with the following: (1) noise interrupts or precludes essential nesting and feeding behaviors; (2) noise or visual stimuli is in such close proximity to the nest that the

activity is perceived as a threat and causes flushing from the nest or missed feedings; or (3) noise is loud and sudden which causes flushing from a nest. Effects of harassment on murrelets could result in reduced reproduction or mortality of young due to avoidance of an area for nesting, adults flushing from the nest, increased susceptibility to predation, aborted feeding of young, nest abandonment, and premature fledging.

Adverse effects on marbled murrelet suitable or potential habitat or designated critical habitat are not expected to occur because nest trees and primary constituent element 1 will be avoided and limited impacts to primary constituent element 2 will not modify the function of stands in those areas. Thus adverse effects were not anticipated to critical habitat. If suitable or potential marbled murrelet habitat must be removed, the project falls outside the scope of this analysis and consultation must be initiated separately to address those effects.

Northern Spotted Owl: Potential effects of the aquatic restoration projects on the northern spotted owl are associated with disturbance from activities that would occur during the critical nesting season (generally March 1 through July 15 although this period may change slightly on individual units). Although many of the projects will be scheduled outside of this period due to work windows that minimize impacts on fish, it is expected that some projects will occur during the nesting period that may adversely affect owls.

Harassment for owls from noise and visual stimuli is similar to that for marbled murrelets. Adverse effects on spotted owl suitable habitat, 2008 designated critical habitat, or proposed critical habitat are not expected to occur because most construction activities would occur in the road prism and in poor quality riparian habitat (such as precommercial thinning in plantations). If occupied or unsurveyed suitable or potential habitat must be removed, the project would fall outside the scope of this analysis and consultation must be initiated separately to address those effects.

Project design criteria NS01 and NS02 may be waived in a particular year if nesting or reproductive success surveys conducted according to spotted owl survey guidelines reveal that spotted owls are not nesting or that no young are present that year. Waivers are valid only until March 1 of the following year. Previously known sites or activity centers are assumed occupied unless protocol surveys indicate otherwise.

Mammals

Canada Lynx: The primary potential effects on lynx from the programmatic actions are associated with disturbance. Most construction activities would occur in the road prism or poor quality riparian habitats where vegetation has been previous degraded or removed. Information in the Lynx Conservation and Assessment Strategy (Ruediger et al. 2000) was used to evaluate potential effects on lynx.

To date, most investigations of lynx have not shown human presence to influence how lynx use the landscape (Aubry et al. 2000). There have been no studies designed to determine the effects of human disturbance on lynx. Studies that have been conducted have reported anecdotal observations regarding lynx apparent tolerance of human presence. Several studies of lynx in the taiga have been conducted in areas of relatively dense rural human populations and agricultural development, suggesting that lynx can tolerate moderate levels of human disturbance. An exception to this may be activities around a den site that may cause abandonment of the site,

possibly affecting kitten survival (Ruggerio et al. 2000). Current research indicates lynx may tolerate limited disturbance, even around active dens, but the level of tolerance is unknown.

By requiring project design criteria that will establish distance buffers around known lynx dens and minimize disturbance, the aquatic restoration projects may affect, but are not likely to adversely affect lynx.

Gray Wolf: Gray wolves are currently rare or nonexistent throughout most of the area where the aquatic restoration projects will be implemented, and it is unlikely locations would directly impact any animals or active den sites. Projects would be of relatively short duration and should not affect prey availability or disturb wolves if animals are present in the area. Therefore, the determination of "may affect, but not likely to adversely affect" is appropriate for this species if the action meets recovery plan direction for den and rendezvous sites (no projects or activities within 1 mile of den or rendezvous sites scheduled to occur between April 15 and June 30).

Grizzly Bear: Potential effects of the projects on grizzly bears include habitat loss and disturbance. However, the amount of habitat removal or degradation near aquatic restoration activities is expected to be minimal (less than 1 acre of low quality riparian habitat for any project). Work would not occur in areas that may affect bears during sensitive time periods when animals could be present. Therefore, with implementation of project design criteria to avoid or minimize effects, the activities may affect, but are not likely to adversely affect the grizzly bear.

Woodland Caribou: Potential effects of the proposed action on woodland caribou include habitat loss and disturbance. However, the amount of habitat removal or degradation near project sites in the caribou recovery area in the Selkirk Mountains is expected to be minimal and would not displace caribou or result in short-term degradation of riparian areas in caribou habitat. Direct mortality or sublethal effects are unlikely. Work would not occur in sensitive areas identified by the local wildlife biologist. Therefore, implementation of the projects may affect, but are not likely to adversely affect the woodland caribou.

Species-Specific Effects for Regional Forester Sensitive Species and Management Indicator Species

Due to the number of Pacific Northwest Region Regional Forester's sensitive species and management indicator species, animals were grouped by the major taxa type: annelid/mollusk, amphibian/reptile, bird, insect, and mammal. Mammals were further broken down into subgroups: bats, mid/large mammals, small mammals, and ungulates.

Annelids/Mollusks

The giant Palouse earthworm (*Driloleirus americanus*) is the only worm that is currently designated as sensitive on the sensitive species list. This subterranean species has been found in deep and shallow loamy soils, silt loam soils, and sandy loam and sandy clay loam soils of grass prairies of the Palouse region (Blevins 2016). It is possible that there are riparian conditions within grasslands that contain the specific soil profile considered suitable for this species. This species lives exclusively underground (USDA Forest Service 2016) and would most likely not be affected by the majority of aquatics restoration activities that are intended to maintain soil productivity and function.

Several terrestrial snails and slugs are sensitive species. Many of the snails and slugs found within the region are endemic to the area. Many can be found near moist areas such as seeps and springs,

under logs, ferns and other features that provide a cool, moist microclimate. Effects to individuals include crushing, and mortality is expected as equipment and personnel are working in the project area. Egg masses that are hidden in litter and soil may also be destroyed during restoration activities such as prescribed burning, blasting, and vegetation manipulation. Due to their cryptic coloration and size, it is not expected that personnel would be able to avoid most individuals. Therefore, there would be an unquantifiable amount of mortality of snails and slugs associated with all aquatic restoration activities within the project area. While mortality of individuals is certain, projects should not result in complete loss of localized populations as project planning areas are in general small compared to the total amount of suitable and/or occupied habitat for these animals.

Amphibians/Reptiles

Amphibians occupy both aquatic and terrestrial habitats and are considered riparian dwelling. Diurnal frogs spend time in both upland and in aquatic habitats during their lifecycle and could be affected directly and indirectly by human use. It is possible that aquatic organism passage projects would dislodge egg masses, trample, and/or disturb tadpoles or newly metamorphosed individuals. Individuals may also be crushed especially in riparian transition zones when animals are transitioning from aquatic to upland habitat. During bull trout protection projects and de-watering and salvage activities, it is anticipated that frogs and salamanders would experience short-term negative effects such as displacement, reduced foraging opportunities, stress and even mortality. Electrofishing is an activity that will be used to remove brook trout and other nonnative fish species in riparian habitat conservation areas and salvage and contain aquatic species. While not lethal, it does cause temporary paralysis to individuals. Excessive handling and containment of amphibians can cause stress, resulting in reduced slime coat and increased susceptibility to diseases/pathogens (Dickens et al. 2010).

Creek and stream alterations during aquatic organism passage and instream, side-channel and floodplain projects could result in increased temporary sedimentation and reduced water quality, which affects breeding and survival of amphibians during their aquatic life-stage. Removal of dams or water retention structures can change the structure of available habitat for amphibians until the site has been fully recovered. Activities such as blasting to remove structures can cause mortality of all life stages of amphibians if not salvaged prior to the operations.

Riparian vegetation projects that are along banks can alter behavior of turtles and frogs who regularly use the shorebanks for basking. If immediately disturbed, individuals would seek cover. Over prolonged disturbance, individuals may abandon the area. This behavior can alter their ability to forage, breed and thermoregulate (Jain-Schlaepfer et al. 2016).

Snakes are considered terrestrial predators that are attracted to waterbodies (Stebbins 2003) and would be found in riparian areas. Snakes may be disturbed by the presence of hand crews and equipment if in the vicinity, but can avoid detection if cover is available. If prey sources (such as small mammals) avoid the area, then snakes may generally avoid the project area. Avoidance may lead to decreased opportunities to forage and result in lower fitness.

Crepuscular and nocturnal species such as salamanders would be minimally disturbed by daytime activities, except for those that are ground disturbing. These highly aquatic, yet terrestrial salamanders exhibit extensive underground activity immediately adjacent to the water banks. These salamanders are expected to be impacted from disturbance by activities at the bank shore. Fossorial salamanders retreat underground during the summer to avoid desiccation, thus further

reducing impacts to these species from surface activities. Most of these species burrow in soft dirt or move into rock crevices or under decaying logs to escape disturbance. Project design criteria for vegetation and snags, down wood, and green trees specify that no down wood will be removed from the project area and any trees felled will be left within the project area. This would help protect wildlife from disturbance by equipment and personnel. However, it is expected that crushing and mortality of some individuals would occur as equipment and personnel work in the riparian ecosystem.

Effects to amphibians and reptiles would be in the form of short-term loss of hiding cover (down woody debris, woodpiles and dense vegetation). Projects that compact soil could make it more difficult for animals to create burrows and move throughout its habitat. Use of project design criteria to minimize soil compaction and erosion would decrease indirect effects by maintaining habitat. Temporary water turbidity and temperature changes could affect egg laying and metamorphosis success. Small dam removal projects, channel reconstruction, and beaver habitat restoration can change the availability of pools for breeding, overwinter cover and temporarily alter prey availability. The spread of the amphibian fungal pathogen, *Batrachochytrium dendrobatidis,* which has contributed to massive deaths of amphibians, has been attributed to contaminated footwear working in aquatic systems. Implementation of decontamination project design criteria would reduce this concern. While aquatic restoration projects are intended to restore the riparian habitat, it is expected that all projects would have short-term negative effects on individuals and habitat.

Long-term positive effects of aquatic restoration include the potential for functioning watersheds, proper nutrient cycling and reduced sedimentation into waterbodies. The removal of structures like man-made dams should improve migration and breeding habitat along creeks and streams. Beaver analog structures or beaver enhancement projects should result in a higher water table and thus more available water for amphibians to reproduce in.

Bats

Bats would be minimally disturbed by aquatic restoration activities, as activities would only occur during the daylight hours. Bats are not riparian obligates, but drink available water and forage near water sources due to the abundance of insects. Bats, which are nocturnal, would most likely be disturbed from equipment and personnel if activities occur during evenings and early mornings when animals leave to forage or return to roost. Human disturbance of known bat roosts has been shown to cause abandonment of roost sites for many species, but data is largely anecdotal (Arroyo-Cabrales and de Grammont 2017).

Bat species that use snags or trees for roosting would be disturbed and displaced as snags or trees are removed as part of riparian vegetation activities. As trees are being cut or burnt, the disturbance is likely to cause bats to abandon the tree, and adult individuals may be able to avoid injury or death by flying away. Daytime disturbance may temporarily affect individuals as they try to reestablish a new roost site. Some bats have been known to use snags for roost sites, so losses of individuals is expected if snags are burnt in prescribed burns or removed as hazard trees. Bats would also be indirectly affected by aquatic restoration projects as there would be a change in habitat composition and available prey base. Bats are insectivores and can consume half of their body weight per night and lactating females eat more than their body weight per night (Fenton and Barclay 1980). The temporary loss of insects from aquatic restoration projects can adversely affect bat reproduction and survival. Implementation of the project design criteria for vegetation and snags, down wood, and green trees would help retain the prey sources (insects)

within the project area. However, it is expected that there would be some loss of foraging opportunities within the project area. Smoke generated from prescribed burns may discourage adults from roosting in the area. There may be a temporary flux (increase or decrease) in prey species as vegetation is altered or removed and ground disturbance occurs, causing insects to disperse. Overall, aquatic restoration projects would result in short-term negative effects to bats as roosting and nesting habitat is altered. Creating landscapes more resilient to fire and changes in climate are beneficial to bat biodiversity in the long term, but there are no anticipated short-term positive effects from aquatic restoration activities for these mammals. Long-term positive effects include the potential for an increase in roosting and nesting sites as trees are girdled, burnt or damaged.

Birds

Many species of birds utilize riparian areas, including waterbirds, shorebirds and songbirds. The proposed aquatic restoration activities could cause auditory and visual disturbances that can negatively affect avian species using the riparian habitats (Slabbekoorn and Ripmeester 2008). Adult and fledgling birds could be displaced from nesting and foraging areas by project activities that create excessive noise above ambient levels or increase human and mechanical presence. Deterring adults from incubating eggs, feeding nestlings, or brooding nestlings during inclement weather periods exposes nestlings to temperature extremes and precipitation and may affect nest success. Species would most likely avoid the project areas for foraging and may abandon nests if repeatedly disturbed. If nest abandonment is likely, then there would be some loss of individuals, including unhatched eggs and juveniles that have not yet fledged or are fledged but still unable to fly. It is unlikely that there would be loss of breeding adult individuals, as they could fly away if disturbed. But adults may not return to the same nesting habitat if the area is highly altered. It is expected that birds will be directly affected and some amount of nest abandonment will most likely occur due to noise disturbance. Implementation of the seasonal timing restrictions to avoid breeding and nesting seasons (see appendix 2, project design criteria) would decrease noise disturbances to birds. Limiting activities in known areas of species nesting would minimize the number of individuals disturbed.

Effects in bird habitat include loss of shrub habitat, canopy cover, and loss of nesting sites and some temporary changes to food source availability. Activities that are ground disturbing such as riparian vegetation projects may result in a flux of available insects, as larvae or egg masses are unearthed. There may be a temporary increase in insects as shrubs are removed and leaf litter is disturbed. Design criteria to retain snags, logs, and vegetative cover would minimize changes to prey sources for insectivorous birds. Birds who use riparian areas opportunistically may benefit from the temporary increase of insects available as vegetation is disturbed. Cavity nesters and upland game birds that are associated with riparian or deciduous vegetation may see short-term negative effects while the projects are being implemented but long-term benefits as these vegetation types establish and undergo succession. Project design criteria for timing restrictions and vegetation would minimize these short-term effects.

Many other birds such as raptors may forage opportunistically or travel through riparian areas, but are not considered regular occupants (Hull et al. 2014). If disturbed, these individuals can easily fly to other areas and would not be affected in the long term by activities. Raptors may be affected by noise disturbance in the short term, but project design criteria relative to large trees and seasonal restrictions will greatly minimize these short-term effects. Multiple passerines who occupy the surrounding upland habitats would be affected by noise disturbance. Equipment travel paths will potentially cause flushing of adults, crushing nests and killing non-flying young. Upon

specific project proposals, a local wildlife biologist would implement any pre-project surveys to determine the occurrence of these species and determine necessary mitigation measures, minimizing potential impacts.

Effects to waterbirds and shorebirds habitat would be in the form of short-term displacement of hiding cover (down woody debris, woodpiles and dense emergent vegetation) from prescribed burns and vegetation treatment. Projects that compact soils could make it more difficult for animals to nest in and hide among shore and bank vegetation. Use of project design criteria to minimize soil compaction and erosion would decrease indirect effects by maintaining habitat. Temporary water turbidity and/or temperature changes could affect insect recruitment and also aquatic vegetation growth for foraging. Small dam removal projects, channel reconstruction, and beaver habitat restoration can change the availability of pools for breeding, overwinter cover and temporarily alter prey availability. The spread of pathogens could occur from contaminated footwear working in aquatic systems. Implementation of decontamination project design criteria would reduce this concern. It is unknown how the spread of aquatic pathogens affects birds' foraging opportunities. Aquatic restoration activities should result in a long-term increase in functioning habitat for bird species that use aquatic habitat. Revegetation of areas with native riparian plant species would increase nesting habitat. Increased riparian vegetation, and increased insect food sources should result in increased reproduction. Prescribed burns should result in a release of nutrients into the ecosystem, which can be utilized by plants for growth.

Insects

Numerous insects are on the Pacific Northwest Region's sensitive species list. Many insects (bees, butterflies and grasshoppers) are considered terrestrial. The remaining insects are considered aquatic. Aquatic insects are addressed and analyzed as part of the Aquatics Species and Watershed section. Terrestrial insects (bees, butterflies, and grasshoppers) would not be affected by aquatic restoration activities that occur directly within the waterway. However, several species are butterflies that have an affinity for wet areas and would more likely be found in riparian habitat. Riparian vegetation projects would directly affect insects through disturbance and changes in habitat structure. Equipment can crush host or nectar plants, which crush insect larvae and egg masses that are on the plants. Adult butterflies would easily avoid disturbance and fly to other places. However, the localized loss of nectar and host plants would reduce foraging and reproduction opportunities. So, while adults may be locally displaced, they may not find nectar or pollen sources to forage, mates, or host plants to lay eggs on. Prescribed burning will kill egg masses, larvae and diapaused individuals within the leaf litter. Host, nectar, and pollen plants would be burned and unavailable for foraging and egg laying. The use of snags and down logs for instream, side-channel and floodplain projects would also have effects on insects that occupy decaying vegetation. Insects that occupy logs chosen for such projects would be submerged in water, potentially causing mortality. Local displacement and mortality of individuals is expected. Project design criteria on snags and down wood would minimize these effects. Removal of nonnative plants either through hand, mechanical or prescribed burn treatments is expected to improve the availability of host and nectar plants for insects in the long term. Creating more resilient landscapes are beneficial to insect biodiversity in the long term, but there are no anticipated short-term positive effects from aquatic restoration activities for insects.

Small Mammals

The small mammals identified on the sensitive species list are not considered to be aquatic mammals and thus would not be directly affected by any aquatic organism passage, instream,

side-channel, or floodplain project. However, small mammals inhabit a multitude of habitats and can be affected by riparian vegetation projects such as prescribed burning. Rodents and insectivores are fairly adaptive, and while none are riparian obligate species, small mammals can use riparian areas as travel corridors and foraging areas if there is suitable cover. Rodents can be affected from presence of equipment and personnel, and noise from aquatic restoration projects. Generally, small mammals would temporarily avoid the activity area if disturbed. Design criteria to retain vegetative cover after project activities would also help provide vegetative cover for displaced individuals. Fossorial animals such as ground squirrels, shrews, and voles may be affected by burrow crushing and soil compaction as equipment move through the area. Activities that temporarily affect soil productivity and function may affect the availability of prey for small mammals that consume insects and other invertebrates (Cornely et al. 1992).

Project design criteria for soils would minimize any effects to these small mammals. Arboreal rodents and their nests could be impacted by the falling or pushing over of large trees to use in large wood placement within the river or stream. Potential effects would be minimized through biologists evaluating these trees for potential nest structures prior to falling or pushing over. Prescribed burning would reduce cover and leaf litter used by mammals for dispersal and cover. Effects from direct heat and smoke into tree canopies of trees occupied by arboreal rodents from riparian controlled burning could potentially displace animals from their nests causing nest abandonment and loss of young for that year. Minimizing direct heat and smoke from entering tree crowns would mitigate potential negative effects to arboreal rodents. It is possible that mortality of small mammals will occur as a result of aquatic restoration activities. Long-term benefits from prescribed burning included an increase in young herbaceous vegetation for mammals to consume as vegetation recovers.

Mid-sized to large Mammals

The mid- to large-size mammals identified in the Wildlife Species List tables on the project website[4] are not considered to be riparian obligates, but can be found in various habitat types across the region. Like many mammals, they are adaptable and may use riparian corridors and adjacent upland habitats for dispersal, foraging and even denning if suitable conditions exist. Aquatic organism passage projects directly in waterways would have no direct effect on these carnivores. It is most likely that instream, side-channel and floodplain projects would have minimal or no effects on carnivores either. Avoidance or local displacement may occur. Individuals have expansive home ranges and can easily avoid the area if disturbed. Indirect effects to mammals would occur from a loss of habitat and cover for prey species (effects to small mammals, birds, insects, and eggs), and by avoidance of the area by prey species within the project area. Loss of understory and mid-story canopy for smaller animals that are prey species will affect the availability of foraging opportunities within riparian habitat for large carnivores. Essentially, small mammals such as rodents would avoid a recently disturbed area due to noise and habitat disturbance. This would limit opportunities for smaller predators to hunt for these small mammals. However, since large mammals have such large home ranges, they are most likely able to find sufficient prey in other parts of their home range. Project design critieria relative to vegetation, snags, seasonal restrictions, down wood, and other design criteria would greatly minimize effects to small prey items.

Fencing projects to protect restoration projects would have the greatest direct effect on mid to large animals. Fences pose a physical hazard to animals who can get tangled, and caught in the

[4] https://www.fs.usda.gov/main/r6/landmanagement/projects

wires (Cozzi et al. 2013). Fences also prohibit the movement of animals along waterways. The use of wildlife friendly fencing standards (Paige 2012) and project design criteria would decrease negative effects of fencing on wildlife.

While aquatic restoration projects are intended to restore the aquatic habitat, it is expected that all projects would have short-term negative effects on individuals and habitat, but long-term ecological benefits. This is particularly true for beaver (*Castor canadenis*), a highly aquatic mammal. Projects that improve in-stream channel flow, riparian vegetation, and road decommissioning would have positive short-term and long-term benefits to beaver. Several projects such as beaver habitat improvement and beaver habitat analog are designed specifically to increase riparian habitat suitability for beaver. While beaver reintroduction is not an activity addressed specifically in this analysis, aquatic restoration projects would make the habitat suitable for such activity.

Ungulates

The ungulates on the sensitive species list are not considered riparian species. Most ungulates are considered upland animals. Ungulates can use riparian areas for access to water and as a migration corridor. It is very unlikely that these animals would be affected by aquatic restoration projects, except for fencing to protect aquatic restoration projects. Fencing projects to protect restoration projects would have the largest direct and indirect effects on ungulates if they travel through riparian areas. Fences pose a physical hazard to animals who can get tangled, and caught in the wires. Fences also prohibit the movement of animals along waterways. The use of wildlife-friendly fencing standards (Paige 2012) would decrease negative effects of fencing on wildlife.

Ungulates would benefit from road decommissioning projects as this would decrease disturbance to individuals, and reduce habitat fragmentation. Individuals may be temporarily disturbed during the implementation of road decommissioning, but can easily avoid the area if disturbed. Ungulates in riparian areas may also be affected by smoke from prescribed burning in riparian vegetation projects that may confuse or disorient them if they are near the project area or within the smoke drift. However, riparian vegetation projects such as prescribe burns will have short term benefits for ungulate forage. Typically, grasses quickly respond to prescribe burns providing additional foraging opportunities to ungulates. Shrubs also release new buds and leaves in response to prescribed burning which can be consumed by ungulates.

Cumulative Effects

This section addresses two legal definitions for cumulative effects/impacts analysis. The cumulative effects boundary for all wildlife species is the occupied and/or suitable riparian habitat within the project analysis boundary and the immediate surrounding areas.

Cumulative effects under the Endangered Species Act (50 CFR 402.02) are those effects of future State or private activities not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation. Aquatic restoration activities are completely within National Forest System lands, and there are no known future State or private activities that are reasonably certain to occur within this area. Adjacent to the riparian habitats across the Pacific Northwest Region, there may be potential for future activities. Private and state lands may take land management actions that have cumulative effects on watersheds within National Forest System lands.

Under the National Environmental Policy Act, cumulative impacts are those impacts caused by past, present, and reasonably foreseeable future Federal, State, and private activities that could affect special status animals and their habitats. Future federal activities or activities permitted by Federal agencies are not included under the Endangered Species Act definition of cumulative effects because any proposed future Federal activities or federally permitted activities must undergo section 7 consultation with the U.S. Fish and Wildlife Service. Cumulative effects as defined by National Environmental Policy Act have or might occur from many Forest Service projects and consist of alteration of suitable or potentially suitable habitat for wildlife. These projects have both spatial and temporal effects.

There are numerous Forest Service activities that occur within riparian reserves and/or riparian habitat conservation areas that contribute to cumulative effects. On-going activities that occur on National Forest System lands that have the ability to add to potential effects include recreation (camping, biking, hiking, equestrian use, target shooting, hunting), off-highway vehicle use, road maintenance, livestock grazing, mining, prospecting, special use permits , fuelwood cutting, Native American products gathering, and fire suppression. Multiple national forests are currently conducting environmental analyses in 2018 for riparian vegetation thinning, which affects wildlife habitat and can disturb individuals. Refer to the master table (table x) for on-going and reasonably foreseeable future actions identified across the Pacific Northwest Region.

Vegetation management on the national forests continues to contribute to noise disturbance and habitat manipulation for species that occur within the projects. Animals are temporarily displaced from suitable habitat and their behavior is affected by the presence of personnel and equipment. If vegetation project implementation occurs over multiple years, animals may abandon the area completely due to the extended disturbance. Prescribed burning, timber harvest, and mastication of shrubs can limit the amount of available habitat for animals in these areas. Livestock grazing programs on National Forests continue to have impacts to wildlife individuals and their habitats through the use of fencing and vegetation utilization. Wildlife may be deterred by the presence of cattle or sheep, compete for limited vegetation (especially during drought conditions) and may avoid the area if fences prohibit movement within the area. Recreation and mining projects contribute to wildlife disturbance and displacement. Recreation activities can expose animals to disturbance from human presence. Activities associated with mining such as blasting and excavation can displace soil and habitat for ground burrowing individuals. Roads and trails used to access facilities continues to provide noise disturbance. Additionally, numerous aquatic restoration projects are currently being implemented or planned within the region. Cumulative effects from these Forest Service projects and activities consist of alteration of occupied, suitable or potentially suitable habitat for sensitive wildlife species, federally listed threatened or endangered species, and animals designated as management indicator species. These activities can result in disturbance, displacement, and reduced foraging, reproduction and dispersal opportunities.

The incremental contribution of the direct and indirect effects (noise and habitat disturbances) from the aquatic restoration actions when added to effects from on-going and reasonably foreseeable future actions would result in insignificant (minimal) cumulative effects to wildlife species individuals and habitat. Overall, riparian ecosystems represent a small portion (spatial scale) of the landscapes across the Pacific Northwest. Aquatic restoration activities within these riparian ecosystem are a small footprint of the activities that can, or will occur there. The small acreage of 2,190 distributed across the region, over 10 to 15 years would be so small (less than 0.01 percent). At the national forest scale, acreage would be higher than 0.01 percent but still

extremely small. Aquatic restoration projects are overall a small footprint of the various national forest management activities that the Forest Service undertakes within the region. Additionally, aquatic restoration projects have a short time frame for implementation. Thus, the duration of the disturbance (temporal scale) is much shorter when compared to larger scale activities such as timber removal, which may take several years to implement. Furthermore, project design criteria and other measures outlined in this document ensure that projects are consistent with land management plans, the Northwest Forest Plan, and PACFISH and INFISH objectives.

Determinations

Table 1 summarizes the effects determinations for the threatened and endangered species considered in this analysis. The U.S. Fish and Wildlife Service concurred with the "may affect, not likely to adversely affect" determinations for gray wolf, Canada lynx, woodland caribou and grizzly bear. The Service agreed with the "may affect, likely to adversely affect" determinations for the northern spotted owl and marbled murrelet. For species with designated critical habitat, the Service agreed to "not likely to adversely modify critical habitat" determination. See the Biological Opinion (U.S. Fish and Wildlife Service 2013) for a detailed rationale of determinations for threatened and endangered species.

The proposed action would impact Pacific Northwest Region sensitive species. The determinations of effects for all of the sensitive wildlife species that occur in the project area or habitat in the area state the aquatic restoration projects may impact individuals or habitat, but will not likely contribute to a trend towards federal listing or cause a loss of viability to the population or species. The project design features are key to reducing or eliminating impacts and not contributing to a trend towards federal listing.

The aquatic restoration projects will not impact 24 management indicator species. Project design criteria and other measures outlined appendix 1 and 2 ensure that projects are consistent with this statement. Therefore, the projects will not contribute to a negative trend in viability on any of the National Forest System units within the region.

These projects will improve conditions for 28 management indicator species and will not contribute to a negative trend in viability on any of the National Forest System units(refer to the Wildlife Species List tables on the project website[5]). Because this project impacts less than 0.01 percent of suitable habitat across the region, the overall direct, indirect and cumulative effects will result in a small negative trend of habitat (increase in disturbance) for 24 species. The loss of habitat (increase in disturbance) will be a bit higher than 0.01 percent but will still be insignificant at the scale of each unit. The restoration projects are consistent with the land management plan, and thus continued viability of the species are expected on each National Forest System unit.

[5] https://www.fs.usda.gov/main/r6/landmanagement/projects

Table 1. Effects determination for threatened, endangered, proposed, and candidate species in the Pacific Northwest Region

Scientific Name	Common Name	Federal Status	Action likely to adversely affect species?	Action likely to adversely affect critical habitat?	Action likely to jeopardize species?	Action likely to destroy/adversely modify critical habitat?
Brachyramphus marmoratus	Marbled murrelet	Threatened	Yes	No	No	No
Strix occidentalis caurina	Northern spotted owl	Threatened	Yes	No	No	No
Canis lupus (Outside Northern Rocky Mtn.)	Gray wolf	Endangered	No	Not applicable	No	No
Lynx canadensis	Canada lynx	Threatened	No	No	No	No
Rangifer tarandus caribou	Woodland caribou	Endangered	No	No	No	No
Ursus arctos horribilis	Grizzly bear	Threatened	No	Not applicable	No	No

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