CONSERVATION OF LANDBIRDS AND ASSOCIATED HABITATS AND ECOSYSTEMS IN THE EAST CASCADE MOUNTAINS OF OREGON AND WASHINGTON

USDA

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Klamath Bird Observatory

AMERICAN BIRD CONSERVANCY

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COVER PHOTOS CLOCKWISE FROM TOP:
Landscape photo by Mark Penninger
Western Bluebird photo by Russ Morgan
Aspen and larch photo by Mark Penninger
Lewis's Woodpecker photo by Russ Morgan

Conservation of Landbirds and Associated Habitats and Ecosystems in the East Cascade Mountains of Oregon and Washington

Version 2.0

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PHOTOS FROM TOP:

Red-naped Sapsucker
Mountain Chickadee
Ash-throated Flycatcher

Photos by Russ Morgan

EXECUTIVE SUMMARY

This document has been prepared to stimulate and support a proactive approach to the conservation of landbirds and associated habitats and ecosystems in the East Cascade Mountains of Oregon and Washington. It represents the collective efforts of numerous individuals from multiple agencies and organizations within the Oregon-Washington Chapter of Partners in Flight. It is based on a process that uses habitat affinities of targeted landbird species (i.e., focal species) as a conservation tool to represent desired habitat conditions. These associations provide an excellent opportunity for achieving broad ecosystem or restoration goals through the planning and implementation of prescriptive recommendations.

Recommendations included in this document are presented to assist the planning efforts and habitat management actions of land managers, and stimulate monitoring and research to support landbird conservation. They also provide the biological foundation for developing and implementing landbird conservation into integrated conservation strategies for multiple species at multiple geographic scales to ensure functional ecosystems.

THE ENVIRONMENT, BIRDS, AND CONSERVATION ISSUES

The East Cascades Mountains includes mostly mid to high elevation forest cover types along the east-slope of the Cascade Mountains in Oregon and Washington. Geographic boundaries are not rigorously defined in this document, but are dependent more upon the presence of our priority habitats. For the purposes of consistency with the Interior Columbia Basin Ecosystem Management Plan, we also recognize their subunits of the Northern Cascades, Southern Cascades, and Upper Klamath Ecological Reporting Units.

There are approximately 125 regularly breeding landbird species in the East Cascade Mountains. There are no endemic landbird species (i.e., species unique to the region), and there are only a couple rare breeding species that are relatively unique to this part of Oregon and Washington.

Landbird conservation issues are diverse, and vary in scale from local land use decisions to changes in ecological processes at landscape scales. Most of the challenges of landbird conservation arise either directly or indirectly from conflicts with the human footprint that result in habitat changes and alteration of natural ecological processes. For many migratory species, issues occurring outside the geographic scope of this document are also likely affecting their breeding populations, perhaps even more significantly than local or regional issues. Some of the primary conservation issues for landbirds and their habitats include declining landbird populations, forest health and forest management, wildfire and post-fire management (e.g., salvage logging), livestock grazing, and climate change.

GOALS AND PROCESS

The primary goal of this document is to promote the long-term persistence of healthy populations of native landbirds and associated habitats and ecosystems. To facilitate that goal, we describe the following steps in a process that emphasizes providing quantitative, prescriptive recommendations for the desired range of habitat types and habitat conditions needed for landbird conservation:

- identify habitat types that are conservation priorities for landbirds
- identify desired habitat attributes for landbirds within priority habitats
- identify species representative of desired habitat types and habitat attributes (i.e., focal species)
- supplement the focal species list with priority and responsibility species that would benefit from habitat conservation for focal species
- establish measurable habitat objectives to achieve desired habitat conditions based on habitat requirements of focal species
- establish measurable population objectives for focal species to be used as one metric for tracking habitat management for desired habitat attributes
- recommend habitat conservation strategies that can be implemented to achieve habitat and population objectives
- conduct monitoring and research to assess vegetation and focal species response to habitat conservation strategies and progress towards habitat and population objectives
- implement adaptive management as appropriate to adjust habitat management in the trajectory of habitat and population objectives

The process described above can be implemented in conjunction with other land management priorities to best meet multiple objectives. These actions will also likely provide added support for the prevention of listing of landbird species as threatened or endangered. When this ecosystem-driven conservation strategy is fully implemented at large geographic scales, the aggregated effect will be the creation of landscapes that should function to conserve all landbird species and communities.

PRIORITY HABITATS

Three habitat types and one habitat category that includes several habitat types were considered priority habitats:

- Dry Forest (ponderosa pine and ponderosa pine/Douglas-fir/grand fir)
- Mesic Mixed Conifer Forest (late-successional)
- Pine-Oak Woodland
- Unique Habitats (i.e., post-wildfire, cliffs and rock outcrops, montane meadows, subalpine forest, whitebark pine, aspen, mature lodgepole pine, mature juniper woodland, mature riparian woodland, sagebrush-steppe, and montane shrubland)

FOCAL SPECIES

Our strategy for achieving functioning ecosystems for landbirds is described through the habitat requirements of 24 focal species. By managing for a suite of species representative of important habitat components, many other species and elements of biodiversity will also be conserved. The following landbird focal species were selected based on their degree of association with important habitat attributes in ecosystems of the East Cascade Mountains of Oregon and Washington:

24 focal species. Photos by Russ Morgan, Frank Lospalluto, and Mark Penninger

Habitat Type	Habitat Attribute	Focal Species
Dry Forest Ponderosa Pine and Ponderosa Pine/ Douglas-fir/Grand fir	large patches late-successional with heterogeneous canopy	White-headed Woodpecker
	large trees	Pygmy Nuthatch
	herbaceous understory with scattered sapling pines	Chipping Sparrow
	large snags	Mountain/Western Bluebird
Mesic Mixed Conifer Forest Late-Successional	large snags	Williamson's Sapsucker
	large trees	Brown Creeper
	multi-layered with high understory foliage volume	Swainson's Thrush
	interspersion of grass openings and dense thickets	Flammulated Owl
	forest edges and openings with scattered trees	Olive-sided Flycatcher
Pine-Oak Woodland	early successional and shrub patches	Nashville Warbler
	large oaks with cavities	Ash-throated Flycatcher
	large trees and snags	Lewis's Woodpecker
Unique Habitats	**Forest Types**	
	Post-Wildfire	Black-backed Woodpecker
	Whitebark Pine	Clark's Nutcracker
	Subalpine Forest	Hermit Thrush
	Mature Juniper Woodland	Gray Flycatcher
	Mature Lodgepole Pine	Mountain Chickadee
	Mature Riparian Woodland	Western Wood-Pewee
	Aspen	Red-naped Sapsucker
	Shrubland/Grassland Types	
	Montane Shrubland	Calliope Hummingbird
	Sagebrush-Steppe	Brewer's Sparrow
	Montane Meadows	Lincoln's Sparrow
	Non-Vegetated Types	
	Cliffs and Rock Outcrops	Rock Wren

BIOLOGICAL OBJECTIVES AND HABITAT CONSERVATION STRATEGIES

Biological objectives (i.e., habitat and population) are provided for all the focal species, and habitat strategies are recommended to achieve them. The biological objectives are not regulatory, nor do they represent the policies of any agency or organization. Establishing quantitative biological objectives serves several purposes:

- targets for designing management plans and benchmarks for measuring success of management actions
- hypotheses for research, particularly when objectives are based on assumptions and/or professional opinion due to lack of data
- outreach to communicate to others what is needed to conserve landbirds
- a starting point for discussion of integration with broader ecosystem-based objectives

The types of biological objectives presented include:

- regional landscape-level habitat objectives
- focal species habitat objectives at site and landscape scales
- focal species population objectives

Habitat conservation strategies are examples of management actions that may be used to support the biological objectives or enhance conservation relative to a habitat attribute or focal species. They are recommendations that can be institutionalized into management practices or implemented on an opportunistic basis within the broader context of ecosystem management.

IMPLEMENTATION

Because of the diversity of landbird species and habitats in the East Cascade Mountains, conservation will require a complex array of conditions within variable landscape patterns. Implementation will also likely require the need for areas that function naturally with limited or no management intervention (e.g., some federal lands), and areas where desired landbird habitat conditions will need to be achieved by incorporating a wide range of habitat management and restoration activities within a working landscape of various land uses (e.g., forestry, livestock grazing, recreational).

Implementation of landbird conservation as described in this document will likely be most effective in providing meaningful conservation value when it is:

- integrated across focal species and habitat types and conditions
- implemented at several geographic and ecological scales
- coordinated among various landowners and land management agencies
- monitored and adjusted as new data warrant

Implementation also will likely require a broad range of partnerships, extensive cooperation, considerable financial resources, and a strong scientific biological foundation within the context of multiple biological and non-biological goals and objectives. Biological objectives in this document can provide the foundation for the landbird conservation part of comprehensive, integrated, landscape designs for conservation of all natural resources.

This document encourages habitat management for all focal species and habitat types. However, for those making decisions on allocation of resources at regional scales, the highest priorities for landbird conservation include:

- protection of all remaining late-successional forest
- restoration of dry forest and Pine-Oak Woodland habitat
- management for appropriate natural regeneration of post-wildfire habitat
- manage at the landscape-level to reduce the risk of historically anomalous fire, insect, and disease occurrences

MONITORING, RESEARCH, AND ADAPTIVE MANAGEMENT

Conservation actions implemented on the basis of recommendations described in this document will be most effectively evaluated through monitoring and/or research. When habitat management actions are undertaken as described in this document, monitoring and/or research programs should be designed and implemented to test the effectiveness of the actions on bird populations and direct adaptive management to improve desired results. In conjunction with research, monitoring also is important for providing data to evaluate assumptions and revise and update biological objectives. Thus, monitoring and research are an integral part of the adaptive management component of our recommendations, and will function to increase our knowledge base and provide scientific data to revise biological objectives and advance the effectiveness of conservation actions.

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Rock Wren, photo by Frank Lospalluto

LANDBIRD CONSERVATION

Clark's Nutcracker, photo by Frank Lospalluto

PARTNERS IN FLIGHT

Continental, regional, and local declines in North American landbird populations, first brought to public attention in the late 1980s (Robbins et al. 1989), have led to concern for the future of migratory and resident landbirds. Scientists and the concerned public recognized that a coordinated, cooperative, conservation initiative focusing on landbirds was needed to address the problem (Pashley et al. 2000). In late 1990, Partners in Flight (PIF; *https://partnersinflight.org/*) was conceived as a voluntary, international coalition of government agencies, conservation groups, academic institutions, private organizations, and citizens dedicated to "keeping common landbirds common" and "reversing the downward trends of declining landbird species" (Rich et al. 2004).

The Oregon-Washington chapter of PIF (*www.orwapif.org*), formed in 1992, has been at the forefront of landbird conservation, not only in the Pacific Northwest but throughout North America. It produced the first regional document within PIF that prioritized landbird species for conservation based on a scoring system (Andelman and Stock 1994), and the first PIF chapter "Project Directory" to catalogue and describe existing monitoring projects (Altman 1994). Oregon-Washington PIF partners have been actively engaged in every aspect of landbird conservation at regional, national, and international levels, providing leadership and participation on various committees and programs along with developing strong partnerships and projects in Canada, Mexico, and Central America.

The foundation of PIF's long-term strategy for bird conservation is a series of geographically-based landbird conservation plans, of which this document is one. The primary goal of PIF landbird conservation planning is to promote long-term persistence of healthy populations of native landbirds. This document is intended to facilitate that goal by stimulating conservation actions for landbirds, particularly for nonlisted and nongame landbirds, which historically have been under-represented in conservation efforts, and many of which are exhibiting significant declines that may be possible to reverse if appropriate actions are taken now. Thus, implementation of the recommendations in this document also supports efforts to reduce the need for future listings of bird species under the Endangered Species Act (ESA).

NORTH AMERICAN BIRD CONSERVATION INITIATIVE

The North American Bird Conservation Initiative (NABCI; *www.nabci-us.org*) emerged in the late 1990s out of the disparate but extensive evolution of the four major bird conservation initiatives (waterfowl, waterbirds, shorebirds, landbirds) to facilitate coordinated implementation of "all-bird, all-habitat" conservation. It was established to provide a unifying theme for bird conservation, a forum for communication, and an avenue for integration among the bird conservation initiatives in North America. The purpose of NABCI is to ensure the long-term health of North America's native bird populations by increasing the effectiveness of bird conservation initiatives, enhancing coordination among initiatives, and fostering greater cooperation among the continent's three national governments and their people. The goal of NABCI is to deliver the full spectrum of bird conservation through regionally-based biologically-driven, landscape-oriented partnerships.

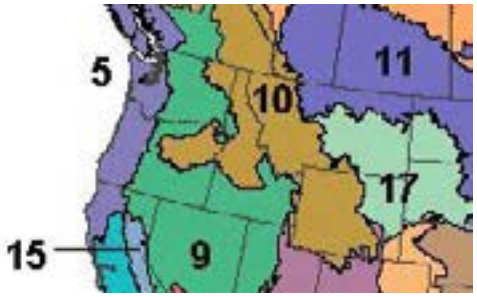


Figure 1. East Cascade Mountains occur along the western border of the Great Basin Bird Conservation Region (BCR 9) within Oregon and Washington.

Bird Conservation Regions (BCRs) are the ecological units that have been identified through NABCI for delivery and tracking of bird conservation (Sidebar: *Bird Conservation Regions*). There are 67 BCRs in North America and Hawaii (Bird Studies Canada and NABCI 2014), including the Great Basin Bird Conservation Region (BCR 9) which encompasses the geographic scope of this document (Figure 1).

Bird Conservation Regions

Historically, most conservation land management decisions were made based on local goals and objectives for land use. However, it is increasingly evident for natural resource conservation, especially with highly mobile animals such as birds, that effective conservation requires that local planning and implementation be designed in the broader context of larger areas such as ecoregions or sub-ecoregions (Noss 1983, Franklin 1993). Conservation and management directed towards ecological landscapes that have been designed to meet the diverse needs of all bird species result in the most efficient use of resources and the greatest likelihood of success. The desirable ecological units for the planning, delivery, and tracking of bird conservation, Bird Conservation Regions (BCRs), have been identified and described under the North American Bird Conservation Initiative (https://nabci-us.org/).

JOINT VENTURES

Under the vision of NABCI, Joint Venture partnerships are being encouraged to play an integral role in the implementation of landbird conservation. Traditionally, Joint Venture partnerships focused on wetland and waterfowl conservation to implement the North American Waterfowl Management Plan. The success of their wetland/waterfowl conservation actions since the late 1980s, along with the need to support implementation of bird and habitat conservation for the other three major bird initiatives, resulted in expansion of the role for Joint Ventures to address all-bird, all-habitat conservation.

There are nearly two dozen Joint Venture partnerships within North America, including the Intermountain West Joint Venture (IWJV; *www.iwjv.org*), which encompasses the geographic scope of this document. The focus of the IWJV is on empowering partnerships to enhance delivery of science-based habitat conservation across the interior West. The primary ways in which the IWJV partnership is advancing landbird conservation are through the development of habitat and population objectives for selected priority landbird species as part of their implementation plan (Casey 2013), and through support of habitat protection, management, and restoration activities by diverse partnerships, with a strong focus on private lands and Farm Bill programs and practices. They also provide decision support tools to inform management decisions (e.g., their HABPOPS database, *http://data.pointblue.org/partners/iwjv/*), capacity grants to enhance partnerships and play a key role in the delivery of the Sage Grouse Initiative.

Mountain Bluebird, photo by Mark Penninger

PURPOSE AND SCOPE

This document is intended to support both the development of conservation or management plans, and the implementation of on-the-ground habitat management activities that have the potential to benefit breeding bird populations in the East Cascade Mountains of Oregon and Washington. The degree to which a land manager is willing or able to manage for bird habitat or bird populations is a decision based on many factors beyond the scope of the document. It is assumed that users of this document already have an interest in managing for bird habitat or bird populations as one of several objectives that land managers must typically balance. However, it is not within the scope of this document to discuss integration of bird conservation with other management objectives. The purpose is to provide those interested in landbird conservation with information and recommendations on:

- the landbird species and habitat attributes (i.e., habitat conditions and/or habitat elements) that should be emphasized for conservation
- the quantitative, measurable objectives that are recommended to support conservation of those landbird species, habitat attributes, and ecosystems in which they occur

VERSION 2.0

This document is an update of *Conservation Strategy for Landbirds in the East-Slope Cascade Mountains of Eastern Oregon and Washington* (Altman 2000a). Among PIF bird conservation plans nationally, one of the unique features of Version 1.0 of the Oregon-Washington PIF bird conservation plans was the quantitative and prescriptive objectives that were established for habitat attributes important to landbird species. One reason for doing this was to fill a gap, which exists in most conservation planning efforts (i.e., the absence of quantitative, prescriptive objectives), yet is something that most land managers want not only to direct their management, but also to use for tracking progress towards conservation goals.

In Version 2.0, not only are the biological objectives for habitat attributes updated based on new data, but there is continued leadership in being progressive and innovative by providing examples of habitat objectives at landscape scales and population objectives that encourage habitat management for small populations where appropriate. It is hoped that the presentation of these types of quantitative biological objectives will not only stimulate conservation action on the ground, but also stimulate data collection and analyses to test the models and professional judgment used to develop the objectives.

Since the development of Version 1.0 in the mid- to late-1990s, considerable changes have occurred in the world of bird conservation. Internationally and nationally, there has been the emergence of NABCI and BCRs, and the enhanced role of Joint Ventures in landbird conservation. Within PIF, there has been extensive advancement and use of the Species Assessment Database which uses biological criteria to evaluate species vulnerability (Panjabi et al. 2005), an emphasis on the geospatial design of landscapes for bird-habitat conservation through the publication of the Five Elements Process (Will et al. 2005), and the emerging recognition of the importance of full life cycle conservation for migratory birds (Berlanga et al. 2010). Additionally, the North American Landbird Conservation Plan (i.e., Continental Plan) was completed for the United States and Canada with the first attempt by PIF to establish continental population estimates and population objectives for landbird species (Rich et al. 2004). A follow-up document which included Mexico (i.e., Trinational Plan), further expanded the vision and connectivity necessary for migratory bird conservation (Berlanga et al. 2010). Finally, an updated version of the Continental Plan was completed in late 2016 (Rosenberg et al. 2016).

Further, there has been the development of an interactive web-based decision support tool for assessing species population changes relative to habitat changes (i.e., HABPOPS), significant advancement in knowledge of landbird species demographic limiting factors (Sidebar: *Vital Rates of North American Landbirds*), and the development of Collaborative Forest Cooperatives that bring diverse stakeholders together to develop recommendations for management of public forest lands.

Vital Rates of North American Landbirds

In 1989 The Institute for Bird Populations initiated the Monitoring Avian Productivity and Survivorship (MAPS) program using a continent-wide network of constant-effort mist-netting and bird-banding stations (DeSante 1992) to assist in the conservation of North American landbirds through demographic monitoring. One of the principal results of this effort has been the publication of Vital Rates of North American Landbirds (*www.VitalRatesOfNorthAmericanLandbirds.org*) which provides estimates of key demographic parameters, often called vital rates, for many North American landbirds using data during the 15 year period 1992-2006. The objective of these analyses was to document and describe temporal (annual) and spatial (at the scale of BCRs) variation in productivity, survivorship, recruitment, and other demographic parameters to provide hypotheses regarding the proximate drivers of population change. An example is whether population was most strongly affected by factors acting on the breeding or wintering grounds. Results are presented in several ways. Visual displays include sampling information and graphs of annual estimates for each of the eight demographic parameters estimated from temporal analyses, and sampling information and maps of BCRs showing color-coded BCR-specific estimates for the same eight parameters from spatial analyses. Additionally, there are summary tables of means, standard deviations, and coefficients of variation from both temporal and spatial analyses, and scatterplots and correlation matrices for pairwise correlations among the estimated demographic parameters. Lastly, there are species account narratives that summarize and interpret the results, particularly as they relate to the demographic correlates of both temporal population changes and spatial differences in population trends. The primary uses and value of this information is that it uses information on productivity, survivorship, and recruitment to enable a deeper understanding of the causes of population changes, which will enable practitioners to more effectively target conservation actions to the times and places in the annual cycle where they will do the most good.

INTEGRATION WITH OTHER CONSERVATION PLANS

This document is intended to complement the goals, objectives, and strategies in several other planning and conservation processes and initiatives by filling a niche that is usually absent in those efforts – quantitative, prescriptive recommendations for habitat conditions most suitable for individual and suites of landbird species at several geographic scales (e.g., regional, landscape, site). The use and implementation of these recommendations can be done independently for landbird-specific conservation or complementary within the context of broader conservation goals to support and strengthen other plans, examples of which include:

- Partners in Flight North American Landbird Conservation Plan (Rich et al. 2004) and the updated Continental Plan (Rosenberg 2016).
- State Wildlife Action Plans (ODFW 2016, WDFW 2015) (Sidebar: *Integration with State Wildlife Action Plans*)
- Intermountain West Joint Venture Implementation Plan (IWJV 2013) (Sidebar: *Integration with Intermountain West Joint Venture Implementation Plan*)
- The Nature Conservancy's (TNC) Ecoregional Assessments for East Cascades-Modoc Plateau and West Cascades (Popper et al. 2007)
- Interior Columbia Basin Ecosystem Management Plan (Wisdom et al. 2000)

Greater Sage Grouse, U.S. Forest Service photo

Designated areas for management and conservation of the Greater Sage Grouse are an important opportunity for the conservation of other sagebrush-steppe species.

Integration with State Wildlife Action Plans

The States of Oregon and Washington recently completed updates in Version 2.0 of their Comprehensive Wildlife Conservation Strategies (i.e., State Wildlife Action Plans) as directed by Congress to proactively encourage the maintenance of healthy fish and wildlife populations and minimize the costly and controversial listing of species under the Federal Endangered Species Act (ODFW 2016, WDFW 2015). These plans provide a broad conceptual framework that identifies and prioritizes species and habitats for conservation and the types of actions that need to occur to support their conservation. However, for the most part, they do not provide quantitative targets or objectives to support implementation of their recommended actions. The greatest potential integration of recommendations in this document with the State Wildlife Action Plans is the prescriptive, quantitative habitat and population objectives that provide the next step for specifically directing conservation and management of priority species and habitats.

Integration with the Intermountain West Joint Venture Implementation Plan

The IWJV partnership recently prepared an Implementation Plan which established a framework for science-based habitat conservation built upon the model of Strategic Habitat Conservation (IWJV 2013). It provides quantitative habitat and population objectives that translate continental bird population objectives to ecoregional scales and identifies the quantity and quality of habitat needed to support priority bird populations at goal levels. The greatest potential integration of recommendations in this document with the IWJV Implementation Plan is the prescriptive, quantitative habitat objectives that describe the specific conditions needed to support species and habitat conservation, and thus provide the "how to" aspect of conservation that complements the "how much" objectives in the IWJV Implementation Plan. Additionally, recommendations in this document are provided for many habitats and species not addressed in the IWJV Implementation Plan, thus providing quantitative targets and specific habitat conditions to achieve those targets for a broader array of landbird species.

PIF Bird Conservation Plans are one of many recent efforts that address conservation of natural resources and ecosystems in the Pacific Northwest. This plan is intended to supplement and support other planning and conservation processes (e.g., Habitat Conservation Plans) and regulatory enactments (e.g., State Forest Practices Act, Endangered Species Act) by describing a conservation strategy for landbirds that are often not addressed or only incidentally addressed in other plans or planning processes.

In particular, we envision extensive integration with the two most comprehensive land management plans for the region, the Northwest Forest Plan (NFP) and the Interior Columbia Basin Ecosystem Management Plan (ICBEMP). It is anticipated that biological objectives and conservation strategies described in this document and future versions will be integrated not only with NFP and ICBEMP, but also with other ongoing and future conservation planning in the East Cascades to provide functioning ecosystems for the region's diverse array of landbird species.

The biological objectives and conservation strategies described in this document provide a biological foundation for landbirds that can be integrated with other conservation planning and implementation to support functioning ecosystems for the region's diverse array of landbird species. Some examples of how this integration can or has been used include:

- in environmental assessments (e.g., biological evaluations) that address migratory birds as required under Executive Order 13186 – the Responsibilities of Federal Agencies to Protect Migratory Birds
- as a guide to direct and monitor restoration efforts through specific habitat conditions or species objectives
- to comparatively assess how alternatives in environmental analyses meet conservation objectives at multiple scales

BIRDS AND HABITATS

The conservation emphasis of this document is native landbirds that regularly breed in the East Cascade Mountains of Oregon and Washington. Because breeding landbirds occur in all the habitats and conditions that support wintering and migratory landbirds, there is an underlying assumption that habitat management for breeding birds will likely support most, if not all, of the habitat needs of all landbirds occurring in these habitat types.

Although only the conservation of landbirds during the breeding season is emphasized, factors that operate outside the breeding season may adversely affect their populations. This is particularly true for migratory birds subject to habitat changes and other factors on their wintering grounds and/or during migration that may impact the abundance and health of breeding populations. There is no attempt to address the extensive breadth of those issues in this document, although there is significant emerging science on the need for full life cycle conservation of migratory birds (Martin et al. 2007, Hostetler et al. 2015) (Sidebar: *Full Life Cycle Stewardship of Migratory Birds*). Until specific limiting factors have been identified for each migratory bird species, appropriate conservation actions on the breeding grounds are considered to be a stewardship responsibility of a natural resource shared with

many other countries and peoples (Altman and Hagar 2007). Bird conservation partners are encouraged to seek opportunities to develop international partnerships and projects to support conservation of shared migratory landbirds (Berlanga et al. 2010). A conservation business plan is being prepared to provide direction on opportunities for collaborative projects that will benefit landbirds of North American western conifer and conifer-hardwood forests, and Sierra Madre pine-oak and cloud forests of Mexico and northern Central America (Sidebar: *Saving Western Migratory Birds*).

Even within the context of breeding birds, this document does not directly address all landbird species, but instead emphasizes a suite of "focal species" to describe the biological objectives for the avian community. Many species not emphasized are habitat generalists that thrive in a wide range of conditions (e.g., American Robin, Downy Woodpecker, Song Sparrow), and thus will benefit from conservation actions for focal species.

A few landbird species are not directly addressed in this document because they already have species-specific conservation strategies and/or recovery plans. This includes the ESA federally listed Northern Spotted Owl, two ESA federally-delisted species with recovery plans, Bald Eagle and Peregrine Falcon, and Greater Sage Grouse which has been the focus of significant conservation planning efforts throughout the Intermountain West (e.g., Sage Grouse Initiative, *www.sagegrouseinitiative.com*). However, existing recommendations for management and conservation of these species has great significance for the conservation of other landbirds. For example, designated areas for management and conservation of the Greater Sage Grouse are an important opportunity for the conservation of other sagebrush-steppe species such as Brewer's Sparrow, Sage Sparrow, and Sage Thrasher. However, managing for Sage Grouse may not adequately conserve the entire suite of sagebrush associated songbirds (Holmes et al. In prep).

This document also does not address birds that primarily use aquatic or wetland habitats such as shorebirds and wading birds (e.g., Great blue-Heron, Spotted Sandpiper), waterfowl (e.g., Mallard), and colonial waterbirds (e.g., Yellow-headed Blackbird). Only a few landbird species are closely associated with these habitats (e.g., Common Yellowthroat, Marsh Wren, Red-winged Blackbird). Additionally, conservation planning for these types of birds is being conducted by other entities and initiatives (e.g., IWJV, North American Waterfowl Management Plan, National and Regional Shorebird Plans, North American Colonial Waterbird Plan).

This document only addresses the conservation of shrub-steppe, grassland, and juniper birds to a limited degree as unique habitats embedded in the forest-dominant landscape of this region. These habitats are the predominant and priority habitats in other ecoregions, and are fully covered in another PIF plan entitled *Conservation Strategy for Landbirds in the Columbia Plateau of Eastern Oregon and Washington* (*https://avianknowledgenorthwest.net/resources/conservation-plans/or-wa-pif-plans/*). Although conservation of landbird species in these habitats is part of this document, their conservation is most important in the Columbia Plateau and Northern Great Basin ecoregions.

There are only limited geospatial habitat objectives presented in this document, usually at larger scales such as ecoregions. This spatially-explicit aspect of landbird conservation has been a focus of other plans such as Ecoregional Plans of The Nature Conservancy and State Wildlife Action Plans, although usually for broader conservation goals than landbirds. The identification of spatially-explicit conservation areas specifically for birds has been addressed to some extent through the Bird Habitat Conservation Areas in the IWJV Coordinated Bird Conservation Plan (*https://iwjv.org/*; IWJV 2005), and Important Bird Areas programs of the American Bird Conservancy (*www.abcbirds.org*) and State Audubon chapters (*https://audubonportland.org/* and *https://wa.audubon.org/*). Bird conservation partners should seek spatially-explicit guidance for landbird conservation from the aforementioned plans and others that provide these types of recommendations.

Full Life-Cycle Conservation of Migratory Birds

Conservation of migratory birds requires actions that provide habitat and ensures healthy populations throughout the year. Habitat conditions in one season can affect the reproduction and survival of migratory birds in subsequent seasons. For example, the quality of winter habitat can affect the timing of migration, leading to decreased survival or reproductive success (e.g., Norris et al. 2004, Rockwell et al. 2012). Therefore, actions to improve conditions in the tropics can have far-reaching positive effects on landbirds on their breeding grounds in North America. Conversely, although many northern breeding migrants spend up to eight months each year in tropical habitats, the health of habitats on the breeding grounds where production of the next generation occurs is critical to a species population.

Mortality during migration may be 15 times higher for some species than during the relatively stable breeding or winter periods (Berlanga et al. 2010). Yet we know little about the routes of their migration or the hazards they face including anthropogenic threats, such as windows, tall lighted structures, wind turbines, indiscriminate pesticide use, and unrestrained cats. For migratory bird conservation to be effective and efficient, we need to know how, where, and when these migratory animals travel, and need to implement appropriate conservation actions throughout their life cycle. Thus, full life cycle conservation for migratory birds - geographic linking of individuals or populations between different stages of the annual cycle - breeding, migration and winter – has become an essential component of landbird conservation (Marra et al. 2010).

Saving Western Migratory Birds

Many landbird species that breed in the temperate forests of western North America and migrate to overwinter south of the US-Mexico border, including three East Cascade Mountains focal species (Flammulated Owl, Calliope Hummingbird, and Olive-sided Flycatcher), are of moderate to high conservation concern based on Partners in Flight's vulnerability assessments. Many of these species winter in the montane forests of western Mexico and northern Central America. Threats associated with unsustainable timber harvest, fire management, water management, agriculture, and other anthropogenic factors that are impacting their habitats also impact their southern wintering habitats. To address these threats an international group of agencies and organizations collaborated to create *An Integrated Conservation Strategy For Western Temperate, Mexican Pine-Oak, and Tropical Cloud Forest Birds: North America to Central America*. This strategy:

- includes a comprehensive list of target bird species that are of conservation concern and a list of indicator bird species that are representative of healthy conditions in western temperate, pine-oak, and tropical cloud forests.
- presents a ranking of the threats, along with contributing factors, that most impact these three target habitats.
- outlines a set of integrated strategies that can be used to address these threats and reverse the population declines of the target species.
- illustrates relationships among strategies, threats, and target habitats and species using a basic conceptual theory of change model.

This strategy was designed as a framework to help focus, align, coordinate, and measure the effectiveness of our investments in the conservation of these target habitats and birds. As a result, the strategy can serve as a tool for integrating conservation efforts throughout the breeding and overwinter distribution ranges of migratory birds that breed in North America's temperate western forests and winter in the pin-oak and tropical cloud forests of western Mexico and northern Central America. It was designed to help link and grow existing conservation efforts and better design new ones. The strategy promotes an adaptive management approach to range-wide strategic conservation planning and implementation and facilitates the scaled monitoring of our conservation investments and achievements based on specific habitat and bird population objectives.

Calliope Hummingbird.
U.S. Forest Service photo

THE ENVIRONMENT

The East Cascades Mountains includes mostly mid to high elevation forest cover types along the east-slope of the Cascade Mountains in Oregon and Washington. This area encompasses several ecoregions including the Northern Cascades and Southern Washington Cascades in Washington, and the High Cascades in Oregon (Franklin and Dyrness 1973). Geographic boundaries are not rigorously defined in this document, but are dependent more upon the presence of our priority habitats. For the purposes of consistency with the ICBEMP, herein we also recognize their subunits of the Northern Cascades, Southern Cascades, and Upper Klamath Ecological Reporting Units (ERUs) (Wisdom et al. 2000).

PHYSICAL FEATURES

The East Cascades Mountains is a linear expanse of mostly forested land that begins at the crest of the Cascade Mountains between northern Washington and southern Oregon, and extends east until it abuts the high desert country of shrub-steppe and juniper habitats in eastern Oregon and Washington. Within higher elevations, elements of forests on the west slope of the Cascades Mountains occur on some north-facing slopes and cold-air drainages to create a complex landscape. At the southern end of the area, the complexity is even greater where the Klamath-Siskiyou Mountains transition into the Cascade Mountains. In addition, many transitional areas occur where forest vegetation mixes with that of steppe and shrub-steppe communities, especially at lower elevations.

A variety of habitat types.
Photos by Mark Penninger

LAND USE

Land use is as diverse as the topography, although resource extraction, particularly timber harvesting, has been the predominant land use. There is a unique contrast in the tree removal objectives, with extraction manifested exclusively as logging in the more heavily forested areas, but clearings in the drier areas are often associated with the removal of juniper to improve rangeland. Fertile grasslands support large hay and livestock operations in areas where windblown silt has created thick soils, while smaller agricultural operations persist in other areas where soils are less developed (Busacca, 1991). There are several designated wilderness areas, and there is extensive recreational use of the forests, especially the remote areas. A minor land use more historical than current is mining.

VEGETATION

A thorough description of the historical and current vegetation is beyond the scope of this document. The information presented below is a cursory overview of the principal features of the vegetation and plant associations that provide habitat for landbirds. More detailed accounts have been described in several sources, especially Franklin and Dyrness (1973), but also Johnson et al. (1994), Clarke and Bryce (1997), Johnson and O'Neill (2001), and Rocchio and Crawford (2015). Vegetation and plant associations are diverse, dependent on a number of interrelated factors including soils, aspect, slope, rainfall, and elevation. The complexities of the diverse physiography and topography result in a patchwork mosaic of vegetation types and disturbance regimes that leads to a highly variable juxtaposition of plant communities and wildlife habitats, and thus landbird species distributions. In general, there is a progression of vegetation types with increasing elevation, beginning with the transition to shrub-steppe juniper at the lowest elevations, and changing to oak woodlands, oak-conifer forest, ponderosa pine forest, mixed conifer forest, subalpine forest and parkland, and alpine meadows (Bryce and Omernik 1997).

PRE-EUROPEAN SETTLEMENT

The landscape at the time of European settlement was primarily dominated by coniferous forest vegetation communities, but also included a complex mosaic of non-forest types such as shrublands, grasslands, wetland, and alpine habitats (Kuchler 1966). Forest and other habitat types were determined and maintained by numerous topographic (e.g., slope, aspect) and physical factors (e.g., temperature, moisture) and natural disturbances (e.g., fire). Historically, vegetation communities were relatively well-defined by elevation and natural processes (e.g., fire).

Among forest vegetation zones, ponderosa pine forests occupied a narrow band (15-30 km wide) along the east flank of the Cascade Mountains (Franklin and Dyrness 1973). Ponderosa pine occurred on the warmest and driest sites, and generally at relatively low elevations; 600-1,200 meters except in the pumice zone of south-central Oregon (1,450-2,000 meters) (Franklin and Dyrness 1973, Henjum et al. 1994). Much of the climax ponderosa pine forest was characterized by an open park-like understory maintained by regular low intensity fires which seldom killed adult trees (Hejl 1992). Grand fir and white fir were also locally important components of this dry forest type (Table 1).

Table 1. Native vegetation characteristic of forest habitat in the East Cascades Mountains of Oregon and Washington.

Habitat	Tree Species	Common Shrubs	Common Herbaceous Plants
Pine-Oak Woodland	Oregon white oak, ponderosa pine	antelope bitterbrush, saskatoon serviceberry	blue wildrye, elk sedge, bluebunch wheatgrass
Ponderosa Pine	ponderosa pine	common snowberry, antelope bitterbrush	Idaho fescue, bluebunch wheatgrass, needle and thread grass, pinegrass
Mixed Conifer	grand fir, white fir, Douglas- fir, western larch, ponderosa pine	Wood's rose, bearberry manzanita, thinleaf huckleberry, baldhip rose, prickly currant	pinegrass, elk sedge, broadleaf arnica, bluebunch wheatgrass, Columbia brome
Subalpine Fir	subalpine fir, Englemann spruce, lodgepole pine	American devilsclub, grouse huckleberry, pachistima, rustyleaf menziesia	lady fern, coolwort foamflower, queencup beadlily, beargrass, spreading fern

The mixed conifer zone was historically dominated by true firs (grand and white) and occurred at relatively mid elevations and sites that were not moisture-stressed. Douglas-fir, grand fir, and western larch were the principal tree species (Table 1), but there was considerable regional variation in importance among tree species in this zone. The mixed conifer zone was more mesic than the ponderosa pine zone, and more diverse in vegetation.

The subalpine fir zone is the coolest and wettest forest zone and it includes a deep winter snowpack. Dominant tree species include subalpine fir, Englemann spruce, and lodgepole pine (Table 1). The lower elevation boundary is approximately 1,000 meters and it extends upward to the ecotone with alpine habitat (Franklin and Dyrness 1973). These forests are conspicuous in frost pockets and other habitats characterized by accumulation of cold air. At tree line scattered throughout the planning area, whitebark pine was an important forest community. Some of the more common tree, shrub, and herbaceous native species characteristic of all these forest zones are listed in Table 1.

CURRENT VEGETATION

Current vegetation has changed substantially due to a number of factors. Coniferous forest still dominates the landscape, but the composition of forest types and conditions has changed more from anthropogenic factors than natural forces that historically maintained the landscape. These anthropogenic factors include fire suppression, intensive forest management, grazing, and widespread development of roads associated with development and recreation (Hann et al. 1997). Associated consequences from these activities that impact the current vegetation include exotic species invasion, alteration of natural disturbances, fragmentation and isolation of habitat patches, and increased development and distribution of closed-canopy forests. The consequences to wildlife are highly variable, both positive and negative, but clearly the ability of the landscape to be maintained to full ecosystem functionality is questionable (Henjum et al. 1994).

Fire suppression, timber harvesting, and more recently climate change have blurred the relatively distinct historical elevational zonation of forest vegetation (Bryce and Omernik 1997). Douglas-fir, grand fir, and Englemann spruce have expanded their range to lower elevations beyond their normal mesic locations. Old-growth ponderosa pine trees have been harvested, and fire suppression and encroachment of other species has resulted in denser mid-successional fir-dominated forests where late-successional ponderosa pine used to dominate. Most of the remaining patches are <40 ha (100 ac), and likely too small to maintain ecosystem processes and many old-growth dependent species (DellaSala et al. 1996).

The effect of extensive road development networks also has adversely affected wildlife. Based on an extensive synthesis of the literature, Wisdom et al. (2000) identified 13 direct or indirect factors associated with road development that impacted >70% of the 91 vertebrate species analyzed (includes many landbirds). Additionally, the adverse effects on wildlife from road-associated factors may be additive to that of habitat loss and alteration (Wisdom et al. 2000).

In addition to forest ecosystems, other ecosystems have been degraded to the point of reduced functional integrity. For example, in lower elevation zones of subalpine parkland, fire suppression has likely altered patterns of succession that favor a denser tree canopy and changes in species composition (Franklin and Dyrness 1973). There also has been an extensive invasion of meadows with tree species throughout the region (Franklin and Dyrness 1973), perhaps due to climatic change in the last 50 years.

High severity fire, photo by Mark Penninger

Current vegetation has changed substantially due to a number of factors… These anthropogenic factors include fire suppression, intensive forest management, grazing, and widespread development of roads associated with development and recreation.

THE PROCESS

CONCEPTUAL APPROACH

Numerous conceptual approaches for wildlife conservation have been proposed and implemented. These have focused on various elements such as single species, management indicator species, ecological guilds, management assemblages, and ecosystems (reviewed by Block et al. 1995). All the approaches have positive features, but also inherent practical or biological limitations. For example, the single-species approach is usually not cost effective or practical for many species, and a broad-based biodiversity approach can have conflicting objectives among the myriad of species involved, and can be ambiguous in terms of design and evaluation without reference to specific habitat requirements for individual species (Lambeck 1997). Salwasser (2001) suggested that a coarse filter (i.e., habitats, landscapes, ecosystems) and fine-filter (i.e., individual species and their habitat needs) approach that is nested and overlapping is the most likely to provide effective wildlife conservation.

The two primary goals for bird conservation under the PIF Initiative are 1) helping species at risk, and 2) keeping common birds common (Rich et al. 2004). Planning to meet both these goals can be problematic because of the large number of landbird species, and the need for conservation actions for both rare and common species. It is unrealistic in terms of cost and time to plan or implement species-specific conservation for so many species.

Within PIF, bird conservation is prioritized by the quantitative scoring system of the Species Assessment Database (*https://www.birdconservancy.org/* [PIF Science Committee 2012]), which has been externally reviewed by Beissinger et al. (2000). Although the emphasis is on single-species conservation, there is an underlying assumption that conservation of priority species supports ecosystem management, because other species will likely benefit from actions implemented to conserve priority species. However, it is unlikely that a suite of PIF priority species can represent the array of habitat features or conditions important for landbirds in a functioning ecosystem, in part because priority species often are a priority because they are habitat specialists. Thus, conservation of an ecosystem or habitat type using priority birds is likely to be compromised because desired conditions for some/many habitat features is dependent on the chance that a priority species is associated with those desired conditions. This results is an opportunistic and unbalanced approach for the conservation of ecosystems or habitats. Furthermore, the broader goals for conservation of biodiversity, increasingly desired as societal and ecological goals, cannot be achieved on a species by species basis (Franklin 1993).

Given the limitations of the priority species approach for habitat or ecosystem conservation, and the recommendations of Salwasser (2001), this document emphasizes a multiple-scale approach for landbird conservation. This includes representation of the habitat types and habitat conditions most important to landbirds (coarse-filter), as described through the specific habitat requirements of a suite of individual bird species most representative of the range of desired habitat types and habitat conditions (fine-filter).

At the core of this approach is the use of focal species (Sidebar: *Focal Species*), an approach increasingly used for conservation of biodiversity (Hannon and McCallum 2004, Wiens et al. 2008). This concept was initially characterized by Lambeck (1997), and has been extensively used in PIF planning (Chase and Geupel 2005, Stephens et al. 2019), including all Oregon-Washington plans (e.g., Altman 2000a). More recently the same concept has been promulgated by the U.S. Fish and Wildlife Service (USFWS) as "surrogate species" (*https://www.fws.gov/*). It is important to emphasize that use of the term focal species in this document, as recommended by Lambeck (1997), is not the same as the often generic use of the term focal species by many conservation entities to mean "the priority species that we are focusing on."

American Robin, U.S. Forest Service photo

The two primary goals for bird conservation under the PIF Initiative are 1) helping species at risk, and 2) keeping common birds common.

Focal Species: A Tool for Ecosystem Conservation

Although each bird species has evolved to occupy a unique ecological niche, there is significant overlap among many species in their basic habitat requirements. These areas of overlap provide an opportunity to efficiently capture the habitat needs of many bird species by directing conservation towards a few key species (i.e., focal species) associated with a suite of shared habitat requirements. The assumption is that conservation directed towards the collective needs of a suite of focal species that represent the range of desired conditions for birds in the habitat type, should also address the habitat needs of most if not all of the other bird species occurring in that habitat type (Lambeck 1997). Further, the use of focal species draws immediate attention to habitat features and conditions most in need of conservation or most important in a functioning ecosystem for landbirds. Focal species should be assessed at management relevant scales, and where feasible validated with local data (Stephens et al. 2019).

The use of a suite of focal species, rather than a single focal species, provides an efficient and more comprehensive tool to support ecosystem management because it ensures that conservation is directed at the range of important habitat conditions for birds within the ecosystem, and not just the relatively limited habitat relationships of a single species. Implementation of this multi-focal species approach should result in a high likelihood of maintaining key habitat attributes and providing functioning ecosystems for landbirds, because the most important habitat attributes for landbirds are targeted for conservation. This approach also provides a comprehensive framework for dealing with priority species (current and future) because the component(s) of the habitat needed by those species are likely already addressed through the suite of focal species. It also provides the opportunity to include priority species either as focal species or as stand-alone unique habitat species with species-level recommendations for their conservation. This hybrid approach of using both vulnerable and representative species (i.e., priority and focal, respectively), should provide a solid framework for achieving broad-scale conservation of all landbirds in priority habitats throughout the region.

COMPONENTS OF THE PROCESS

The process to support the conceptual approach described above includes the following components, which are summarized in the following sections and presented in detail in the Biological Objectives section:

- identify habitat types that are conservation priorities for landbirds
- identify desired habitat attributes for landbirds within priority habitat types
- identify species representative of desired habitat types and habitat attributes (i.e., focal species)
- supplement the focal species list with priority and responsibility species that would benefit from habitat conservation for focal species
- establish measurable habitat objectives to achieve desired conditions based on habitat requirements of focal species
- establish measurable population objectives for focal species to be used as one metric for tracking management for desired habitat attributes
- recommend habitat conservation strategies that can be implemented to achieve habitat and population objectives
- conduct monitoring to assess vegetation and focal species response to habitat conservation strategies and progress towards habitat and population objectives
- implement adaptive management as appropriate to adjust habitat management towards the trajectory of the habitat and population objectives

PRIORITY HABITATS

Priority habitats were selected based on a combination of factors including:

- priority status in the previous Oregon-Washington PIF bird conservation plan for this region (Altman 2000a)
- loss, alteration, and current condition of the habitat relative to that of historical conditions (Wisdom et al. 2000)
- designated as priority in other conservation plans (e.g., IWJV Implementation Plan [Casey 2013]; Oregon and Washington State Wildlife Actions Plans [ODFW 2016, WDFW 2015])
- designated as a priority in a statewide process (e.g., Priority Habitats and Species, WDFW)
- importance to one or more priority species as designated by the USFWS, BLM, USFS, ODFW, WDFW

Three habitat types and one habitat category that included several habitat types were selected as priority habitats:

- Dry Forest (ponderosa pine and ponderosa pine/Douglas-fir/grand fir)
- Mesic Mixed Conifer Forest (late-successional)
- Pine-Oak Woodland
- Unique Habitats (i.e., post-wildfire, cliffs and rock outcrops, montane meadows, subalpine forest, whitebark pine, aspen, mature juniper woodland, mature riparian woodland, sagebrush-steppe, mature lodgepole pine, and montane shrubland)

General descriptions of the priority habitat types are presented in later sections.

HABITAT ATTRIBUTES

Desired habitat attributes (Sidebar: *Habitat Attributes*) were selected based on a review of scientific literature on bird-habitat relationships to determine the range of important habitat attributes for landbirds within the context of the ecologically desired conditions for the priority habitats. This does not include habitat attributes which may be important to other taxa or the broader ecological community, but are not a primary habitat feature for landbirds (e.g., seeps for amphibians and downed logs for mammals).

Habitat Attributes

The term habitat attribute is used to describe those habitat features, conditions, or elements that function as important life requisites for the focal species representing them. The presentation of quantitative objectives for habitat attributes provides land managers with descriptive and measurable targets to strive to achieve through management or natural succession.

Because there is considerable latitudinal and elevational variability in the geographic scope of this document, there is also high variability in habitat types and conditions and the bird species relationships with those habitat conditions. Thus, it is important to recognize that although bird species are generally responsive to the same habitat attributes, there can be variation in response to the specific parameters of the habitat attribute. The characterization of bird-habitat relationships in the habitat objectives reflects primary tendencies that can be targeted for the greatest conservation value for those species and habitats. However, there are no absolutes in bird-habitat relationships, and these broad-scale characterizations should not replace local knowledge or data for the conservation of focal species and their associated habitat types and habitat attributes (Stephens et al. 2019).

FOCAL SPECIES

Focal species were selected based on a combination of factors including focal species in the previous Oregon-Washington PIF bird conservation plan relevant to the project area (i.e., Altman 2000a), focal species designated in other conservation planning (e.g., Wisdom et al. 2000), and the following:

- regularly occurring breeding species throughout the geographic area under consideration
- strongly associated with the habitat type such that it is a primary habitat type for the species, and they reach some of their highest breeding densities in this habitat type
- strongly associated with an important habitat feature or condition within the habitat type such that they could demonstrate significant responses to management or restoration targeted at the habitat feature or condition
- readily monitored using standard techniques to be able to track progress towards objectives at multiple scales

When more than one species would seemingly make a good focal species for a particular habitat attribute, preference was given to priority species or responsibility species and/or species for which more knowledge exists about its life history and ecology to provide the information for setting biological objectives. One example is White-headed Woodpecker which is not regularly occurring throughout the region and occurs in relatively low densities where it does occur, but is a high priority species and has been studied relatively extensively.

Although there was an attempt to ensure the completeness of the geographic representation of each focal species, there is priority habitat where some of the focal species may not occur as breeding species. In these cases, the recommendation is to use the habitat objectives presented for the focal species, and one of the species listed under "species to benefit" (Appendix A) for tracking population response to habitat management or progress towards any population objective for the focal species.

INTEGRATION OF PRIORITY SPECIES

Many PIF partner agencies and organizations have prioritized bird species for conservation based on factors such as small populations, limited distribution, declining population trends, or threats to habitat. An assumption of the focal species approach is that a suite of focal species can cover the habitat requirements of priority bird species. However, some priority species are such unique ecological specialists that this is not always true (Stephens et al. 2019). Additionally, most agencies and organizations have

historically used priority species, and there is established interest in tracking conservation of these species. In order to account for the conservation of these species, priority species were either designated as unique habitat focal species with biological objectives, or recognized as species to benefit from conservation actions directed towards focal species.

Priority species were designated based on their primary association with our priority habitats and their occurrence on one of the following lists:

- USFWS Birds of Conservation Concern (USFWS 2008)
- USFS Regional Forester's Threatened, Endangered, and Sensitive Species (*www.fs.fed.us/r6/sfpnw/issssp/agency-policy/*)
- BLM Threatened, Endangered, and Special Status Species (*https://www.blm.gov/*)
- ODFW Strategy Species (ODFW 2016)
- WDFW Strategy Species (WDFW 2015)
- Intermountain West Joint Venture Priority Landbirds (*https://iwjv.org/*)
- PIF North American Landbird Conservation Plan Species of Continental Importance for the Intermountain West Avifaunal Biome (Rich et al. 2004) (*https://partnersinflight.org/*)
- State of the Birds 2014 Watch List (Rosenberg et al. 2014).

INTEGRATION OF RESPONSIBILITY SPECIES

As part of the goal of keeping common birds common, PIF has traditionally stressed the importance of "responsibility" which highlights geographic areas with a high percent of a species population. This implies a level of responsibility to be good stewards of species where there is a high responsibility for the species based on population size, and that conservation actions taken in these areas will have the greatest effect on the species population. Herein, responsibility species are designated based on data from the PIF population estimates database (*www.rmbo.org/pifpopestimates/Database.aspx*) using percent population in BCR 10 along with some arbitrary thresholds that reflect the reduced area of Oregon and Washington within the much larger geography of BCR 10. Responsibility species were recognized and designated as focal species with biological objectives if appropriate, or integrated where appropriate as species to benefit from conservation actions directed towards focal species.

BIOLOGICAL OBJECTIVES

Quantitative habitat and population objectives (collectively referred to as biological objectives) are the cornerstone of this document. Habitat and population objectives were established based on the premise that measurable, prescriptive targets for birds and associated habitat attributes are what is most needed by those working on-the-ground for landbird conservation. Conservation partners are encouraged to use the population and habitat objectives as a numerical context within which to stimulate and gauge the local and regional perspective of their conservation actions.

The biological objectives are not regulatory, nor do they represent the policies or recommendations of any agency or organization (Sidebar: *Quantitative Biological Objectives*). Establishing quantitative biological objectives serves several purposes:

- targets for designing management plans and benchmarks for measuring success of management actions
- hypotheses for research, particularly when objectives are based on assumptions and/or expert opinion due to lack of data

Quantitative Biological Objectives

It is important to recognize that the biological objectives in this document have been established solely for the promotion of landbird conservation. They are not tempered by societal or economic concerns or by the conservation concerns of other wildlife or natural resource values. Integration of those factors is important, but outside the scope of this document. It will be important for people historically steeped in regulatory enactments such as the Endangered Species Act or National Environmental Policy Act, to think outside the regulatory paradigm that associates quantitative objectives with compliance and consequences of non-compliance, and recognize the different purpose and value of the biological objectives presented herein. The quantitative biological objectives are what we think the birds need based on current knowledge, and are intended to stimulate conservation action in the trajectory of an objective, not provide the expectation of a rigid threshold or benchmark with accompanying consequences. Furthermore, the biological objectives are based on the premise that a quantitative target is more likely to stimulate conservation action than a descriptive, qualitative target that does not provide a numerical context for the desired outcome or means of tracking progress towards it. Simply stated, most land managers want to know the measurable parameters—how much, where, and by when—in order to plan and implement bird conservation actions in an effective and integrated manner with other objectives, and perhaps just as importantly to have a context within which to track their progress towards objectives.

- outreach to communicate to others what is needed to conserve landbirds
- a starting point for discussion of integration with broader ecosystem-based objectives

Because of variability in the type, quality, and amount of data on focal species, some biological objectives are based on empirical data and others are based on professional judgment. To indicate this degree of variability, sources for the biological objectives are provided for each focal species (Assumptions/Data Sources). In many cases, the biological objectives were taken directly from recommendations in the scientific literature based on empirical data on bird-habitat relationships. Where bird-habitat relationships data are limited for a focal species, and the biological objectives are based more on professional judgment, these objectives become testable hypotheses for research. All the numerical biological objectives should be viewed as dynamic, with an emphasis on the need for research, refinement, and improvement over time.

HABITAT OBJECTIVES

Several types of habitat objectives at different scales are presented in the document. At the regional scale, quantitative habitat objectives are presented for three priority conditions including the amount of late-successional (i.e., old-growth and mature) habitat in dry forest and mesic mixed conifer forest, the amount of natural forest regeneration in post-fire habitat, and the amount of habitat relative to historical conditions and restoration priorities in riparian woodland. These were derived considering historical and current amounts and projected future land uses.

At smaller scales (i.e., sites), prescriptive habitat objectives are presented as measurable targets for specific habitat attributes such as canopy cover, tree or snag size, and understory cover. These were derived from an evaluation of bird-habitat relationship data in the scientific literature and determination of the most optimal targets. Three factors were paramount in setting these prescriptive, quantitative, site-level objectives for habitat conditions or attributes:

- means (rather than minimums) of available data were used because they are more likely to provide adequate conditions for maintaining populations
- a range of values were often used to represent the plasticity of a species' relationship with a habitat attribute, and to acknowledge the historical range of variation that likely occurred for many habitat attributes
- conditions of optimal or high quality habitat were emphasized for self-sustaining populations in geographic areas most suitable for maintaining or providing that habitat (i.e., ecologically appropriate)

Unless otherwise indicated, data on population abundance or density were used to establish habitat objectives that indicate good habitat suitability. This assumes healthy, viable populations where species are most abundant, despite recognition that population density and associated habitat quality can in some cases be a misleading or inaccurate measure of population viability (Van Horne 1983). From a practical standpoint, this approach has been widely used because of the ease and cost effectiveness of collecting abundance or density data relative to demographic data, which are often unavailable. However, a consistent theme throughout this document is that use of habitat quality to represent population health is an assumption that will ultimately need to be validated with demographic data to determine relationships between habitat characteristics and population viability.

Red-Tail Hawk and chicks in nest, U.S. Forest Service photo

Although each bird species has evolved to occupy a unique ecological niche, there is significant overlap among many species in their basic habitat requirements.

POPULATION OBJECTIVES

The PIF Continental Plan used range-wide Breeding Bird Survey (BBS) trend data to establish *ideal* (i.e., not based on potential or capacity to achieve it) continental population abundance objectives (i.e., maintain, increase by 50%, increase by 100%) to reverse population declines to the beginning of the BBS in 1968 (Rich et al. 2004). The expectation was that regional and local assessments would be conducted to establish habitat-based population objectives at those scales that reflect the practical realities of the capacity of those areas to contribute towards the continental population objective. The establishment of continental landbird population objectives was conceptually based on the model of the North American Waterfowl Management Plan in which population objectives have proven to be a valuable tool for stimulating conservation actions and for measuring the success of those actions.

There is inherent value in having quantitative objectives for bird populations as part of bird conservation. Some of these include:

- a marketing tool to emphasize the magnitude of the conservation needed
- a communication tool that is compelling and understandable for public outreach
- a management tool with measurable targets for planning and implementation
- a performance metric to track bird populations relative to habitat management actions
- an adaptive management tool for monitoring ecological response and assessing the need for changes

Bottom-up habitat-based regional assessments to establish landbird population objectives have not been completed for the geography of this document. Herein, population objectives were established for some species based on target density estimates for breeding pairs within optimal habitat. These were established based on a literature review and professional judgment that used focal species mean territory size as the minimum target to encourage the amount of habitat most likely to support the species. Additionally, for species susceptible to Brown-headed Cowbird nest parasitism, population objectives were set to maintain low levels of parasitism.

LANDSCAPE OBJECTIVES

In addition to site-level habitat attributes, for some bird species there are essential habitat relationships described by the composition and pattern of habitat types and/or structural attributes across the landscape. Conservation of these species requires designing and implementing habitat management at the landscape-level. However, most of what is known about landbird ecology exists at the scale of individual birds/pairs or small populations at the site-level, and less is known about the relationships between landbird populations and habitat at the landscape scale (Marzluff et al. 2000). Because recognition of the importance of landscape-level considerations for bird conservation is receiving more attention (Aubry 2007), some landscape-level objectives are provided in this document as appropriate.

Landscape objectives for focal species were developed in several ways including documented habitat relationships between species and landscape conditions (e.g., percent agriculture or development), species area requirements for occurrence or population viability, and emerging biological knowledge on demographic monitoring and species-specific ecological modeling (e.g., Nott et al. 2005, Nott and Pyle 2012). Further, some landscape objectives for the amount of area of suitable habitat were established for many focal species to encourage habitat management for small populations (e.g., >10 pairs) rather than individual pairs. All these objectives need to be tested in an effort to expand our knowledge of landbird ecology and management at the landscape scale.

HABITAT CONSERVATION STRATEGIES

Habitat conservation strategies are provided as examples of management actions that may be used to support the habitat objectives or enhance conservation relative to a habitat attribute or focal species. They are presented as general recommendations for the habitat type, and also for each focal species to support achieving the specific habitat conditions or attributes that species represents.

The habitat strategies can be institutionalized into management practices or implemented on an opportunistic basis within the broader context of ecosystem management. The recommendations include only some of a variety of likely appropriate actions. Land managers should consult with ecologists and scientists from other disciplines to ascertain appropriate habitat conservation actions to prescribe for specific areas. These individuals also can be a valuable source of information for additional habitat management actions to achieve the biological objectives.

THE BIRDS

We considered approximately 125 native landbird species to be highly associated breeding species in all or parts of the East Cascade Mountains (Johnson and O'Neill 2001). There are no endemic landbird species (i.e., species unique to the region). There are a couple rare breeding species that are relatively unique to this part of Oregon and Washington including Boreal Chickadee, Pine Grosbeak, and White-winged Crossbill. A few species are substantially more abundant in the northern part of the region (i.e., Northern Cascades) than the southern part (i.e., Klamath Mountains) including American Redstart, Black Swift, and Spruce Grouse. Conversely, more species are substantially more abundant in the southern part of the region than the northern part including Ash-throated Flycatcher, Cassin's Finch, Green-tailed Towhee, Juniper Titmouse, and Pinyon Jay.

BIRD-HABITAT RELATIONSHIPS

An essential component for establishing biological objectives and recommending appropriate habitat strategies to support the biological objectives is an understanding of the relationships between landbird species and their habitat. The most recent synthesis of knowledge on this is *Wildlife Habitats and Species Associations in Oregon and Washington* (Johnson and O'Neil 2001), and two recent State bird books, Marshall et al. (2003) for Oregon, and Wahl et al. (2005) for Washington. Herein, available information on bird-habitat relationships from these compendiums and numerous other studies were used to support the selection of focal species and the setting of biological objectives.

LANDBIRD CONSERVATION ISSUES

Landbird conservation issues are diverse, and vary in scale from local land use decisions to changes in ecological processes across large landscapes. Most of the challenges of landbird conservation arise either directly or indirectly from conflicts with the human footprint that result in habitat changes and alteration of natural ecological processes. For many migratory species, issues occurring outside the geographic scope of this document also are likely affecting their breeding populations, perhaps even more significantly than local or regional issues.

Because most land ownership in the East Cascade Mountains is large areas of publicly managed forest and private timberlands, a significant part of landbird conservation is addressing issues within the context of forest policy, planning, and regulations. This habitat-based landbird conservation strategy does not include the political-based strategies needed to address these issues. However, it does provide potential language and recommendations in the form of biological objectives that could be used to develop policy/regulations to support landbird conservation.

DECLINING LANDBIRD POPULATIONS

The Breeding Bird Survey (BBS) (Robbins et al. 1986) is the primary source of population trend information for North American landbirds since 1968 (*www.mbr-pwrc.usgs.gov/bbs/*) (Sidebar: *The Breeding Bird Survey: A Source for Landbird Population Trends*). Extensive habitat changes prior to that time undoubtedly affected bird populations, but there are no quantitative data to document them. Attempts to assess the extent of bird population changes prior to the BBS have been documented through an examination of historical habitats at the time of European settlement (approximately 1850), and knowledge of bird species habitat relationships (Wisdom et al. 2000). This information is presented as available under each focal species account in the Biological Objectives section.

The Breeding Bird Survey: A Source for Landbird Population Trends

The Breeding Bird Survey (*www.mbr-pwrc.usgs.gov/bbs/bbs.html*), a volunteer-based survey initiated in the late 1960s, provides the best data on population trends of most landbird species. Each June, volunteers conduct roadside counts on over 4,000 randomly selected routes across the North American continent. Data are stored and managed by the administering agencies, the U.S. Fish and Wildlife Service and the Canadian Wildlife Service.

There is no standard population trend analyses of BBS data specifically for the geographic scope of this document. The East Cascade Mountains occur within the much larger BBS Great Basin Physiographic Region. However, trend estimates for the Great Basin Physiographic Region do provide some level of understanding of populations in the East Cascade Mountains, especially for forest species, since this is where most of the forest occurs within the Great Basin Physiographic Region. In the Great Basin Physiographic Region, BBS data for landbird species considered in this document indicates approximately 60% more species with statistically significant recent (1980–2015) and/or long-term (1966–2015) declining population trends than increasing population trends (i.e., 25 species versus 17 species) (Table 2; Sauer et al. 2017). Additionally, other landbird species may be experiencing population declines, but lack sufficient data for statistical confidence (e.g., Olive-sided Flycatcher, Purple Finch, Rufous Hummingbird), or are not adequately addressed by the BBS such as owls.

Olive-side Flycather. Photo by Russ Morgan.

Table 2. Landbird species with statistically significant population trends in the Great Basin from the Breeding Bird Survey analyses. [1,2]

Species [3]	Significantly Declining Trends		Significantly Increasing Trends	
	Long-Term (1968-2015)	Short-Term (2005-2015)	Long-Term (1968-2015)	Short-Term (2005-2015)
Barn Swallow	X			
Black-capped Chickadee	X	X		
Brewer's Blackbird	X			
Brown-headed Cowbird	X	X		
Bullock's Oriole			X	
California Quail			X	
Cassin's Vireo			X	
Chipping Sparrow	X	X		
Cliff Swallow			X	X
Common Nighthawk	X			
Common Raven			X	X
Dark-eyed Junco	X			
Dusky Flycatcher	X			
Golden-crowned Kinglet	X			
Gray Flycatcher			X	X
Green-tailed Towhee	X			
Hermit Thrush	X			
Horned Lark	X	X		
House Finch			X	
House Wren			X	
Lazuli Bunting			X	
Mountain Bluebird			X	
Mountain Chickadee	X			
Mourning Dove	X			
Nashville Warbler			X	X
Pine Siskin	X			
Pinyon Jay	X			
Red-tailed Hawk			X	
Ring-necked Pheasant	X			
Rough-winged Swallow	X			
Savannah Sparrow	X			
Spotted Towhee			X	X
Townsend's Warbler	X			
Varied Thrush	X	X		
Veery	X			
Vesper Sparrow	X			
Warbling Vireo			X	X
Western Kingbird			X	
Western Meadowlark	X	X		
Western Tanager			X	X
Western Wood-Pewee			X	X
Willow Flycatcher	X			

[1] Includes only native landbird species that are regular breeders in the East Cascade Mountains of Oregon and Washington.

[2] Includes only species with statistically significant trends and a relatively high confidence in the data with at least moderate precision and moderate abundance in routes (i.e., blue dot credibility measure: www.mbr-pwrc.usgs.gov/bbs/credhm09.html) (Sauer et al. 2017).

[3] Bold = focal, priority, and/or responsibility species; Blue = focal species; Underline = priority species; Italics = responsibility species.

FOREST HEALTH

Composition and structure of existing dry forest landscapes have been dramatically altered by decades of fire suppression, grazing by domestic livestock, and timber harvest and associated forest management resulting in (1) fewer old trees of fire-resistant species, (2) denser forests with multiple canopy layers, slower growth, and reduced vigor in existing trees, (3) more densely forested landscapes with continuous high fuel levels, and, consequently, (4) more sites and landscapes highly susceptible to uncharacteristic large-scale wildfire and insect epidemics (e.g., Hessburg et al. 2005, Noss et al. 2006, Franklin et al. 2008).

Very little historical old-growth dry forest conditions (i.e., >200 years old) exist today. Where it does occur, tree densities and fuel accumulations present a significant risk to long-term survival and future restoration (Agee 1993, Hessburg et al. 2005, Franklin et al. 2008). Lightning-caused and accidental fires have the potential to burn with higher intensity and severity then was typical of historical fire regimes. Large-scale fire removes the option for restoration because the old-growth trees remaining today would be lost from the landscape and cannot be replaced for more than 200 years.

Understanding how current forest conditions relate to historical range of variability can inform restoration (Haugo et al. 2015). The increased density of trees in degraded dry forest ecosystems, generally 10 to 100 times their historical density (Sloan 1998), has resulted in increased competition on these sites. Overstory trees have become water- and nutrient-stressed, making them more susceptible to disease and insect outbreaks (Sidebar: *Beetles and Forest Birds*). Regeneration is negatively affected with density-related stress, diseases, and insects which affect an older tree's ability to produce seed to recolonize sites for restoration. Further, the overall density of trees also affects the ability of ponderosa pine to regenerate and thrive in the understory.

Snags are deficient in many forests types, but especially dry forests and especially on private lands. Dead and dying trees are an essential component of forest ecosystems, providing invaluable habitat for landbirds, especially cavity-nesting birds, and a means for important nutrients to cycle back into the forest. While too many snags may indicate unhealthy conditions, a healthy forest always contains some amount of diseased, dying, and dead trees.

In dry forests prior to European settlement, regular understory fires and bark beetles were the primary disturbance factors maintaining a succession of snags through time across the landscape. The current situation is very different with snag removal a common practice, especially on private lands for safety, and on some public lands for fuelwood. Further, extensive reduction in old trees due to harvest has resulted in snags that do occur being much smaller in diameter. Additionally, although there may be an actual increase in the number of snags due to large-scale wildfires and beetle infestations, the snags created by these circumstances are very dissimilar to historical conditions, and provide different types of value to focal and priority landbirds (Sidebar: *Not all Snags are Created Equal*).

The importance of snags to cavity-nesting birds in Intermountain West conifer forests is widely recognized (Bull et al. 1986, Saab and Dudley 1998). Among priority landbird species, the four most prominent are all cavity-nesting birds highly associated with snags in dry forests – Flammulated Owl, Lewis's Woodpecker, White-headed Woodpecker, and Williamson's Sapsucker. These species have been the focus of a regional alliance for their conservation lead by the American Bird Conservancy (Sidebar: *American Bird Conservancy and Cavity-nesting Birds in Private Ponderosa Pine Forests*).

Beetles and Forest Birds

Forest beetles play an important ecosystem role by principally attacking old or weakened trees, allowing younger trees to develop, while providing an important food resource to insectivores such as woodpeckers (Saab et al. 2014). However, tree mortality from large-scale bark beetle outbreaks are increasingly prevalent in western North America, causing considerable ecological change in forests with important implications for birds. A comprehensive review of literature on beetle infestations in lodgepole and ponderosa pine forests revealed a range of results among 25 landbird species (Saab et al. 2014). Some general conclusions were that cavity-nesting species responded more favorably to beetle-killed forests than species with open-cup nests, and species nesting in the shrub layer favored outbreak forests compared with ground and open-cup canopy nesters that generally showed mixed relationships. Bark-drilling species as a group clearly demonstrated a positive short-term association compared with that of other foraging assemblages. Cavity-nesting birds that do not consume bark beetles (i.e., secondary cavity-nesting species and nonbark-drilling woodpeckers) also exhibited some positive responses to outbreaks, although not as pronounced or consistent as those of bark-drilling woodpeckers.

Not all Snags are Created Equal

Some of the recent, large-scale wildfires and beetle infestations throughout the Pacific Northwest have occurred in lodgepole pine forests, which have a very different relationship with insects and fire than ponderosa pine dry forests. Lodgepole pine forests naturally grow very dense, and large intense wildfires and massive beetle infestations were part of the regular life cycle of these forests, setting the stage for a new cycle of dense tree regeneration. Historical fires in dry forests and mesic mixed conifer forests most often were of low or moderate intensity (occasionally high intensity), and created a mosaic of burned and unburned conditions with snags of varying sizes, and both clumped and scattered across the landscape within the context of a living forest. Thus, the large-scale and intensive, often complete tree mortality frequently seen today in both these forest types is often very different from what landbird species evolved with. Although the snags and habitats created by the current conditions of large-scale mortality can be important to some birds (e.g., Black-backed Woodpecker), they do little to benefit the focal and priority dry forest cavity-nesting birds due to the lack of larger snags and lack of heterogeneity in landscape and microsite habitat conditions.

FOREST MANAGEMENT

A principal conservation issue affecting breeding landbird populations in the East Cascade Mountains is forest management because of the dominance of forests across the landscape, and the extensive use of the forests for a variety of human activities and commodity production. An underlying premise of this document is that forest management can have a direct and significant influence on bird populations.

Consequently, manipulation of forest conditions as part of forest management can be designed and implemented to achieve bird conservation objectives (Busing and Garman, 2002; Lehmkuhl et al. 2002).

The types of timber harvest and their impacts on landbirds have changed over the years. Early timber harvests targeted the largest trees in the most accessible lower elevations, which in most instances were ponderosa pine, and to a much lesser extent Douglas-fir and western larch (Sallabanks et al. 2001). This form of harvest, coupled with fire suppression, allowed smaller, shade-tolerant, late-successional species such as Douglas-fir to capture the growing space (Sampson et al. 1994). The result was a rapid shift on many sites from forests dominated by seral species to forests dominated by late-successional species, and from open forests of old growth trees to dense forests of relatively younger trees (Agee 1993). This significantly changed the habitat available to birds associated with the historical open forests.

As forest management advanced with mechanization, intensive harvest practices such as clearcutting and replanting were the norm, especially at lower elevations. This completely and suddenly changed the landbird community with the greatest negative effects on less adaptive species with high site fidelity and narrower tolerances in habitat requirements.

Approximately 30% of lands in the East Cascades of Oregon and Washington need restoration to move current forest structure towards the natural range of variability as defined by ecosystem characteristics prior to European settlement (Haugo et al. 2015). Accordingly, the current emphasis in forest management on some public lands is to maintain or reestablish forest health through ecological restoration activities such as selective harvest (e.g., thinning), fuels reduction, and natural regeneration which is considered a more ecologically responsible harvest method in dry forests (Steele 1994). This change has been referred to in several ways, including as "New Forestry" (Franklin 1989) or "Ecological Forestry" (Johnson and Franklin 2009). The basis for this type of forest management is an attempt to 1) use disturbance patterns and habitat heterogeneity that occur in unmanaged forests as a guide for harvest patterns and retention, and 2) accelerate re-establishment of late-successional forest conditions and structural elements such as snags, down logs, and vertical heterogeneity (Sidebar: *Dry Forest Accelerated Restoration*).

American Bird Conservancy and Cavity-nesting Birds in Private Ponderosa Pine Forests

American Bird Conservancy in cooperation with numerous partners has developed a full-spectrum, regional conservation alliance to improve habitat conditions and increase populations of cavity-nesting birds in ponderosa pine forests of the Pacific Northwest. The program emphasis is high priority species such as Flammulated Owl, Lewis's Woodpecker, White-headed Woodpecker, and Williamson's Sapsucker in Oregon, Washington, Idaho, and Montana. The primary focus has been to assist private landowners to incorporate management prescriptions with the specific needs of the birds into the more general prescriptions of forest management to improve forest health. Additionally, there has been extensive on-the-ground habitat management. Three outreach brochures and a technical document on cavity-nesting bird conservation have been produced to assist private landowners (www.abcbirds.org/results/publications/#special-reports).

Landbird responses to forest management practices are complex, species-specific, and dependent upon many environmental and ecological factors. Because timber harvesting changes the structure, density, and vegetative diversity in forests, the new habitats may have beneficial or negative effects depending on the species (Ghalambor 2003). It is also important to recognize that habitat alterations during restoration activities may temporarily or permanently displace landbird species currently using those areas. However, most degraded dry forest habitats tend to disproportionately support invasive bird species or habitat generalist species, both of which are of less conservation concern. Summaries of the effects of forest management on birds in coniferous forests of the Pacific Northwest have been synthesized by Hagar et al. (1995), Bunnell et al. (1997), and Sallabanks et al. (2001). More specifically, projections of potential landbird response to dry forest restoration activities is presented in Appendix B.

This document does not attempt to describe all potential forest management activities that could be conducted to achieve the desired habitat conditions for landbirds. Those need to be determined locally by assessing the most ecologically appropriate management at each site. However, to assist land managers, the document offers some basic forest management activities that are widely accepted for promoting particular habitat attributes.

Dry Forest Accelerated Restoration

After more than a century of active fire suppression and evolving timber management practices, dry forests that historically experienced low intensity surface fires have become vulnerable to uncharacteristic outbreaks of insects, diseases, and high severity crown fires. Thus, there is a great need for actively managing these degraded forests. Ecological departure, that is, how landscapes compare to natural range of variability in ecological conditions prior to European settlement, has become a key concept in restoration planning (Haugo et al. 2015, DeMeo et al. 2018). A goal of forest health restoration is to regain ecological integrity and forest functionality in frequent fire forests (i.e., dry forests) to more normalized levels of resilience to fire, insects, disease and other disturbances, as well as maintaining forest structures prevalent prior to modern fire suppression policy and methods (Maginnis and Jackson 2007). While consideration of historical conditions is a component of restoration, reducing current threats and increasing resilience to climate change are equally important.

Dry forests dominated by ponderosa pine are the target of most forest restoration activities in the western United States (Hessburg et al. 1999, Allen et al. 2002, Baker et al. 2007). Nearly 800,000 hectares in the Oregon East Cascades and over 475,000 ha in the Washington East Cascades are in need restoration (Haugo et al. 2015). Of those areas, approximately 65% is managed by the USFS in Oregon and 40% in Washington. Recently, the USFS has implemented forest restoration treatments on about 129,000 acres of dry forest annually in eastern Oregon, or just 1.4 percent of the USFS forestland in eastern Oregon not restricted from active forest management (Economic Assessment Team 2012). Thus, the rate of forest restoration has not kept pace with current and ongoing degradation, and the acres in need of restoration have out-paced restoration accomplishments. Therefore, there has been significant efforts on USFS lands to initiate landscape-level restoration projects to restore ecological resiliency and ensure socio-economic viability of the forests through an accelerated pace and scale of restoration.

Desirable restoration activities include silvicultural treatments that retain and release older trees, reduce tree densities through thinning, shift composition toward fire-and drought-tolerant tree species, incorporate spatial heterogeneity at multiple spatial scales, and reintroduce fire where appropriate (Franklin and Johnson 2012). In addition to these vegetation management activities, forest health restoration presents opportunities to improve the overall condition of forested watersheds and related habitat through watershed restoration activities such as upgrading stream crossing structures, improving and reducing road networks, stabilizing stream banks, and reintroducing native plant species.

WILDFIRE

Wildfire historically was a regular and significant natural disturbance in the East Cascade Mountains, ranging from frequent low-severity fires to infrequent high-severity fires (Kotliar et al. 2005). Dry forest sites typically experienced predominantly low- and mixed-severity fires at frequent intervals (e.g., 5–35 years), with much larger return intervals for mixed conifer forests (50-100 years) and subalpine forests (>100 years) (Agee 1993, Perry et al. 2011). Lower elevation forests and drier sites tended to burn more frequently with lower intensity, which would leave most of the large trees alive. The ecological persistence of many forest birds was facilitated by wildfire (Kennedy and Fontaine 2009, Fontaine and Kennedy 2012), which played a role in maintaining a mosaic of successional stages or habitat structures (e.g., snags) throughout forests of the Pacific Northwest (Huff et al. 2005).

Vegetation build-up following decades of fire suppression over much of the 20th century has resulted in a fire regime that is well outside the historical range of variability (McCullough et al. 1998). Despite the long established history of wildfire in the Intermountain West with its low-to-moderate precipitation and abundance of fuel sources (Heyerdahl et al. 2001), uncharacteristically severe wildfires which are now common do not have the same benefits to forests and associated bird species. While the extent and severity of wildfires today inevitably differs from pre-settlement patterns, the nuances of these differences are a topic of some debate. Yet, generally, in dry forests ecosystems low severity fire is lacking under current fire regimes (Haugo et al. 2019).

In recent years (1984-2015), more wildfire in dry forests burned at high severity (36%) compared to historic levels (6-9%, Haugo et al. 2019). Recent efforts to quantify wildfire risk across the Pacific Northwest (Gilbertson-Day et al. 2018), in conjunction with improved understanding of departure from the natural range of variability (Haugo et al. 2015, DeMeo et al. 2018) are informative for restoration prioritization and planning.

Many landbird species that evolved with historical post-wildfire habitat, and find varying degrees of habitat suitability in the conditions associated with the more recent expansion of large-scale wildfires, face another challenge with salvage logging (Sidebar: *Salvage Logging and Cavity-Nesting Birds*). Post-wildfire salvage logging has become increasingly prevalent as the amount of forested area burned by wildfire has increased over the past two decades (McIver and Starr 2001, Beschta et al. 2004, Stephens and Ruth 2005).

Salvage Logging and Cavity-Nesting Birds

Natural forest regeneration after wildfires historically was an ecological process under which landbirds evolved. Where current wildfires have occurred, there is significant pressure to conduct salvage logging to extract merchantable lumber. Salvage logging removes dead, dying, or weakened trees that provide nesting and foraging habitat for woodpeckers and other cavity-nesting species (Hutto and Gallo 2006, Saab et al. 2007). Significant research has been conducted to address the consequences of salvage logging on cavity-nesting birds under the Birds and Burns Network (www.fs.fed.us/rm/wildlife-terrestrial/birds-burns/). In mixed-severity ponderosa pine forests in western Idaho, among seven cavity-nesting bird species, Hairy Woodpecker was the only species in which partial-salvage logging had a measurable, negative impact on both nesting densities (Saab et al. 2007, 2009) and nesting success (Saab et al. 2011). Several other species, including Black-backed Woodpeckers, Mountain Bluebirds, and Northern Flickers, had higher nesting densities only in unlogged burned forest (Saab et al. 2007, 2009). Saab et al. (2011) concluded that carefully planned salvage logging can maintain habitat for successfully breeding cavity-nesting birds if the prescriptions include both unlogged reserves (especially if located centrally in post-wildfire forests, distant from unburned habitats that potentially serve as sources of nest predators), and partially logged areas that retain moderate snag diameters (>23 cm [9 in] DBH) and densities (45 snags/ha [18/ac]). Hutto (1995) commented similarly on the need for unlogged areas in burned forests to maintain microhabitat conditions for several bird species highly associated with the entire ecosystem that burned forests provide.

Several other non cavity-nesting bird species respond positively to conditions created by wildfires. In particular, Olive-sided Flycatcher demonstrates a strong positive response to early-successional conditions following wildfires throughout their range (Hutto 1995, Sallabanks and McIver 1998, Stephens et al. 2015). Salvage logging negatively impacts the presence and/or quality of shrub habitat through ground-disturbing activities. This can affect availability of flying insects, the principal prey item for Olive-sided Flycatcher. Furthermore, post-salvage planting and management for conifer trees often selects against deciduous trees and shrubs considered competing vegetation to conifer establishment.

LIVESTOCK GRAZING

Livestock grazing began shortly after European settlement, and by the late 1800s herds of sheep and cattle roamed freely throughout lower elevation dry forests (Sallabanks et al. 2001). Livestock grazing is the most common land management practice in the western United States (Platts 1991), occurring on 70% of the land cover in 11 western states (Fleischner 1994). Current livestock grazing pressure is reduced from the early 1900s but remains prominent on both public and private lands. Cattle graze on 63% of the 245 million Bureau of Land Management (BLM) acres and 50% of the 191 million Forest Service acres (USFS 2016). Ecological effects are many-fold and include soil compaction and reduced water infiltration (Holecheck et al. 1989), disruption of ecological succession (Longhurst et al. 1982), alteration of vegetation structure (Cooper 1960; Kauffman et al. 1983), decreases in native grasses and increases in the spread of noxious and exotic weeds, and negative impacts on abundance and diversity of birds, herpetofauna, small mammals, salmonid fish, and insects (e.g., Fleischner 1994; Saab et al. 1995). Intensive grazing also interrupts natural fire regimes by reducing fuels and the occurrence of low intensity fires from spreading in a normal pattern (Covington and Moore 1994).

There has been extensive research and summaries on the effect of livestock grazing on bird abundance and populations (e.g., Bock et al. 1993, Tewksbury et al. 2002). Cattle tend to congregate in riparian areas where avian diversity is also disproportionately high and therefore the impacts of grazing in these areas are of particular conservation concern (Fleischner 1994; RHJV 2004). Responses are often species-specific, but any level of livestock grazing is potentially detrimental to riparian landbirds, especially for species dependent on understory vegetation composition and structure (Martin and McIntyre 2007). Some results suggest that bird abundance and species richness are greater at ungrazed riparian areas compared to grazed areas (Popotnik & Giuliano 2000; Nelson et al. 2011; Earnst et al. 2012), especially riparian obligate abundance and richness (Knopf et al. 1988; Forrester et al. 2017). In a review, Saab et al. (1995) found that 46% of 68 migratory species that breed in western riparian habitats decreased in abundance with grazing. Complete exclusion of livestock grazing in riparian habitat is the most beneficial management action for bird populations (Krueper 1993, Earnst et al. 2012). However, seasonal exclusion (e.g., winter only) with controls on intensity

can still provide habitat for some species (Nelson et al. 2011). Avian response is often dependent on grazing type and intensity, frequently overlooked factors (Fleischner 1994) that are becoming better-studied (Nelson et al. 2011; Lusk & Koper 2013; Golding & Dreitz 2017).

CLIMATE CHANGE

Research has indicated that birds are impacted by climate change in a variety of ways, both directly such as distributional changes and indirectly by altering food supply or timing of reproduction or migration, thus affecting overall fitness (King and Finch 2013). One of the greatest concerns is the potential for unsynchronized responses of vegetation and birds to a changing climate that results in settlement (residency or movement) in marginal or unsuitable habitat where resources are deficient.

Forest birds, especially western forest birds, are predicted to fare better in a changing climate than birds in other habitats (Peterson 2003, North American Bird Conservation Initiative 2010). Though habitat specialists with small distributions and long-distance migrants are exceptions. Montane forest birds, especially spruce-fir species, are especially vulnerable because the area available for them to colonize decreases as habitat and species ranges shift upwards in elevation due to climate change (King and Finch 2013). Alpine birds face an even greater challenge with a warming climate and encroaching forests resulting in less area and limited opportunities to move (Jackson et al. 2015). Long-distance migrants, and especially aerial insectivores, may face challenges around the timing of food availability throughout their migratory range (North American Bird Conservation Initiative 2010).

Herein, there is no attempt to address the issue of climate change relative to the setting of biological objectives, rather, biological objectives should be integrated into climate-smart restoration and land management. Most focal species habitat relationships are relatively static, and changes in habitats will likely result in changes in the distribution and abundance of those species. Early strategies identified to potentially mitigate the impacts of climate change on bird populations include:

- maintaining the resilience of habitats through active management to reduce compound stressors (fire suppression, human development, overgrazing, invasive species) that potentially interact with climate change and magnify its impact
- increasing the area of protected lands to include greater representation of habitat refugia, where species are predicted to be buffered from the effects of climate change (Millar et al. 2007, Stralberg et al. 2009)
- establishing and maintaining habitat connectivity along elevational and latitudinal gradients through corridors or networks of preserves to facilitate incremental shifts in distribution by climate-adaptive species following likely routes of change in vegetation (Peters 1992, Mawdsley et al. 2009)

There is a significant and growing body of information on climate change and birds. The international PIF web page (*www.partnersinflight.org/climate_change*) provides a bibliography of articles on this topic. Two web pages on research and predictive modeling on climate change and birds in the Pacific Northwest are American Bird Conservancy (*https://abcbirds.org/*), and Institute for Bird Populations (*https://birdpop.org/*). The Audubon Birds and Climate Change Report, which documents the results of modeled analyses of bird data, provides projected outcomes on all North American birds (Langham et al. 2014).

Pine Beetle Damage. U.S. Forest Service photo

Research has indicated that birds are impacted by climate change in a variety of ways, both directly such as distributional changes and indirectly by altering food supply or timing of reproduction or migration, thus affecting overall fitness.

FOCAL SPECIES

A list of focal species and the habitat attributes they represent is presented below for each of the three priority habitat types and the 11 unique habitats.

DRY FOREST

Dry forest includes coniferous forest composed exclusively of ponderosa pine or co-dominated by ponderosa pine and Douglas-fir or grand fir. It occurs primarily at lower elevations and mostly on xeric, upland sites with shallow, rocky soils.

The justification for dry forest as a priority habitat is the extensive loss and degradation of these forests, especially ponderosa pine forests, and the number of priority bird species highly associated with this habitat type. Declines of dry forest habitat were among the most widespread and strongest declines among habitat types in an analysis for terrestrial vertebrates in the ICBEMP (Wisdom et al. 2000). In addition to the overall loss of this forest type, two features, snags and old-forest conditions, have been diminished greatly and negatively impacted species such as Flammulated Owl, Lewis's Woodpecker, Pygmy Nuthatch, White-breasted Nuthatch, White-headed Woodpecker, and Williamson's Sapsucker.

The desired condition in dry forest is a large tree, single-layered canopy with an open, park-like understory dominated by herbaceous cover with scattered shrub cover and pine regeneration as ecologically appropriate. Because of the extensive loss and degradation of dry forest, habitat restoration is the most important strategy for conservation of landbirds associated with this habitat type (Sidebar: *Dry Forest Restoration: Winners Trump Losers in Bird Conservation*). Landbird conservation in dry forest emphasizes maintaining healthy ecosystems that include representative focal species for four habitat attributes. These include large patches of late-successional forest with heterogeneous canopy cover, large trees, large snags, and an open herbaceous understory with scattered sapling pines (Table 3).

Dry Forest Restoration: Winners Trump Losers in Bird Conservation

Restoration of degraded dry forests will reduce populations of landbird species that are provided habitat in the closed canopy, dense understory mixed conifer forests that now dominate what was historically dry forest. This may include focal and priority species such as Northern Goshawk and Townsend's Warbler. This impact may surface as a concern at the project level, but these habitats represent degradation of historical dry forest conditions and they dominate the region. Even with an emphasis on restoration of historical dry forest conditions, there is not likely to be a shortage of the current degraded conditions in what was historically dry forest throughout the region. Further, populations of these mixed conifer forest species have benefitted from the habitat degradation with expansion of their habitat at the expense of populations of focal, priority, and responsibility dry forest species such as Chipping Sparrow, Flammulated Owl, Lewis's Woodpecker, Pygmy Nuthatch, and White-headed Woodpecker.

Table 3. Habitat attributes and associated landbird focal species for conservation in Dry Forest habitats in the East Cascade Mountains of Oregon and Washington.

Habitat Type	Habitat Attribute	Focal Species
Dry Forest Ponderosa Pine and Ponderosa Pine/ Douglas-fir/Grand fir	large patches late-successional with heterogeneous canopy	White-headed Woodpecker
	large trees	Pygmy Nuthatch
	herbaceous understory with scattered sapling pines	Chipping Sparrow
	large snags	Mountain/Western Bluebird

MESIC MIXED CONIFER FOREST

Late-successional mesic mixed conifer forest within the East Cascades Mountains includes coniferous forest composed primarily of cool, moist Douglas-fir/grand fir; cool, dry Douglas-fir; western larch; hemlock; and occasional ponderosa pine. It occurs mostly at higher elevations, wetter sites, northerly aspects, and in draws where soils are mesic and well-developed.

The justification for mesic mixed conifer forest as a priority habitat is a substantial loss of the late-successional stage and important structural elements such as snags. It has been commonly harvested by regeneration prescriptions such as clearcuts or shelterwood cuts to reduce insect infestation and disease and reduce the risk of uncharacteristic wildfire. Landbird species highly associated with mesic mixed conifer forest that have been adversely impacted by the loss and degradation of late-successional conditions and structural elements such as snags include Dusky Grouse, Golden-crowned Kinglet, Olive-sided Flycatcher, Red-breasted Nuthatch, Townsend's Warbler, and Varied Thrush.

The desired condition in mesic mixed conifer forest is a multi-layered late-successional forest with a diversity of structural elements (e.g., snags, dense shrub patches, high canopy cover) in large patches as ecologically appropriate. Landbird conservation in mesic mixed conifer forest emphasizes maintaining healthy ecosystems that include representative focal species for five habitat attributes. These include large trees, large snags, interspersion of grassy openings with dense thickets, a multi-layered/dense understory, and edges and openings with scattered trees (Table 4).

Table 4. Habitat attributes and associated landbird focal species for conservation in Mesic Mixed Conifer habitats in the East Cascade Mountains of Oregon and Washington.

Habitat Type	Habitat Attribute	Focal Species
Mesic Mixed Conifer Forest Late-Successional	large snags	Williamson's Sapsucker
	large trees	Brown Creeper
	interspersion of grass openings and dense thickets	Flammulated Owl
	multi-layered with high understory foliage volume	Swainson's Thrush
	forest edges and openings with scattered trees	Olive-sided Flycatcher

PINE-OAK WOODLAND

Pine-Oak woodland habitats within the East Cascade Mountains occur mostly in Klickitat (WA) and Wasco (OR) counties along and in the uplands near the Columbia River. They are also a minor component in the Klamath Basin ecoregion, especially in the Klamath River Canyon. We refer to Pine-Oak Woodland as including both oak-dominated woodland and mixed pine-oak habitats. Bird species associated with Pine-Oak Woodland have been adversely impacted primarily by the loss of large oak and pine trees and old-forest conditions, and the lack of recruitment for replacement of old trees.

The desired condition in Pine-Oak Woodland is a large tree, multi-layered canopy with an understory mosaic of herbaceous and shrub-dominated patches including regeneration saplings as ecologically appropriate. Landbird conservation in Pine-Oak Woodland emphasizes maintaining healthy ecosystems through representative focal species for three habitat attributes. These include early successional and/or dense shrub patches, large oaks with cavities, and large pine trees and snags (Table 5).

Table 5. Habitat attributes and associated landbird focal species for conservation in Pine-Oak Woodland habitats in the East Cascade Mountains of Oregon and Washington

Habitat Type	Habitat Attribute	Focal Species
Pine-Oak Woodland	early successional and shrub patches	Nashville Warbler
	large oaks with cavities	Ash-throated Flycatcher
	large trees and snags	Lewis's Woodpecker

UNIQUE HABITATS

Landbird conservation also is directed toward 11 Unique Habitats and associated focal species in the East Cascade Mountains (Table 6). This category was used to capture a wide range of habitat types that are important for landbird conservation for one or more of the following reasons:

- relatively small in size and/or limited in extent and occur in disjunct patches dispersed throughout the mostly forest landscape (e.g., aspen, cliffs and rock outcrops)
- small to large contiguous patches that occur in narrow elevational or ecological windows (e.g., subalpine forest, mature juniper woodland, mature lodgepole pine, montane shrubland, montane meadows, whitebark pine)
- ephemeral in occurrence and distribution dependent on natural factors such as fire and hydrology (e.g., post-wildfire, mature riparian woodland)
- priority landbird species highly associated with these habitats that are not focal species in the priority habitat types (e.g., sagebrush-steppe)

Table 6. Landbird focal species for conservation in Unique Habitats in the East Cascade Mountains of Oregon and Washington.

Habitat Type	Habitat Attribute	Focal Species
Unique Habitats	**Forest Types**	
	Post-Wildfire	Black-backed Woodpecker
	Whitebark Pine	Clark's Nutcracker
	Subalpine Forest	Hermit Thrush
	Mature Lodgepole Pine	Mountain Chickadee
	Mature Juniper Woodland	Gray Flycatcher
	Mature Riparian Woodland	Western Wood-Pewee
	Aspen	Red-naped Sapsucker
	Shrubland/Grassland Types	
	Montane Shrubland	Calliope Hummingbird
	Sagebrush-Steppe	Brewer's Sparrow
	Montane Meadows	Lincoln's Sparrow
	Non-Vegetated Types	
	Cliffs and Rock Outcrops	Rock Wren

Most unique habitats are structurally less complex than priority habitats, and usually can be represented by one focal species. Further, the uniqueness of these habitats sometimes results in a high degree of habitat specialization for the focal species associated with them, which also are often priority species (e.g., Black-backed Woodpecker, Brewer's Sparrow, Calliope Hummingbird).

Sagebrush-steppe habitat is considered a unique habitat rather than a priority habitat for several reasons. Sagebrush-steppe habitat in the East Cascade Mountains tends to be disjunct and variable in size and distribution amid the predominantly forested landscape. Additionally, the most highly associated species occur as low density breeding species, and are often peripheral to the region relative to their range-wide distribution and population size (e.g., Sage Thrasher, Sagebrush Sparrow). Perhaps most importantly, sagebrush-steppe habitat is the highest priority in the adjacent Columbia Plateau and Northern Great Basin ecoregions of Oregon and Washington. Thus, conservation of species such as Ferruginous Hawk, Grasshopper Sparrow, Loggerhead Shrike, Sagebrush Sparrow, and Sage Thrasher are most appropriately addressed in those ecoregions (Altman and Holmes 2000).

PRIORITY SPECIES

There are 26 priority landbird species identified by primary bird conservation partners that are regularly breeding species in the East Cascade Mountains of Oregon and Washington (Table 7). Lewis's Woodpecker is the only species identified as priority in all seven lists that were reviewed. Flammulated Owl is the only species considered priority in six of the seven lists. Among the 26 species, 10 are focal species in this document and 10 are responsibility species.

Table 7. Landbird species designated as priority bird species by primary bird conservation partners that are regularly associated with breeding habitats in the East Cascade Mountains of Oregon and Washington. [1]

Species	USFWS BCC [2]	USFS/ BLM Sensitive [3]	ODFW Strategy [4]	WDFW Strategy [5]	IWJV Priority [6]	PIF CPLAN [7]	WATCH LIST [8]
Black Swift	X	XY-OR					Yellow
Black-backed Woodpecker			X				
Brewer's Sparrow	X				X		
Calliope Hummingbird	X					X	Yellow
Cassin's Finch						X	
Common Nighthawk						X	
Evening Grosbeak						X	Yellow
Flammulated Owl	X		X	X	X	X	Yellow
Gray Flycatcher		XY-WA					
Great Gray Owl		XY-WA	X	X			
Green-tailed Towhee	X	Y-WA					
Lewis' s Woodpecker	X	XY-OR,WA	X	X	X	X	Yellow
Mountain Quail		XY-WA		X		X	
Northern Goshawk		Y-WA	X				
Northern Waterthrush		XY-OR					
Olive-sided Flycatcher	X		X		X	X	Yellow
Pine Siskin						X	
Pinyon Jay	X				X	X	Yellow
Pygmy Nuthatch				X			
Red-naped Sapsucker					X		
Rufous Hummingbird					X		Yellow
Swainson's Hawk			X		X		
Three-toed Woodpecker			X				
White-headed Woodpecker	X	XY-OR,WA	X	X	X		
Williamson's Sapsucker	X						
Willow Flycatcher	X				X		

[1] The criteria for inclusion on this list was priority status by a State or Federal agency (the first four columns) or bird conservation partnership (the last three columns), and regularly breeding in the East Cascade Mountains of Oregon and Washington (i.e., not peripheral or irregular breeders). The list does not include Federal or State ESA listed or recently delisted species such as Bald Eagle and Peregrine Falcon.

[2] USFWS BCC = U.S. Fish and Wildlife Service Birds of Conservation Concern (http://www.fws.gov/migratorybirds/pdf/grants/BirdsofConservationConcern2008.pdf) (USFWS 2008). The area encompassed by this USFWS list is BCR 9, which also includes significant area outside of Oregon and Washington and outside of the East Cascade Mountains.

[3] USFS/BLM Sensitive = U.S. Forest Service/Bureau of Land Management Sensitive Species (http://www.fs.fed.us/r6/sfpnw/issssp/agency-policy/). The area encompassed by this list is all of Oregon and Washington. X = USFS, Y = BLM.

[4] ODFW Strategy = Oregon Department of Fish and Wildlife Strategy Species for the East Cascades ecoregion in the State Wildlife Action Plan (https://www.dfw.state.or.us/) (ODFW 2016).

[5] WDFW Strategy = Washington Department of Fish and Wildlife Strategy Species (https://wdfw.wa.gov/) (WDFW 2015).

[6] IWJV Priority = Intermountain West Joint Venture Priority Landbirds (https://iwjv.org/). The area encompassed by this list includes significant area outside Oregon and Washington.

[7] PIF CPLAN = Partners in Flight North American Landbird Conservation Plan Species of Continental Importance for the Intermountain West Avifaunal Biome (Rich et al. 2004) (https://partnersinflight.org/)

[8] WATCH LIST = The State of the Birds 2014 Watch List (Rosenberg et al. 2014). Red = Highest Priority; Yellow = Second Priority.

RESPONSIBILITY SPECIES

There are 15 species with a relatively large percent of their population in BCR 9, and thus considered to be a high responsibility for landbird conservation partners (Table 8). Eleven of the 15 also are focal or priority species for this region including six species - Brewer's Sparrow, Calliope Hummingbird, Gray Flycatcher, Lewis's Woodpecker, White-headed Woodpecker, and Williamson's Sapsucker - that are both focal and priority species. It is important to recognize that BCR 9 includes substantial area outside the East Cascades Mountains, in particular the sagebrush-steppe and associated habitats of the Great Basin ecoregion. Thus, some of the high responsibility species, such as Brewer's Sparrow and Lazuli Bunting, have the majority of their population outside the East Cascades Mountains.

Table 8. Landbird species with a high responsibility for conservation based on the percent of their range-wide population in BCR 9 which includes the East Cascades Mountains of Oregon and Washington. [1,2]

Species [3]	Percent Population BCR 9
Brewers Sparrow	57.2
Cassin's Finch	37.1
Calliope Hummingbird	31.6
Common Poorwill	27.1
Evening Grosbeak	27.2
Gray Flycatcher	68.8
Green-tailed Towhee	28.4
Lazuli Bunting	29.5
Lewis's Woodpecker	46.7
Mountain Chickadee	24.6
Pinyon Jay	40.5
Rock Wren	27.2
Vaux's Swift	24.9
White-headed Woodpecker	23.5
Williamson's Sapsucker	27.8

[1] *www.rmbo.org/pifpopestimates/Database.aspx*

[2] *The arbitrary cut-off was >20% of the species continental population in BCR 9, which also includes a substantial area outside of the East Cascades Mountains.*

[3] *Bold = focal or priority species; Blue = focal species: Underline = priority species.*

Williamson's Sapsucker, Photo by Mark Penninger.

POPULATION ESTIMATES

Population size is an important metric in assessments of a species conservation status and its response to natural or anthropogenic changes in its habitat. Within PIF, the Species Assessment Database includes population size as one of several factors considered in the prioritization of species (PIF Science Committee 2012). Although habitat is essential for bird conservation, habitat conservation does not necessarily equate to bird conservation. Habitat conservation efforts still require a litmus test assessment of bird populations, the ultimate measure and currency of bird conservation. This concept is currently receiving increasing emphasis among bird conservation partners as a means of quantitatively accounting for the response of bird populations to investments in habitat conservation.

Population estimates have been developed for all bird species in North America at the continental level by the four bird conservation initiatives. Population estimates for landbirds were originally published in the PIF Continental Plan (Rich et al. 2004), and later updated in the PIF Population Estimates Database (PIF Science Committee 2013) with new data and to address some of the recommendations of the Thogmartin et al. (2006). The estimates were derived from a process described in Blancher et al. (2007) using relative abundance counts from BBS data. The population estimates were further stepped-down to smaller geographic scales (i.e., states, BCRs, state/BCR polygons) to provide a starting point for dialogue on the setting of regional population objectives through regional assessments (Rosenberg 2004). Although this top-down approach does not account for the known disproportionate sampling of habitats by the BBS, it does illustrate differences in the relative degrees of magnitude among species populations, and provides a point of discussion for initiating the dialogue on the impacts of actions on landbird populations. Further, as mentioned above for responsibility species, some of these bird species are more associated with habitats in the Great Basin ecoregion portion of BCR 9 which is outside the East Cascade Mountains. Population estimates using the process stepped-down from the continental population estimates are provided for focal, priority, and responsibility species in Table 9.

Calliope Hummingbird, Photo by Russ Morgan.

Table 9. Population estimates of focal, priority, and responsibility species in Oregon and Washington portions of BCR 9 stepped-down from Partners in Flight continental population estimates.[1]

Species [3]	BCR 9		BCR 9 OREGON		BCR 9 WASHINGTON		CONTINENTAL
	Pop. Est. [2]	% [3]	Pop. Est. [2]	% [3]	Pop. Est. [2]	% [3]	Pop. Est. [2]
Focal Species [4,5]							
Ash-throated Flycatcher	350,000	5.0	57,000	0.8	1,000	0.0	6,800,000
Black-backed Woodpecker	49,000	2.8	35,000	2.0	2,500	0.1	1,700,000
Brewer's Sparrow	9,600,000	57.2	1,600,00	9.7	220,00	1.3	17,000,000
Brown Creeper	660,000	7.0	260,00	2.8	120,000	1.3	9,500,000
Calliope Hummingbird	1,400,000	31.6	58,000	1.3	240,000	5.4	4,500,000
Chipping Sparrow	6,300,000	2.7	1,800,000	0.8	950,000	0.4	230,000,000
Clark's Nutcracker	56,000	19.4	15,000	5.1	2,600	0.9	290,000
Flammulated Owl	1,100	22.7					4,900
Gray Flycatcher	2,000,000	68.8	570,000	19.8	3,000	0.1	2,900,000
Hermit Thrush	650,000	0.9	310,000	0.4	150,000	0.2	72,000,000
Lewis' s Woodpecker	38,000	46.7	4,400	5.4	31,000	0.0	82,000
Lincoln's Sparrow	170,000	0.2	47,000	0.1	17,000	0.0	88,000,000
Mountain Bluebird	1,300,000	23.2	320,000	5.7	110,000	2.0	5,600,000
Mountain Chickadee	1,900,000	24.7	950,000	12.1	120,000	1.5	7,900,000
Nashville Warbler	760,000	1.9	110,000	0.3	340,000	0.9	40,000,000
Olive-sided Flycatcher	120,000	6.0	72,000	3.8	11,000	0.6	1,900,000
Pygmy Nuthatch	310,000	10.0	110,000	3.5	65,000	2.1	3,100,000
Red-naped Sapsucker	270,000	13.8	2,500	0.1	48,000	2.4	2,000,000
Rock Wren	1,100,000	27.2	300,000	7.4	59,000	1.4	3,400,000
Swainson's Thrush	1,500,000	1.2	15,000	0.0	750,000	0.6	120,000,000
Western Bluebird	370,000	5.2	32,000	0.5	170,000	2.4	7,100,000
Western Wood-Pewee	1,300,000	15.1	260,000	3.0	450,000	5.1	8,800,000
White-headed Woodpecker	50,000	20.5	20,000	8.4	2,800	1.1	240,000
Williamson's Sapsucker	82,000	27.8	51,000	17.3	18,000	6.1	290,000
Black Swift	2,700	3.0			2,200	2.5	170,000
Cassin's Finch	1,200,000	37.1	200,000	6.3	130,000	4.1	3,200,000
Common Nighthawk	3,000,000	13.9	680,000	3.1	240,000	1.1	22,000,000
Evening Grosbeak	1,000,000	27.2	36,000	1.0	570,000	14.9	3,800,000
Great Gray Owl	640	0.9					71,000
Green-tailed Towhee	1,400,000	28.4	350,000	7.4			4,800,000
Mountain Quail	19,000	7.8	4,700	1.9			250,000
Northern Goshawk	7,900	3.9	4,200	2.0	1,200	0.6	210,000
Northern Waterthrush	53,000	0.3					17,000,000
Pine Siskin	2,600,000	5.8	190,000	0.4	750,000	1.7	45,000,000
Pinyon Jay	310,000	40.5	11,000	1.4			760,000
Rufous Hummingbird	1,700,000	7.9	140,000	0.7	750,000	3.5	22,000,000
Swainson's Hawk	94,000	11.4	6,000	0.7	11,000	1.7	820,000
Three-toed Woodpecker	2,900	0.2			240	0.0	1,600,000
Willow Flycatcher	880,000	10.9	150,000	1.9	240,000	3.0	8,100,000

table continued on next page

Table 9, continued

Responsibility Species [4,5]							
Common Poorwill	360,000	27.1	81,000	6.1	18,000	1.4	1,700,000
Lazuli Bunting	1,900,000	29.5	400,000	6.2	220,000	3.4	6,500,000
Vaux's Swift	100,000	24.9	36,000	8.6	53,000	12.7	870,000

[1] Partners in Flight (2019)

[2] Pop. Est. = population estimate (heavily rounded)

[3] % = percent of the population. Estimates of percent population are likely more accurate than population estimates which are heavily rounded, whereas percent populations are not (P. Blancher pers. comm.).

[4] Blank cells indicate no BBS data for that strata. Percent cells with no population estimate from BBS data indicate percent population was derived from other sources.

[5] Species are listed alphabetically within each category. Species that are included in more than one category are listed in the highest category in the following order – focal, priority, and responsibility.

Common Poorwill.
U.S. Forest Service photo

BIOLOGICAL OBJECTIVES

Two types of landbird biological objectives (i.e., habitat and population) are presented at several scales. First, regional landscape-level habitat objectives are presented to recognize the high priority of the following habitat conditions for landbirds throughout the region:

- the desired proportions of late-successional dry forest and mesic mixed conifer forest
- the amount of natural forest regeneration in post-wildfire habitat
- the extent and amount of habitat restoration in Pine-Oak Woodland

Secondly, habitat objectives are presented for 24 focal species and their associated habitat attributes at site and landscape scales to promote the desired conditions and structural components to support landbird conservation within each habitat type. Lastly, population objectives are presented for most of the 24 focal species as the ultimate bird conservation metric to assess focal species status.

In the following sections, biological objectives are described for each focal species and associated habitat attribute presented in Tables 3-6. Preceding these, there are brief comments about the habitat or species, and a listing of primary habitat associations for each species. This is followed by habitat and population objectives (in **bold with a ►**), and recommended habitat strategies to achieve the objectives. The habitat strategies are species-specific recommendations independent of the more general habitat strategies presented for each habitat type. Assumptions and data sources upon which the biological objectives are based are stated, along with suggestions for research or monitoring to address priority habitat information needs. Examples of priority and responsibility species most likely to benefit from habitat management or restoration for each focal species is presented in Appendix A (*Sidebar: Species to Benefit*).

Species to Benefit

Species to benefit are those priority and responsibility species that have a strong breeding season habitat association with the habitat type and/or habitat attributes of the focal species, and would likely benefit from conservation directed towards the focal species and associated habitat attribute. The potential benefit is only appropriate if the site is within the range of the species to benefit, is large enough to meet the species area requirements, and other specific habitat attributes or conditions required by the species are available or being managed for. Thus, conservation of species to benefit can be enhanced by conservation of focal species, but is not dependent on or synonymous with conservation of focal species. The species to benefit list in Appendix A also can provide a good source list for species to use as substitutes when the focal species is not appropriate for a site due to range, habitat conditions, elevation, etc.

It is important to note that the habitat objectives for each focal species are not only specific to the habitat attribute that a particular species is representing, but also for other habitat conditions essential to the species conservation. For example, in addition to the habitat objective for large trees or snags that Lewis's Woodpecker represents in Pine-Oak Woodland habitat, there are habitat objectives for appropriate canopy cover and shrub cover to make the habitat suitable beyond large trees and snags. These habitat objectives are provided to recognize that the species' overall conservation may include important features beyond the habitat attributes they represent.

Oak woodland habitat, photo by Mark Penninger

REGIONAL HABITAT OBJECTIVES

LATE-SUCCESSIONAL HABITAT IN DRY FOREST AND MESIC MIXED CONIFER FOREST

- **Maintain all existing late-successional (mature and old-growth) forest (Sidebar: Late-Successional Forest: The Highest Priority for Bird Conservation).**
- **Maintain 20-30% of large landscapes (e.g., Level 4 ecoregions, multiple watersheds, national forests) as late-successional forest with >30% of the late-successional forest as old-growth.**
- **Where existing late-successional forest comprises <20% of large landscapes, initiate habitat restoration actions that emphasize where possible:**
  - **increasing net size of existing late-successional forest patches**
  - **providing connectivity between patches**
  - **providing likely refugia from wildfire based on landscape context**
- **Existing or projected late-successional forest should have a minimum area of 50 ha (125 ac) with low edge to interior ratio.**
- **Late-successional forest should have or be managed for the ecologically appropriate range of variability in habitat attributes as described below for the focal species for each habitat type.**

Assumptions/Data Sources: The objectives for percent of large landscapes as late-successional forest were developed based on Hann et al. (1997). It recognizes the long-term nature of restoration for late-successional forest by emphasizing the dedicated commitment to the establishment of late-successional forest, and having management actions initiated to move the forest towards that condition (e.g., understory thinning, prescribed burning). The objective for minimum area was developed based on professional judgment.

Late-Successional Forest: The Highest Priority for Bird Conservation

Late-successional forest, especially in dry forest and mesic mixed conifer forest, has been significantly reduced from historical levels, primarily due to large-scale timber extraction and more recent losses to large-scale wildfires and insect infestations. The amount of late-successional forest and the number of remnant large- and medium-diameter trees are currently a fraction of those present historically (Hessburg et al. 1999, Wisdom et al. 2000). Further, wildlife species closely associated with late-successional forests have shown the largest population declines among all forest communities (Hann et al., 1997). Achieving objectives for the amount, distribution, and condition of late-successional dry forest and mesic mixed conifer forest as described in this document is the highest priority for landbird conservation in the region. Federal lands are likely to play the primary role in providing this habitat; however, opportunities on private lands are available through many incentive-based programs, and should be considered an important component for achieving the regional objective for late-successional forest habitat for landbirds.

NATURAL FOREST REGENERATION IN POST-WILDFIRE HABITAT

- **Maintain >40% of post-wildfire habitat as naturally regenerating forest (i.e., unlogged).**
- **Where salvage logging is occurring, conduct selective removal and maintain larger-diameter snags (>53 cm [21 in] DBH) and patches of deciduous shrubs (>15% cover).**

Assumptions/Data Sources: The objective for percent of landscape as post-wildfire habitat was developed based on Hutto (1995), McCullough et al. (1998), and Saab et al. (2011). The objective for unlogged area as naturally regenerating forest was developed based on Hutto (1995) and Saab et al. (2011). The objective for retention of large snags was developed based on Saab et al. (2011).

HABITAT RESTORATION IN PINE-OAK WOODLAND

- ► **Maintain >30% of the historical extent of each Pine-Oak Woodland system to the ecologically appropriate range of variability in habitat type and conditions as described below for the Pine-Oak Woodland focal species.**
- ► **Where existing riparian Pine-Oak Woodland comprises <30% of the historical extent of each Pine-Oak Woodland system, initiate habitat restoration actions that emphasize where possible:**

  - **increasing net size of existing Pine-Oak Woodland**
  - **providing connectivity between Pine-Oak Woodland patches**
  - **maximizing restoration of degraded sites with existing structural attributes for focal species (e.g., large mature trees, dense native understory patches)**

- ► **Residential or agricultural lands should not exceed 10% of the landscape to minimize potential impacts of fragmentation (e.g., high edge to interior ratio and potential consequences of increased nest predation and Brown-headed Cowbird parasitism) and adverse human-related effects (e.g., disturbance from increased activity, residences with feral and domestic cats).**

Assumptions/Data Sources: The objective for maintaining a percent of the historical area of Pine-Oak Woodland was developed based on professional judgment, and is intended to stimulate restoration actions at multiple scales and locations.

Late-successional forest on the Mt. Hood National Forest, U.S. Forest Service Photo

DRY FOREST

HABITAT ISSUES

- loss of late-successional forest and large diameter trees and snags from timber harvesting, particularly at lower elevations
- loss of large areas of forest from uncharacteristic large wildfires and insect infestations
- loss and degradation of properly functioning forest ecosystems where there is encroachment of urban and residential development, especially at lower elevations
- habitat degradation from fire suppression, particularly declines in characteristic herbaceous and shrub understories from increased density of small shade-tolerant trees
- fire suppression which has allowed understory encroachment and increased fuel loads which predisposes these areas to stand-replacement fires and suppresses the development of young recruitment pines
- invasion of exotic plants contributing to alteration of understory conditions and increase in fuel loads
- loss of snags and down wood from fuelwood cutting and salvage logging
- fragmentation of forest tracts negatively impacts species with large area requirements such as White-headed Woodpecker and increases energy expenditure and risk of predation to secure resources for species like Pygmy Nuthatch
- landscapes in proximity to agricultural and residential areas, which may have high densities of nest parasites (Brown-headed Cowbird), exotic nest competitors (European Starling), and domestic predators (cats), and may be subject to high levels of human disturbance
- restoration issues such as techniques (mowing, thinning, burning) and timing (spring/summer versus fall) that can negatively impact desired bird species
- some areas are among the most popular and intensively used recreation sites in the west
- increasing road network provides access that may increase levels of fuelwood cutting

HABITAT STRATEGIES

- Maintain existing areas of moderate to high quality dry forest habitat, and actively manage to promote their sustainability.
- Initiate actions to enhance size and connectivity of existing quality dry forest patches (i.e., reduce fragmentation), especially in areas that are likely refugia from wildfire.
- Initiate actions to improve quality of degraded dry forest habitat and avoid or minimize future degradation through management such as thinning or prescribed fire, especially in areas that are likely refugia from wildfire and where providing connectivity to other patches.
- Target for restoration excessively dense young to mature stands surrounding late-successional old growth to reduce fire risk into late-successional forest.
- Initiate actions to secure conservation commitments on private lands that enhance habitat connectivity or patch size or directly support focal species habitat requirements.
- Manage for large diameter trees through wider tree spacing and reduction of competition (Kolb et al. 2007).
- In intensively managed forests, manage for large diameter trees through longer rotation periods.
- Retain all blown-out large living trees or snags, regardless of landscape context.
- Retain mature and decadent trees for future snag production, particularly where existing snags are deficient.
- If snags are limiting and the habitat is otherwise suitable for nesting, create snags through appropriate methods (e.g., girdling, topping, fungal inoculation, beetle pheromone packets).
- Eliminate public fuelwood cutting of standing snags, and restrict other fuelwood cutting by closing roads, limiting permits, and prohibiting during the nesting season (i.e., April 15-July 15) (Lorenz et al. 2016).
- Eliminate or restrict pesticide use which may reduce insect prey base.
- Eliminate or sustainably manage livestock grazing and operations on public lands (or opportunistically on private lands) to support habitat conditions for focal species and minimize negative impacts on development of regenerating seedlings and disturbance or destruction of nests.
- Conduct habitat management and restoration activities outside the nesting season (April 15 - July 15)

HABITAT TYPE

Dry Forest

HABITAT ATTRIBUTE

Large Patches Of Late-Successional Forest With Heterogeneous Canopy Cover

FOCAL SPECIES

White-Headed Woodpecker (*Picoides albolarvatus*)

White-headed Woodpecker. Photo by Russ Morgan

HABITAT/SPECIES COMMENTS

Within the East Cascades Mountains of the Interior Columbia Basin, historical habitat for White-headed Woodpecker occurred in most of the Northern Cascades and all of the Southern Cascades and Upper Klamath ERUs (Wisdom et al. 2000). Declines in habitat were extensive in the Northern Cascades (89%) and Southern Cascades (66%) ERUs. There has been a slight increase (13%) in habitat in the Upper Klamath ERU. White-headed Woodpeckers often preferentially use small, burned forest patches (e.g., prescribed burns) within a mosaic of live forest where there is an increased presence of snags with softened wood for nesting (Lorenz et al. 2015). They also regularly nest in younger managed ponderosa pine forests with adequate snag availability (Kozma 2011).

PRIMARY HABITAT ASSOCIATIONS

- relatively large patches of forest for area requirements
- large trees for foraging (insects and seed cone production) and snag recruitment
- moderate to open canopy with large snags for nesting
- open understory with limited woody vegetation

HABITAT OBJECTIVES

Landscapes: **Where ecologically appropriate in Dry Forest, maintain or initiate actions to provide the following conditions:**

- **► in predominantly old-growth forest (>75%) provide contiguous suitable habitat patches >140 ha (350 ac)**
- **► in 25-75% old-growth forest provide contiguous suitable habitat patches >280 ha (700 ac)**

***Sites*: Where ecologically appropriate in Dry Forest, maintain or initiate actions to provide the following conditions:**

- **>25 trees/ha (10/ac) >53 cm (21 in) DBH, and >2 of the trees >79 cm (31 in) DBH for foraging trees and replacement snags**
- **>4 snags/ha (1.6/ac) >20 cm (8 in) DBH with >50% >64 cm (25 in) DBH in a moderate to advanced state of decay**
- **canopy cover 10-40%**
- **shrub layer cover <30%**

POPULATION OBJECTIVES

***Sites:* Where ecologically appropriate in Dry Forest, maintain or initiate actions to provide the following conditions:**

- **mean target densities <80 ha (200 ac)/pair in suitable habitat**

Assumptions/Data Sources: The landscape objective and the objective for large trees were developed based on Oliver and Ryker (1990) and Dixon (1995). The objective for canopy cover was developed based on Latif et al. (2014). The objective for snags was developed based on Milne and Hejl (1989) and Buchanan et al. (2003). The objectives for canopy and shrub cover was developed based on Wightman et al. (2010), Hollenbeck et al. (2011), Mellen-McLean et al. (2013), and Latif et al. (2014). The objective for mean target densities was developed based on Dixon (1995) and Lorenz et al. (2012).

HABITAT STRATEGIES

- Target conservation efforts in areas of broken canopies and large snags or areas with existing large pines.
- Maintain all large, dominant pine-cone producing trees to provide seeds for foraging during the non-breeding season (Oliver and Ryker 1990).
- Retain broken-topped snags, soft snags, leaning logs, and high stumps (>3 m [10 ft] tall) for potential nesting, and retain or provide downed logs for foraging sites.
- Manage for low shrub and down wood cover through prescribed fire and manual treatments to reduce populations of small mammals as nest predators (Kozma and Kroll 2012).
- Conduct uneven-aged forest management that provides for a mosaic of canopy cover (Marshall et al. 1996, Rodrick and Milner 1991).

HABITAT INFORMATION NEEDS

- What are the landscape features and area requirements that affect White-headed Woodpecker occurrence, abundance, or population viability in dry forest?
- Is there a relationship between pine cone cycles and White-headed Woodpecker populations in dry forest?
- Do restored (treated) sites attract White-headed Woodpeckers and provide viable habitat? What are the treatment conditions most effective in doing this?
- Does an intensively harvested landscape that meets snag and large tree objectives support viable populations of White-headed Woodpecker?

HABITAT TYPE

Dry Forest

HABITAT ATTRIBUTE

Large Trees

FOCAL SPECIES

Pygmy Nuthatch (*Sitta Pygmaea*)

Pygmy Nuthatch.Photo by Russ Morgan

HABITAT/SPECIES COMMENTS

Within the East Cascades Mountains of the Interior Columbia Basin, historical habitat for Pygmy Nuthatch occurred in most of the Northern Cascades and all of the Southern Cascades and Upper Klamath ERUs (Wisdom et al. 2000). Declines in habitat were extensive in the Northern Cascades ERU (88%) and moderate in the Southern Cascades ERU (50%). There has been a slight increase (13%) in habitat in the Upper Klamath ERU.

Pygmy Nuthatch is unique in that it is one of the few cooperatively breeding passerines in North America (Kingery and Ghalambor 2001). Within the context of mature and old-growth forest, they spend more time during the breeding season foraging on trunks and large branches, and more time in the non-breeding season foraging on small branches, twigs, and cone clusters (Kingery and Ghalambor 2001). Pygmy Nuthatch is a near-obligate for ponderosa pine forests.

PRIMARY HABITAT ASSOCIATIONS

- mature and old-growth ponderosa pine trees for foraging
- mature and old-growth ponderosa pine snags or live trees with dead sections for nesting
- open canopies
- moderately open understories

HABITAT OBJECTIVES

Landscapes: **Where ecologically appropriate in Dry Forest, maintain or initiate actions to provide the following conditions:**

- **► areas of suitable habitat >20 ha (50 ac)**

Sites: **Where ecologically appropriate in Dry Forest, maintain or initiate actions to provide the following conditions:**

- **► >25 trees/ha (10/ac) >53 cm (21 in) DBH, and >2 of the trees >79 cm (31 in) DBH for foraging trees and replacement snags**
- **► >3.6 snags/ha (1.4/ac) >20 cm (8 in) DBH with >50% >64 cm (25 in) DBH in a moderate to advanced state of decay**
- **► canopy cover <50%**

POPULATION OBJECTIVES

Sites: **Where ecologically appropriate in Dry Forest, maintain or initiate actions to provide the following conditions:**

► **mean target densities <1 ha (2.5 ac)/pair in suitable habitat**

Assumptions/Data Sources: The landscape objective for patch size was developed based on multiple sources in Kingery and Ghalabor (2001) to encourage management for small populations (e.g., >10 pairs) rather than individual pairs. The objectives for tree and snag DBH and height, and canopy cover are based on multiple studies summarized in Ghalambor and Dobbs (2006). The objective for mean target densities was developed based on multiple sources in Kingery and Ghalabor (2001).

HABITAT STRATEGIES

- Maintain open stands of mature to old growth ponderosa pine (Nicholoff 2003).
- Maintain a mosaic of large trees and snags, in clusters, with an open canopy (Nicholoff 2003).
- Retain snags and all trees with nest cavities, preferably in clusters (Nicholoff 2003).
- Retain mature and decadent trees for future snag production, particularly where existing snags are deficient (Nicholoff 2003).
- Use prescribed fire to maintain open stands of dry forest (Nicholoff 2003).
- Establish and maintain a nest box program where snags are unavailable and the lack of nest sites is limiting pygmy nuthatch reproduction (Nicholoff 2003).
- Avoid or minimize insecticide use; where possible, allow insect outbreaks to proceed naturally (Nicholoff 2003).

HABITAT INFORMATION NEEDS

- Does an intensively harvested landscape that meets snag and large tree objectives support viable populations of Pygmy Nuthatch?
- Are corridors essential for Pygmy Nuthatch dispersal and colonization among patches?

Old growth ponderosa pine habitat. U.S. Forest Service photo

HABITAT TYPE

Dry Forest

HABITAT ATTRIBUTE

Large Snags

FOCAL SPECIES

Mountain Bluebird (*Sialia currucoides*) and Western Bluebird (*Sialia mexicana*)

From left: Mountain Bluebird. Photo by Mark Penninger. Western Bluebird. Photo by Russ Morgan

HABITAT/SPECIES COMMENTS

Within the East Cascades Mountains of the Interior Columbia Basin, historical habitat for Western Bluebird occurred in all of the Northern Cascades, Southern Cascades, and Upper Klamath ERUs (Wisdom et al. 2000). Declines in habitat were extensive in the Northern Cascades ERU (65%) and moderate in the Southern Cascades (48%) and Upper Klamath (38%) ERUs. Mountain/Western Bluebirds are secondary cavity nesters and will use nest boxes. They also regularly use post-fire habitats.

PRIMARY HABITAT ASSOCIATIONS

- open woodlands/savannas or edge habitat
- large snags with cavities for nesting, especially older snags
- open understory with low, exposed perches
- low-statured, sparsely vegetated ground cover for foraging

HABITAT OBJECTIVES

Landscapes: **Where ecologically appropriate in Dry Forest, maintain or initiate actions to provide the following conditions:**

- **areas of suitable habitat >40 ha (100 ac)**

Sites: **Where ecologically appropriate in Dry Forest, maintain or initiate actions to provide the following conditions:**

- **canopy cover <35%**
- **shrub cover <25%**
- **5 snags/ha (>2 snags/ac) >40 cm (>16 in) DBH**

POPULATION OBJECTIVES

***Sites*: Where ecologically appropriate in Dry Forest, maintain or initiate actions to provide the following conditions:**

- **► mean target densities <3 ha (12.5 ac)/pair in suitable habitat**

Assumptions/Data Sources: The landscape objective was developed based on Power (1980) and Hurteau et al. (2010) to encourage management for small populations (e.g., >10 pairs) rather than individual pairs. The objectives for canopy and shrub cover were developed based on Russell et al. (2007) and Saab et al. (2009). The objective for snag size was developed based on Balda (1975) and Cunningham et al. (1980). The objective for mean target densities was developed based on Power (1980) and Hurteau et al. (2010).

HABITAT STRATEGIES

- Maintain open stands of mature to old growth ponderosa pine with a moderately open understory.
- Establish and maintain a nest box program where snags are unavailable and the lack of nest sites is limiting bluebird reproduction.

HABITAT INFORMATION NEEDS

- What is the relative reproductive success for Mountain/Western Bluebirds in different habitats (e.g., open forest, post-fire, logged areas) and what are the factors that are most responsible for population viability.

Old growth ponderosa pine habitat. U.S. Forest Service photo

HABITAT TYPE

Dry Forest

HABITAT ATTRIBUTE

Short-Statured Herbaceous Understory With Scattered Sapling Pines

FOCAL SPECIES

Chipping Sparrow (*Spizella Passerina*)

Chipping Sparrow. Photo by Russ Morgan

HABITAT/SPECIES COMMENTS

Chipping Sparrows can respond favorably to dry forest restoration that creates an open canopy and an open, grassy ground cover with some areas of conifer regeneration including sapling trees. They also regularly breed in subalpine forest.

PRIMARY HABITAT ASSOCIATIONS

- open canopy
- short-statured herbaceous ground cover for foraging
- moderate shrub layer cover (shrubs and small trees) for nesting and cover

HABITAT OBJECTIVES

Landscapes: **Where ecologically appropriate in Dry Forest, maintain or initiate actions to provide the following conditions:**

- **<10% of the landscape in agricultural lands with moderate to heavy grazing pressure or other areas supporting Brown-headed Cowbird populations**
- **a heterogeneous landscape with a mix of understory conditions such that 10-30% of the landscape meets site-level conditions as described below**

Sites: **Where ecologically appropriate in Dry Forest, maintain or initiate actions to provide the following conditions:**

- **short-statured herbaceous ground cover >50%**
- **shrub layer cover 20-50% (includes shrubs and small trees) with >20% of the shrub layer in regenerating sapling pines**
- **canopy cover 30-70%**

POPULATION OBJECTIVES

***Sites*: Where ecologically appropriate in Dry Forest, maintain or initiate actions to provide the following conditions:**

- **mean target densities <0.7 ha (2 ac)/pair in suitable habitat**
- **Brown-headed Cowbird parasitism rates <10% within project areas**

Assumptions/Data Sources: The landscape objective was developed based on Nott and Pyle (2012) to maintain the landscape in a mix of open herbaceous and dense understory shrub layer condition. The objective for an open canopy with a grassy understory and moderate shrub layer was developed based on positive associations with open canopy and grass/shrub understory (Sallabanks et al 2006), and positive associations with regenerating trees and bare ground (O'Connell et al. 1997). The objective for canopy cover was developed based on Swanson et al. (2004). The objective for mean target densities was developed based on Middleton (1998). This species is highly susceptible to Brown-headed Cowbird parasitism, therefore it is appropriate to maintain parasitism at low levels (<10%).

HABITAT STRATEGIES

- Conduct thinning or partial overstory removal to provide suitable canopy and ground cover habitat.
- Avoid extensive limbing-up of ponderosa pine branches during restoration which reduces suitable nesting substrates.
- Target conservation areas distant from agriculture or open landscapes suitable for Brown-headed Cowbird.

HABITAT INFORMATION NEEDS

- What are the features of ground cover (e.g., ratio of vegetation to bare ground, height of herbaceous vegetation) that affect Chipping Sparrow occurrence, abundance, or population viability in dry forest?
- What are the levels and timing of grazing that are compatible with maintaining vegetative ground cover suitable for Chipping Sparrow in dry forest?
- What are the aspects of grazing that attract Brown-headed Cowbirds and affect Chipping Sparrow productivity in dry forest (e.g., intensity, trampling/destruction of nests, proximity to agriculture)?

Cattle grazing.
Photo by Mark Penninger

Employee looks up at a tree snag, U.S. Forest Service photo

MESIC MIXED-CONIFER FOREST

HABITAT ISSUES

- loss of older forests and large diameter trees and snags from timber harvesting, particularly at lower elevations
- high risk of loss of extensive areas of forest from large-scale fires and insect infestations
- fragmentation of forest tracts due to timber harvesting or large-scale mortality events negatively impacts species with large area requirements
- invasion of exotic plants contributing to alteration of understory habitat and loss of native plant diversity
- landscapes in proximity to agricultural and residential areas, which may have high density of nest parasites (Brown-headed Cowbird), exotic nest competitors (European Starling), and domestic predators (cats), and may be subject to high levels of human disturbance
- restoration issues such as techniques (thinning, burning) and timing (spring/summer versus fall) that can negatively impact desired bird species
- loss of snags and down wood from fuelwood cutting and salvage logging
- some areas are among the most popular and intensively used recreation sites in the west
- increasing road network provides access that may increase levels of fuelwood cutting

HABITAT STRATEGIES

- Maintain existing areas of moderate to high quality mesic mixed conifer forest (Late-Successional) habitat, and actively manage to promote their sustainability.
- Initiate actions to enhance size and connectivity of existing quality mesic mixed conifer forest (Late-Successional) patches (i.e., reduce fragmentation), especially in areas that are likely refugia from wildfire.
- Initiate actions to improve quality of degraded mesic mixed conifer forest (Late-Successional) habitat and avoid or minimize further degradation through management such as selective harvests, thinning, or prescribed fire, especially in areas that are likely refugia from wildfire and where providing connectivity to other patches.
- Target for forest health treatment of excessively dense young to mature stands surrounding late-successional old growth to reduce the risk of fire spread into late-successional forest.
- Initiate actions to secure conservation commitments on private lands that enhance habitat connectivity or patch size or directly support focal species habitat requirements.
- Retain all large living trees >100 cm (40 in), dying or defective trees (e.g., broken tops, fungal conks, insect infestations), and large snags (>30 cm [12 in]DBH) regardless of landscape context.
- If snags are limiting and the habitat is suitable, create snags through appropriate methods (e.g., girdling, topping, fungal inoculation, beetle pheromone packets).
- Eliminate public fuelwood cutting of standing snags, and restrict other fuelwood cutting by closing roads, limiting permits, and prohibiting during the nesting season (i.e., April 15-July 15) (Lorenz et al. 2016).
- Extend rotation ages on intensively managed lands to >80 years to allow for development of large trees and snags, and retain these at each harvest entry.
- Eliminate or restrict pesticide use in known nest areas or suitable habitat to minimize reductions in prey.
- Eliminate or sustainably manage livestock grazing and operations on public lands (or opportunistically on private lands) to support habitat conditions for focal species and minimize negative impacts on development of regenerating seedlings and disturbance or destruction of nests.
- Conduct habitat management and restoration activities outside the nesting season (April 15 - July 15).

HABITAT TYPE

Mesic Mixed Conifer Forest

HABITAT ATTRIBUTE

Large Snags

FOCAL SPECIES

Williamson's Sapsucker (*Sphyrapicus thyroideus*)

Williamson's Sapsucker. Photo by Mark Penninger

HABITAT/SPECIES COMMENTS

Within the East Cascades Mountains of the Interior Columbia Basin, historical habitat for Williamson's Sapsucker occurred in all of the Northern Cascades, Southern Cascades, and Upper Klamath ERUs (Wisdom et al. 2000). Declines in habitat were extensive in the Northern Cascades ERU (63%) and moderate in the Southern Cascades ERU (46%). There has been an extensive increase (60%) in habitat in the Upper Klamath ERU. Williamson's Sapsucker also regularly breeds in dry forest and aspen habitat. It is unique among woodpeckers as a long-distance migrant.

PRIMARY HABITAT ASSOCIATIONS

- late-successional forest
- moderately open to closed canopy
- large snags for nesting and roosting
- large live trees in a state of partial or advanced decay
- open understory with low shrub cover

HABITAT OBJECTIVES

***Landscapes*: Where ecologically appropriate in Mesic Mixed Conifer Forest, maintain or initiate actions to provide the following conditions:**

- **areas of suitable habitat >160 ha (395 ac)**

***Sites*: Where ecologically appropriate in Mesic Mixed Conifer Forest, maintain or initiate actions to provide the following conditions:**

- **canopy cover 25-75%**
- **shrub cover <40%**
- **>4 hard snags/ha (>1.6 snags/ac) >51 cm (20 in) DBH with >1 snag/ha (0.4 snags/ac) >71 cm (28 in) DBH**
- **>4 live trees/ha (>1.6 live trees/ac) with heartwood decay >51 cm (20 in) DBH with >1 live tree/ha (0.4 live trees/ac) >71 cm (28 in) DBH**

POPULATION OBJECTIVES

***Sites*: Where ecologically appropriate in Mesic Mixed Conifer Forest, maintain or initiate actions to provide the following conditions:**

- ► **mean target densities <16 ha (40 ac)/pair in suitable habitat**

Assumptions/Data Sources: The landscape objective for patch size was developed based on Gyug et al. (2009) to encourage management for small populations (e.g., >10 pairs) rather than individual pairs. The objectives for canopy and shrub cover and snag and tree sizes were developed based on Sousa (1983), Madsen (1985), Bull et al. (1986), Manning and Cooper (1996), Neilsen-Pincus (2005), Gyug et al. (2010), and Drever et al. (2015). The objective for mean target densities was developed based on Gyug et al. (2009).

HABITAT STRATEGIES

- Target conservation efforts within areas of late-successional western larch trees (Bull et al. 1986, Manning and Cooper 1996, Gyug et al. 2009).

HABITAT INFORMATION NEEDS

- Can viable populations of Williamson's Sapsucker be maintained through rotations in managed mesic mixed conifer forests?
- Are there landscape features or area requirements that affect Williamson's Sapsucker occurrence, abundance, or population viability in mesic mixed conifer forests?
- Will Williamson's Sapsuckers recolonize areas where suitable snags are created? Are there variables to consider such as proximity to riparian habitats, proximity to other nesting areas?

Snags provide food, nesting and shelter. U.S. Forest Service photo

HABITAT TYPE

Mesic Mixed Conifer Forest

HABITAT ATTRIBUTE

Large Trees

FOCAL SPECIES

Brown Creeper (*Certhia Americana*)

Brown Creeper. Photo by Russ Morgan

HABITAT/SPECIES COMMENTS:

Within the East Cascade Mountains of the Interior Columbia Basin, historical habitat for Brown Creeper occurred in all of the Northern Cascades, Southern Cascades, and Upper Klamath ERUs (Wisdom et al. 2000). Declines in habitat were extensive in the Northern Cascades ERU (50%). There was a slight increase in habitat in the Southern Cascades ERU (4%), and an extensive increase (71%) in the Upper Klamath ERU. Brown Creepers show a preference for Douglas-fir which offers better foraging opportunities in the deeply fissured bark. There are indications that it may be a forest interior species that is area-sensitive (Rosenberg and Raphael 1986, Nelson 1989, McGarigal and McComb 1995).

PRIMARY HABITAT ASSOCIATIONS

- large trees for foraging, especially deeply fissured Douglas-fir
- large trees or snags with extensive crevices or small cavities for nesting
- large patches of suitable habitat

HABITAT OBJECTIVES

***Landscapes*: Where ecologically appropriate, initiate actions in Mesic Mixed Conifer forest to maintain or initiate actions to provide the following conditions:**

- **areas of suitable habitat >30 ha (75 ac)**

***Sites*: Where ecologically appropriate, initiate actions in Mesic Mixed Conifer forest to maintain or initiate actions to provide the following conditions:**

- **>10 trees/ha (4/ac) >46 cm (18 in) DBH with at least 2 trees >60 cm (24 in) DBH**
- **>10 snags/ac (4/ac) >30 cm (12 in) DBH**

POPULATION OBJECTIVES

***Sites*: Where ecologically appropriate, initiate actions in Mesic Mixed Conifer forest to maintain or initiate actions to provide the following conditions:**

- **mean target densities <1 ha (2.5 ac)/pair in suitable habitat**

Assumptions/Data Sources: The landscape objective for patch size was developed to encourage management for small populations (e.g., >10 pairs) rather than individual pairs. The objective for tree size is based on multiple sources in Wiggins (2005). The objective for mean target densities was developed based on multiple sources in Hejl et al. (2002).

HABITAT STRATEGIES

- In harvest units, retained tress should be clumped rather than dispersed and should be primarily Douglas-fir.

HABITAT INFORMATION NEEDS

- Is there a minimum density of foraging sites (i.e., large trees) per Brown Creeper territory? If so, is there a threshold of the spatial extent of foraging sites that cannot be exceeded for acceptable levels of energetic sustainability? Does this vary by elevation or forest type?
- At the landscape-level, does patch size, configuration, or proportional occurrence in the landscape affect reproductive success of Brown Creeper?
- What are the effects of forest isolation on Brown Creeper survival and dispersal (Wiggins 2005)?

Mature deeply fissured Douglas-fir provide forage. U.S. Forest Service photo

HABITAT TYPE

Mesic Mixed Conifer Forest

HABITAT ATTRIBUTE

Interspersion Of Herbaceous Openings And Patches Of Dense Sapling/Pole Trees

FOCAL SPECIES

lammulated Owl (*Otus flammeolus*)

Flammulated Owl. Photo by Frank Lospalluto

HABITAT/SPECIES COMMENTS

Within the East Cascades Mountains of the Interior Columbia Basin, historical habitat for Flammulated Owl occurred in all of the Northern Cascades, Southern Cascades, and Upper Klamath ERUs (Wisdom et al. 2000). Declines in habitat were extensive in the Northern Cascades ERU (72%) and moderate in the Southern Cascades ERU (29%). There has been an extensive increase (61%) in habitat in the Upper Klamath ERU.

Flammulated Owl is unique among owls in a diet of arthropods, especially moths and beetles, and their long distance migrant status. They are a late arriving migrant that nests in cavities, so availability of cavities can be a limiting factor.

PRIMARY HABITAT ASSOCIATIONS

- broken and heterogeneous canopies
- grassland openings within forest for foraging
- moderate to large trees and snags for nest and roost sites
- small patches of dense thickets for roosting and calling

HABITAT OBJECTIVES

***Landscapes*: Where ecologically appropriate in Mesic Mixed Conifer Forest, maintain or initiate actions to provide the following conditions:**

- **areas of suitable habitat >140 ha (350 ac)**

***Sites*: Where ecologically appropriate in Mesic Mixed Conifer Forest, maintain or initiate actions to provide the following conditions:**

- **broken and open canopies with 20-50% canopy cover**
- **moderate to high snag density with >3 snags/ha (1.2/ac) >46 cm (18 in) DBH and > 1.8 m (6 ft) tall**
- **mean tree DBH 30-51 cm (12-20 in) with >20 trees/ha (8/ac) >53 cm (21 in) DBH to function as recruitment snags**
- **shrub layer cover 10-30% for production of insect prey**
- **at least one large (0.5 ha [1.2 ac]) or two smaller (0.2 ha-0.5 ha [0.5-1.2 ac]) dense thickets of sapling/pole trees for roosting habitat**
- **at least one large (1-2 ha [2.5-4.9 ac]) or two smaller (<1 ha [2.5 ac]) grassy openings for foraging habitat**

POPULATION OBJECTIVES

***Sites*: Where ecologically appropriate in Mesic Mixed Conifer Forest, maintain or initiate actions to provide the following conditions:**

- **mean target densities <12 ha (30 ac)/pair in suitable habitat, and patches of suitable habitat >140 ha (350 ac) to provide for a potential nesting population of at least 10 pairs.**

Assumptions/Data Sources: The landscape objective for patch size was developed based on Goggans (1986). The objective for snags was developed based on Bull and Anderson (1978), Thomas (1979), Jones and Stokes Association Incorporated (1980), Goggans (1986), and Bull et al. (1990). The objectives for tree and snag sizes were developed based on (Goggans 1986) and are for current and future nest and roost sites. The objective for canopy cover was developed based on Goggans (1986) and Howie and Ritcey (1987). The objective for grassy openings for foraging sites was developed based on Howey and Ritcey (1987). The objective for dense thickets of young trees was developed based on professional judgment. The objective for mean target densities was developed based on McCallum (1994) and Linkhart et al. (1998).

HABITAT STRATEGIES

- Target conservation efforts near grassland or dry meadow openings.
- Conduct uneven-aged forest management that provides for a mosaic of broken and closed canopies (Marshall et al. 1996, Rodrick and Milner 1991).
- Manage for proximity of patches of dense trees for roosting and snags and snag-patches for nesting (Goggans 1986).
- In restoration efforts, leave patches of dense sapling thickets to function as roost and cover sites.
- Where grassy openings in potential or suitable habitat are being encroached by shrubs and trees, initiate actions such as manual removal and prescribed fire to maintain these openings.
- Use nest boxes as short-term habitat augmentation where restoration activities are occurring and snags are limiting.

HABITAT INFORMATION NEEDS

- What are the specifics of patch size, configuration, and abundance of grassy openings for Flammulated Owl foraging and clumped thickets of sapling/pole trees for roosting in dry forest?
- Do restored (treated) sites attract Flammulated Owls and provide viable habitat in dry forest, and if so what are the treatment processes and conditions most effective in doing this?

HABITAT TYPE

Mesic Mixed Conifer Forest

HABITAT ATTRIBUTE

Multi-Layered With High Understory Foliage Volume

FOCAL SPECIES

Swainson's Thrush (*Catharus ustulatus*)

Swainson's Thrush. Photo by Russ Morgan

HABITAT/SPECIES COMMENTS

High understory foliage volume is in mesic mixed conifer forests important habitat for many landbird species, especially if the foliage is dominated by deciduous small trees and shrubs. Swainson's Thrush also regularly breed in early successional harvested forests dominated by a shrub layer, and riparian habitats if a well-developed shrub layer is present.

PRIMARY HABITAT ASSOCIATIONS

- dense understory shrub layer for nesting and foraging
- high percent understory cover of deciduous trees and shrubs
- moderate to high percent canopy cover

HABITAT OBJECTIVES

***Landscapes*: Where ecologically appropriate in Mesic Mixed Conifer Forest, maintain or initiate actions to provide the following conditions:**

- **areas of suitable habitat >20 ha (50 ac)**

***Sites*: Where ecologically appropriate in Mesic Mixed Conifer Forest, maintain or initiate actions to provide the following conditions:**

- **shrub layer cover >40%**
- **canopy cover >40%**

POPULATION OBJECTIVES

***Sites*: Where ecologically appropriate in Mesic Mixed Conifer Forest, maintain or initiate actions to provide the following conditions:**

- **mean target densities <2.5 ha (6.3 ac)/pair in suitable habitat**

Assumptions/Data Sources: The landscape objective for patch size was developed based on multiple sources in Mack and Yong (2000) and professional judgment to encourage management for small populations (e.g., >10 pairs) rather than individual pairs. The objectives for ground and shrub cover were developed based on Timossi (1990). The objective for mean target densities was developed based on multiple sources in Mack and Yong (2000).

HABITAT STRATEGIES

- Retain or promote understory growth through natural disturbance or management that breaks up the forest canopy, yet still maintains the dominance of a mid- or late-successional forest.

HABITAT INFORMATION NEEDS

- Are there floristic specifics in the shrub layer (e.g., species composition, native versus non-native) that affect Swainson's Thrush occurrence, abundance, or population viability in mesic mixed conifer forests?

Old growth stand with dense understory. U.S. Forest Service photo

HABITAT TYPE

Mesic Mixed Conifer Forest

HABITAT ATTRIBUTE

Forest Edges And Openings With Scattered Trees

FOCAL SPECIES

Olive-Sided Flycatcher (*Contopus cooperi*)

Olive-Sided Flycatcher. Photo by Russ Morgan

HABITAT/SPECIES COMMENTS

Within the East Cascades Mountains of the Interior Columbia Basin, historical habitat for Olive-sided Flycatcher occurred in all of the Northern Cascades, Southern Cascades, and Upper Klamath ERUs (Wisdom et al. 2000). Declines in habitat have been substantial in the Southern Cascades (78%) and Upper Klamath (>100%), with moderate increase in the Northern Cascades (29%). Olive-sided Flycatcher also regularly breeds in post-wildfire habitat.

PRIMARY HABITAT ASSOCIATIONS

- large areas of suitable habitat for area requirements
- forest edges and openings, especially juxtaposition of early and late-successional
- scattered large conifer trees and snags in open forests for foraging and nesting
- moderate shrub cover for production of flying insect prey

HABITAT OBJECTIVES

***Landscapes*: Where ecologically appropriate in Mesic Mixed Conifer Forest, maintain or initiate actions to provide the following conditions:**

- ► **areas of suitable habitat >200 ha (500 ac)**

***Sites*: Where ecologically appropriate in Mesic Mixed Conifer Forest, maintain or initiate actions to provide the following conditions:**

- **trees and snags >51 cm (20 in) DBH**
- **>2.5 snags/ha (1 snag/ac) >12 m (40 ft) high, and >5.5 trees/ha (2 trees/ac) >12 m (40 ft) high**
- **patches with a mix of potential nest trees (live trees) within the context of potential foraging and singing perches (dead trees)**
- **tree foliage volume >50%**
- **canopy cover 5-30%**
- **shrub cover >40%**

***Sites*: In Post-Wildfire habitat maintain:**

- **shrub-herbaceous (includes bare ground) cover ratio that is 30-70% for each parameter**
- **trees and snags >51 cm (20 in) DBH**

POPULATION OBJECTIVES

***Sites*: Where ecologically appropriate in Mesic Mixed Conifer Forest, maintain or initiate actions to provide the following conditions:**

- **mean target densities <15 ha (37 ac)/pair in suitable habitat**

Assumptions/Data Sources: The landscape objective for patch size was developed based on Altman (2000b) to encourage management for small populations (e.g., >10 pairs) rather than individual pairs. The objectives for tree size and amounts of tree, shrub, and herbaceous cover were developed based on Altman (2000b). The objective for mean target densities was developed based on Altman (2000b).

HABITAT STRATEGIES

- Conduct underburning or other techniques to promote a shrubby understory for insect production.

HABITAT INFORMATION NEEDS

- Can viable populations of Olive-sided Flycatcher be maintained in harvested mesic mixed conifer forests where appropriate snags/leave trees are maintained (Altman 2000b)?
- Are there issues related to prey type and availability under different habitat conditions that affect Olive-sided Flycatcher occurrence, abundance, or population viability in mesic mixed conifer forests?

Timber harvest.
U.S. Forest Service photo

PINE-OAK WOODLAND

HABITAT ISSUES

- habitat losses from commercial harvesting, especially large ponderosa pine
- harvest of oaks for firewood
- cutting of dead oak limbs for fuel reduction
- reduction in old trees with natural cavities
- loss from agricultural, rural, and residential development, particularly the loss of individual large oaks which have proportionately more cavities
- habitat degradation, particularly the lack of recruitment of young oaks and pines, from encroachment of Douglas-fir and non-native shrubs (e.g., Himalayan blackberry, Scot's broom) due to fire suppression, and from intensive grazing impacts on regeneration
- land ownership is primarily private
- landscapes in proximity to agricultural and residential areas with high densities of nest parasites (Brown-headed Cowbird), exotic nest competitors (European Starling), and domestic predators (cats), and subject to high levels of human disturbance
- high energetic costs associated with high rates of competitive interactions with European Starlings for cavities may reduce reproductive success of species such as acorn woodpecker, Lewis' woodpecker, white-breasted nuthatch, western bluebird, and American kestrel, even when outcome of the competition is successful for these species
- hazard reduction/brush removal is being extensively used despite no information on landbird response and problematic timing of the actions (i.e., breeding season)
- intensive grazing that limits development of shrub layers for arthropod prey
- unnaturally moderate to high intensity fires that reduce suitable habitat
- Douglas-fir and juniper encroachment as a result of fire suppression

HABITAT STRATEGIES

- At the landscape-level, initiate actions to maintain or provide high quality Pine-Oak Woodland habitat in tracts >40 ha (100 ac) in a mosaic of habitat conditions to support viable populations of pine-oak focal bird species.
- Maintain existing moderate to high quality Pine-Oak Woodland stands, and actively manage to promote their sustainability, regardless of size.
- Emphasize conservation of large patches of Pine-Oak Woodland habitat with large-diameter and open-form oaks.
- Retain all oak and ponderosa pine trees and snags >51 cm (20 in) DBH, regardless of landscape context.
- Remove invasive Douglas fir and juniper in areas of encroachment.
- Encourage judicious use of low-intensity prescribed burns to exclude Douglas-fir encroachment, stimulate oak and pine sprouting, reduce infestations of exotic plants, and contribute to multi-aged stands (Larsen and Morgan 1998).
- Eliminate or sustainably manage livestock grazing and operations on public lands (or opportunistically on private lands) to support habitat conditions for focal species and minimize negative impacts on development of regenerating seedlings and disturbance or destruction of nests.
- Eliminate or restrict pesticide in known nest areas or suitable habitat to minimize reductions in the prey base which has been shown to delay nest initiation, thus potentially reducing productivity (Marshall et al. 2002).
- Eliminate public fuelwood cutting of standing snags, and restrict other fuelwood cutting by closing roads, limiting permits, and prohibiting during the nesting season (i.e., April 15-July 15) (Lorenz et al. 2016).
- Conduct habitat management and restoration activities outside the nesting season (April 15 - July 15).

HABITAT TYPE

Pine-Oak Woodland

HABITAT ATTRIBUTE

Early Successional And Shrub Patches

FOCAL SPECIES

Nashville Warbler (*Vermivora ruficapilla*)

Nashville Warbler. Photo by Russ Morgan

HABITAT/SPECIES COMMENTS

Early successional Pine-Oak Woodland habitat dominated by a dense cover of regenerating young trees, or understory shrub patches in pockets of mature woodland provides foraging and nesting habitat important to several species. Nashville Warblers also regularly breed in the understory of mesic mixed conifer forest.

PRIMARY HABITAT ASSOCIATIONS

- dense patches of regenerating woodland
- dense foliage understory with high vertical density
- deciduous woody shrubs and small trees
- distant from livestock grazing or agriculture to minimize Brown-headed Cowbird parasitism

HABITAT OBJECTIVES

***Landscapes*: Where ecologically appropriate in Pine-Oak Woodland, maintain or initiate actions to provide the following conditions:**

- ► **<10% of suitable landscapes in agricultural lands with moderate to heavy grazing pressure or other areas supporting Brown-headed Cowbird populations**
- ► **areas of suitable habitat >10 ha (25 ac) with minimum edge**

***Sites*: Where ecologically appropriate in Pine-Oak Woodland, maintain or initiate actions to provide the following conditions:**

- ► **40-80% native shrub cover interspersed with grassy openings and with or without scattered trees that comprise <30% canopy cover**

POPULATION OBJECTIVES

***Sites*: Where ecologically appropriate in Pine-Oak Woodland, maintain or initiate actions to provide the following conditions:**

- **mean target densities <0.8 ha (2 ac)/pair in suitable habitat**
- **Brown-headed Cowbird parasitism rates <10% within project areas**

Assumptions/Data Sources: The landscape objective for patch size was developed to encourage management for small populations (e.g., >10 pairs) rather than individual pairs. The objectives for shrub and canopy cover and mean target densities were based on professional judgment.

HABITAT STRATEGIES

- Avoid road building and development that fragments existing shrub patches.

HABITAT INFORMATION NEEDS

- Are there thresholds for patch size that affect Nashville Warbler occurrence, abundance, or population viability in Pine-Oak Woodland?

Pine-Oak woodland
U.S. Forest Service photo

HABITAT TYPE

Pine-Oak Woodland

HABITAT ATTRIBUTE

Large Oaks With Cavities

FOCAL SPECIES

Ash-Throated Flycatcher (*Myiarchus cinerascens*)

Ash-Throated Flycatcher. Photo by Russ Morgan

HABITAT/SPECIES COMMENTS

Within the East Cascades Mountains of the Interior Columbia Basin, historical habitat for Ash-throated Flycatcher occurred in patches throughout the northern Cascades and most of the Southern Cascades and Upper Klamath ERUs (Wisdom et al. 2000). Increases in habitat have been extensive in the Northern Cascades and Upper Klamath ERUs (both >100%), with a slight decrease in the Southern Cascades ERU (9%). Ash-throated Flycatchers also regularly breed in juniper woodlands. They are a secondary cavity nester and will use nest boxes.

PRIMARY HABITAT ASSOCIATIONS

- mature oak trees in savanna or open woodland conditions
- open-growth trees with extensive cavities for nesting
- mosaic of shrub patches for foraging

HABITAT OBJECTIVES

Landscapes

► **areas of suitable habitat >40 ha (100 ac) with extensive edge habitat**

***Sites*: Where ecologically appropriate in Pine-Oak Woodland, maintain or initiate actions to provide the following conditions:**

► **oaks with DBH >36 cm (14 in) with >20% of trees >53 cm (21 in) DBH**

► **shrub cover 15-60%**

POPULATION OBJECTIVES

***Sites*: Where ecologically appropriate in Pine-Oak Woodland, maintain or initiate actions to provide the following conditions:**

- **► mean target densities <2 ha (5 ac)/pair in suitable habitat**

Assumptions/Data Sources: The landscape objective for patch size was developed based on Hensley (1954) and Seavey (1997) to encourage management for small populations (e.g., >10 pairs) rather than individual pairs. The objective for size of oak trees and shrub cover was based on Seavey (1997). The objective for mean target densities was based on Seavey (1997).

HABITAT STRATEGIES

- Retain and restore native understory shrub patches.

HABITAT INFORMATION NEEDS

- What are the thresholds of territory size and landscape area that are most conducive to Ash-throated Flycatcher's occurrence, abundance, or population viability?

Oak woodland. Photo by Mark Penninger

HABITAT TYPE

Pine-Oak Woodland

HABITAT ATTRIBUTE

Large Pine Trees And Snags

FOCAL SPECIES

Lewis's Woodpecker (*Melanerpes lewis*)

Lewis's Woodpecker. Photo by Russ Morgan

HABITAT/SPECIES COMMENTS

Within the East Cascade Mountains of the Interior Columbia Basin, historical habitat for Lewis' Woodpecker occurred only in small portions of the Northern Cascades ERU and approximately half of the Southern Cascades ERU (Wisdom et al. 2000). Declines in habitat have been extensive; 80% in the Northern Cascades ERU and 63% in the Southern Cascades ERU. Within the entire Interior Columbia Basin, the overall decline in habitat (83%) was the greatest of any species analyzed (Wisdom et al. 2000).

Lewis's Woodpecker populations can fluctuate with natural or anthropogenic impacts on their prey base (Bock 1970). Their weak excavation morphology precludes them from excavating in hard snags or trees, so existing cavities, natural or created, or soft snags are necessary (Goodge 1972, Raphael and White 1984, Zhu 2012). They also regularly breed in riparian woodland (Vierling 1997) and recently burned sites (Russell et al. 2007).

PRIMARY HABITAT ASSOCIATIONS

- large soft snags for nesting
- large live trees in a state of partial or advanced decay
- open canopy and subcanopy for foraging
- moderate shrub cover for production of flying insect prey

HABITAT OBJECTIVES

***Landscapes*: Where ecologically appropriate in Pine-Oak Woodland, maintain or initiate actions to provide the following conditions:**

- **areas of suitable habitat >80 ha (200 ac)**

***Sites*: Where ecologically appropriate in Pine-Oak Woodland, maintain or initiate actions to provide the following conditions:**

- **canopy cover <30%**
- **shrub cover 40-80%**
- **>3 soft snags/ha (>1.2/ac) >53 cm (21 in) DBH with 1 soft snag/ha (0.4/ac) >81 cm (>32 in) DBH**
- **>2 trees/ha (0.8/ac) >53 cm (21 in) DBH**

POPULATION OBJECTIVES

***Sites*: Where ecologically appropriate in Pine-Oak Woodland, maintain or initiate actions to provide the following conditions:**

- **mean target densities <6 ha (15 ac)/pair in suitable habitat**

Assumptions/Data Sources: The landscape objective for patch size was developed based on professional judgment to encourage management for small populations (e.g., >10 pairs) rather than individual pairs. The objectives for tree and snag size were developed based on Galen (1989), Russell et al. (2006), and Saab et al (2009). The objectives for canopy and shrub cover were developed based on Sousa (1983) and Galen (1989). The objective for mean target densities was developed based on Thomas et al. (1979).

HABITAT STRATEGIES

- If snags are limiting and the habitat is suitable, create snags through appropriate methods (e.g., girdling, topping, fungal inoculation, beetle pheromone packets).
- Implement habitat augmentation through nest box programs as an interim measure where snags are currently limiting but are being managed for in the long-term.
- Conduct controlled underburning or other techniques to promote a shrubby understory for insect production, and minimize brush control and grazing that limit understory growth (Sousa 1983, Galen 1989, Saab and Dudley 1998).
- Consider local presence of European Starling when targeting conservation sites because high energetic costs of competition may reduce reproductive success and survivorship even when the outcome of competition is successful for Lewis' Woodpecker (Siddle and Davidson 1991,TashiroVierling 1994, Cooper et al. 1998).

HABITAT INFORMATION NEEDS

- What are the thresholds of snag density that facilitate the use of nest boxes by Lewis's Woodpecker in Pine-Oak Woodland?
- What are the effects of pesticide use on Lewis's Woodpecker occurrence, abundance, or population viability in Pine-Oak Woodland?

Snag. Photo by Mark Penninger

High Severity Fire. Photo by Mark Penninger

UNIQUE HABITATS

There are numerous specific habitat issues and strategies associated with each of the 12 unique habitats. The most pertinent ones are identified individually for each focal species in the following sections. However, many of the habitat strategies identified previously for the three priority habitats also are applicable for the unique habitats.

A variety of habitat types. Photos by Mark Penninger

HABITAT TYPE
Unique Habitat

HABITAT
Post-Wildfire

FOCAL SPECIES
Black-Backed Woodpecker (*Picoides arcticus*)

Black-Backed Woodpecker. Photo by Russ Morgan

HABITAT/SPECIES COMMENTS

Within the East Cascades Mountains of the Interior Columbia Basin, historical habitat for Black-backed Woodpecker occurred in all of the Northern Cascades, Southern Cascades, and Upper Klamath ERUs (Wisdom et al. 2000). Declines in habitat were moderate in the Northern Cascades ERU (48%), but increases have been extensive in the Upper Klamath ERU (88%) and moderate in the Southern Cascades ERU (28%).

Black-backed Woodpeckers often colonize burned areas immediately after fire, where they consume abundant beetle and wood borer larvae, and thus, fire suppression and post-fire salvage logging has likely decreased habitat availability for this species. High woodpecker densities have been found in the four- to six-year period post-fire (Saab et al. 2007, Nappi and Drapeau 2009, Saracco et al. 2011), with density often declining 6-10 years post-fire (Siegel et al. 2016). Reductions in black-backed woodpecker density over time in post-burn habitats may reflect the lifespan of individuals that colonize an area shortly post-fire as colonization is largely attributed to natal dispersal, and adult breeding dispersal is uncommon (Siegel et al. 2016). Their low density in post-fire salvage-logged areas is more related to the reduction in food (wood boring beetles) than nest-site availability (Hutto and Gallo 2006). While Black-backed Woodpeckers also regularly breed in lodgepole and ponderosa pine forests (Goggans et al. 1987, Verschuyl et al. In review), and to a lesser extent mixed conifer forests if there is a high proportion of dead trees (Bull et al. 1986), habitat objectives in unburned forest are not considered here.

PRIMARY HABITAT ASSOCIATIONS

- relatively large areas of burned forest for area requirements
- moderate to large trees in recently burned forest for nesting
- dead or dying trees infested with beetles for foraging

HABITAT OBJECTIVES

***Landscapes*: Where ecologically appropriate in Post-Wildfire, through natural events (i.e., wildfire) or management (i.e., prescribed burning), maintain or initiate actions to provide the following conditions:**

- ► **areas of suitable habitat >3,000 ha (7,500 ac)**
- ► **>40% of the post-fire landscape as naturally regenerating (i.e., unsalvaged)**

***Sites*: Where salvage logging is occurring in Post-Wildfire, maintain or initiate actions to provide the following conditions:**

- **unsalvaged areas minimum patch size >40 ha (100 ac)**
- **in post-fire areas >40 ha (100 ac), salvage <50% of the standing and down dead**
- **maintain snag densities 15-30/ha (6-12/ac) >25 cm (10 in) DBH, and >20/ha (>8/ac) >48 cm (19 in) DBH**
- **retain all trees/snags >51 cm (20 in) DBH and >50% of those 30-51 cm (12-20 in) DBH, independent of logged or unlogged areas**
- **retained snags should be clumped rather than evenly spaced, with both hard and soft decay classes to lengthen the period that the site is suitable nesting habitat**
- **shrub understory cover >15%**

POPULATION OBJECTIVES

***Sites*: Where ecologically appropriate in Post-Wildfire, maintain or initiate actions to provide the following conditions:**

- **mean target densities <200 ha (494 ac)/pair in suitable habitat**

Assumptions/Data Sources: The landscape objective for patch size was developed based on Goggans et al. (1987), Dudley and Saab (2007), and Bond et al. (2102) to encourage management for small populations (e.g., >10 pairs) rather than individual pairs. The landscape objectives for percent of the landscape as post-wildfire and naturally regenerating were developed based on Hutto (1995), McCullough et al. (1998), and Saab et al. (2011). The objectives for snag densities and size were developed based on Saab and Dudley (1998) and Haggard and Gaines (2001). The objective for mean target densities was developed based on Goggans et al. (1987), Dudley and Saab (2007), and Tingley et al. (2014).

HABITAT STRATEGIES

- Target for conservation efforts post-wildfire areas with broken-topped snags which provide an avenue for heartrot fungi (McClelland et al. 1979) and provide nest sites sooner after fire when other snags are not easily excavated due to case hardening (Saab and Dudley 1998).
- Eliminate or manage salvage logging with selective removal that retains snags in clumps rather than evenly spaced, retains both hard and soft snags, and retains large patches as unsalvaged (Saab and Dudley 1998).
- Minimize the impact to shrubs during management activities in post-wildfire habitat.
- Delay salvage logging for five years post-fire to maximize use of foraging resources and habitat suitability (Hutto 1995, Dixon and Saab 2000).
- Exempt some areas from commercial or salvage timber management, and manage these areas to retain late-successional characteristics as long as possible.

HABITAT INFORMATION NEEDS

- What are the relative effects of different intensity post-fire snag removal treatments on Black-backed Woodpecker occurrence, abundance, or population viability in post-fire forests?
- What are the effects of pesticide use and other efforts to reduce beetle populations in forests on Black-backed Woodpecker occurrence, abundance, or population viability in post-fire forests?
- Quantify Black-backed Woodpecker vital rates in green and burned forests to understand the relative contribution of these two forest types in supporting populations.
- Evaluate the movement of Black-backed Woodpecker individuals between green and unburned forests, particularly through natal dispersal.

HABITAT TYPE
Unique Habitat

HABITAT
Whitebark Pine

FOCAL SPECIES
Clark's Nutcracker (*Nucifraga columbiana*)

Clark's Nutcracker. Photo by Frank Lospalluto

HABITAT/SPECIES COMMENTS

Whitebark pine occurs in the highest elevational forest zones (subalpine and timberline). Within the Interior Columbia River Basin, whitebark pine habitat has declined by 45% since the turn of the century (Keane 1995). Most of this loss occurred in the more productive, seral whitebark pine types, of which 98% has been lost. The declines have been associated with regeneration from fire suppression, climate change, and invasion of competing trees (Arno and Hoff 1990). Additionally, disease (white pine blister rust) and insect infestations (mountain pine beetles) can eliminate habitat areas, including mature trees. Clark's Nutcracker is dependent on pine cone seeds, and will undergo extensive movements when seed is unavailable.

PRIMARY HABITAT ASSOCIATIONS

- mature trees for seed production and nesting
- xeric exposed sites for caching of seeds for germination and pine regeneration

HABITAT OBJECTIVES

***Landscapes*: Where ecologically appropriate in Whitebark Pine, maintain or initiate actions to provide the following conditions:**

- ► **areas of suitable habitat >1,000 ha (2,500 ac)**

***Sites*: Where ecologically appropriate in Whitebark Pine, maintain or initiate actions to provide the following conditions:**

- ► **mature tree cover 30-70%**
- ► **regeneration tree cover >10%**

POPULATION OBJECTIVES

***Sites*: Where ecologically appropriate in White-barked Pine, maintain or initiate actions to provide the following conditions:**

- ► **mean target densities <200 ha (494 ac)/pair in suitable habitat**

Assumptions/Data Sources: The landscape objective for patch size was developed based on Schaming (2016). The objectives for tree cover were developed based on professional judgment. The objective for mean target densities was developed based on Schaming (2016).

HABITAT STRATEGIES

- Target conservation efforts in areas where whitebark pine is part of a mosaic of habitats with other cone-producing trees such as Douglas-fir (Schaming 2016).
- Eliminate or manage livestock grazing to ensure adequate regeneration of seedling trees.
- Maintain existing and reestablish pure and mixed stands of whitebark pine dominated by blister rust resistant trees with reduced potential of stand replacement fire.
- Adjacent habitat conditions that facilitate mountain pine beetle and blister rust should be reduced where possible to maintain existing whitebark pine sites from infestation.
- Reintroduce natural fire regimes into whitebark pine systems.

HABITAT INFORMATION NEEDS

- What are the thresholds of amount and area of whitebark pine cover that are most conducive to Clark's Nutcracker occurrence, abundance, or viability?

White bark pine habitat. Photo by Mark Penninger

HABITAT TYPE
Unique Habitat

HABITAT
Subalpine Forest

FOCAL SPECIES
Hermit Thrush (*Catharus guttatus*)

Hermit Thrush. Photo by Russ Morgan

HABITAT/SPECIES COMMENTS

The relationship between shrub and herbaceous cover in subalpine forest is dependent on site conditions, especially moisture levels affected by variables such as elevation, aspect, and proximity to streams. Hermit Thrush also regularly breeds in the understory of mixed conifer forests.

PRIMARY HABITAT ASSOCIATIONS

- mature forest with shaded understory
- moderate to large patch size for occurrence
- moderate canopy cover with openings
- interspersion of herbaceous and shrub cover for foraging and nesting

HABITAT OBJECTIVES

***Landscapes*: Where ecologically appropriate in Subalpine Forest, maintain or provide the following conditions:**

- **within 1,000 ha (2,500 ac) blocks, provide patch sizes of suitable habitat conditions in the following forest cover amounts for high suitability:**
- **>90% forest cover = >8 ha (20 ac) patch size**
- **>80% forest cover = >26 ha (64 ac) patch size**
- **>70% forest cover = >66 ha (163 ac) patch size**
- **>60% forest cover = >156 ha (385 ac) patch size**
- **>50% forest cover = >353 ha (873 ac) patch size**

***Sites*: Where ecologically appropriate in Subalpine Forest, maintain or initiate actions to provide the following conditions:**

- **ratio of shrub-herbaceous (includes bare ground) cover 30–70%**
- **canopy cover 30-70%**

POPULATION OBJECTIVES

***Sites*: Where ecologically appropriate in Subalpine Forest, maintain or initiate actions to provide the following conditions:**

- **► mean target densities <2 ha (5 ac)/pair in suitable habitat**

Assumptions/Data Sources: The landscape objectives for the relationship between patch size and forest cover were developed based on data from throughout western North America indicating the sensitivity of Hermit Thrush to forest fragmentation (Rosenberg et al. 2003). The site objectives for canopy cover and ratio of shrubs and herbaceous cover were developed based on (Mannan and Meslow 1984). The objective for mean target densities was developed based on Manuwal (1968).

HABITAT STRATEGIES

- Target conservation efforts where broken canopies and heterogeneous understories are ecologically appropriate (e.g., where there is diverse topography, soil, and moisture regimes).
- Eliminate or manage livestock grazing to develop and promote the long-term persistence and balance of herbaceous and shrub communities.
- Eliminate or restrict pesticide use which may reduce insect prey base.
- Promote understory growth through natural disturbance or management that breaks up the forest canopy yet still maintains the dominance of a mid- or late-successional forest.
- Where fuels reduction is occurring as part of wildfire management, maintain enough patchy shrub cover to meet the percent shrub cover objective.

HABITAT INFORMATION NEEDS

- What are the threshold and most suitable ratios of shrub and herbaceous cover for Hermit Thrush occurrence, abundance, or population viability in subalpine forest?
- Are Hermit Thrush sensitivities to forest fragmentation in western North America (Rosenberg et al. 2003) applicable to the subalpine forests of eastern Oregon and Washington?
- What are the range of spatial patterns of patches in subalpine forest that promote Hermit Thrush occurrence, abundance, or population viability while effectively reducing fire risk?
- What are the effects of fuels reduction on Hermit Thrush occurrence, abundance, or population viability in subalpine forest?

HABITAT TYPE

Unique Habitat

HABITAT

Mature Lodgepole Pine Forest

FOCAL SPECIES

Mountain Chickadee (*Poecile gambeli*)

Mountain Chickadee. Photo by Russ Morgan

HABITAT/SPECIES COMMENTS

Lodgepole pine is found most commonly on relatively poor soil sites (e.g., frost pockets, pumice soils). It often forms extensive, dense, and pure stands and can quickly establish following a disturbance and exclude other tree species. Thinning or improvement cutting are often needed to ensure vigor and development of mature forests, which are the most deficient age class of this forest type (Emmingham et al. 2005). Mountain Chickadee also regularly breeds in subalpine forest.

PRIMARY HABITAT ASSOCIATIONS

- mature forest with moderate to high canopy cover and openings
- open understory
- decadent trees for nesting cavities

HABITAT OBJECTIVES

***Landscapes*: Where ecologically appropriate in Mature Lodgepole Pine Forest, maintain or initiate actions to provide the following conditions:**

- ► **areas of suitable habitat > 70 ha (175 ac)**

***Sites*: Where ecologically appropriate in Mature Lodgepole Pine Forest, maintain or initiate actions to provide the following conditions:**

- ► **canopy cover 40-90%**
- ► **shrub cover <15%**
- ► **mean tree DBH >40 cm (16 in)**

POPULATION OBJECTIVES

***Sites*: Where ecologically appropriate in Mature Lodgepole Pine Forest, maintain or initiate actions to provide the following conditions:**

► **mean target densities <5 ha (12 ac)/pair in suitable habitat**

Assumptions/Data Sources: The landscape objective for patch size was developed based on professional judgment to encourage management for small populations (e.g., >10 pairs) rather than individual pairs. The objectives for canopy cover and shrub cover were developed based on Hill and Lein (1988) and Lesh (1999). The objective for tree size was based on Li and Martin (1991). The objective for mean target densities was developed based on Hill and Lein (1988).

HABITAT STRATEGIES

- Retain all mature and old-growth lodgepole pine trees.
- Exempt some areas from commercial or salvage timber management, and manage these areas to retain late-successional characteristics as long as possible.
- Maintain all large snags and initiate active snag creation (e.g., fungal inoculation, topping) where snags are limiting.
- Eliminate or restrict fuelwood cutting (snag removal) in suitable habitat by closing roads and/or limiting permits.

HABITAT INFORMATION NEEDS

- Are there landscape factors, patch size, or area requirements that limit Mountain Chickadee occurrence, abundance, or population viability in lodgepole pine forest?

Lodgepole pine forest.
U.S. Forest Service photo

HABITAT TYPE

Unique Habitat

HABITAT ATTRIBUTE

Mature Riparian Woodland

FOCAL SPECIES

Western Wood-Pewee (*Contopus sordidulus*)

Western Wood-Pewee. Photo by Russ Morgan

HABITAT/SPECIES COMMENTS

Riparian Woodland occurs primarily in lower elevation valley bottoms. It is limited in occurrence and patchy in distribution, but important in biodiversity. There has been substantial loss and degradation of Riparian Woodland habitat due to numerous factors such as inundation from impoundments, riverine recreational developments, clearing for agriculture, cutting and spraying for eased access to water courses, invasive exotic species, and livestock overgrazing.

Western Wood-Pewee is highly associated with edges and openings in Mature Riparian Woodlands, especially those dominated by cottonwood trees. It also regularly breeds in several other open forest habitats, including aspen.

PRIMARY HABITAT ASSOCIATIONS

- mature woodland with tall trees for nesting
- open midstory for aerial foraging
- high contrast of edge and closed canopy
- dead trees or trees with dead limbs for foraging perches

HABITAT OBJECTIVES

***Landscapes*: Where ecologically appropriate in Mature Riparian Woodland, maintain or initiate actions to provide the following conditions:**

- ► **agriculture comprises <50% of the landscape**

***Sites*: Where ecologically appropriate in Mature Riparian Woodland, maintain or initiate actions to provide the following conditions:**

- **canopy height >15 m (50 ft)**
- **canopy cover 40-85%**
- **shrub cover <30%**
- **mean tree DBH >30 cm (12 in)**
- **high edge to opening ratios**

POPULATION OBJECTIVES

***Sites*: Where ecologically appropriate in Mature Riparian Woodland, maintain or initiate actions to provide the following conditions:**

► **mean target densities <1.2 ha (3 ac)/pair in suitable habitat**

Assumptions/Data Sources: The landscape objective for limited agriculture was developed based on a negative association with grazing (Tewksbury et al. 2002). The objectives for canopy and shrub cover and tree size were developed based on Richardson (2007). The objective for mean target densities was developed based on Eckhardt (1976).

HABITAT STRATEGIES

- Target conservation efforts where cottonwood trees are ecologically appropriate.
- Target conservation efforts where broken canopies and habitat edges are ecologically appropriate.
- Eliminate or restrict pesticide use which may reduce prey populations.

HABITAT INFORMATION NEEDS

- Are there understory habitat conditions (e.g., shrub cover, ground cover) that determine prey abundance and affect Western Wood-Pewee occurrence, abundance, or population viability in riparian woodland?
- Are there thresholds of canopy closure or stem densities that preclude Western Wood-Pewee occurrence?
- Is Brown-headed Cowbird parasitism a significant problem for Western Wood-Pewee near agricultural fields?

Western Wood-Pewee nest and eggs. U.S. Forest Service photo

HABITAT TYPE

Unique Habitat

HABITAT ATTRIBUTE

Aspen

FOCAL SPECIES

Red-Naped Sapsucker (*Sphyrapicus nuchalsi*)

Red-Napped Sapsucker. Photo by Russ Morgan

HABITAT/SPECIES COMMENTS

Most of the aspen in the Pacific Northwest is in older age classes and in critical need of regeneration. Older sites are usually less vigorous and least likely to regenerate successfully, and many aspen trees are being crowded out by competing conifers. Effective fire suppression over the past 50 years has permitted competition and disease to reduce clone vigor to levels lower than would be expected under natural conditions. Compounding the situation, fire suppression has drastically reduced fire induced regeneration in recent years resulting in few young aged sites. Red-naped Sapsucker also regularly breeds in riparian woodland habitat, and less frequently in mixed conifer forests (Simmons 2003).

PRIMARY HABITAT ASSOCIATIONS

- large snags or live trees with heartrot for nesting cavities
- moderate canopy cover
- young trees for recruitment

HABITAT OBJECTIVES

***Landscapes*: Where ecologically appropriate in Aspen, maintain or initiate actions to provide the following conditions:**

- ► **areas of suitable habitat >120 ha (300 ac)**

***Sites*: Where ecologically appropriate in Aspen, maintain or initiate actions to provide the following conditions:**

- ► **canopy height >18 m (60 ft)**
- ► **canopy cover 40-80%, either clumped with patches and openings or relatively evenly distributed**
- ► **mean tree DBH >54 cm (21 in)**
- ► **>10% cover of saplings in the understory for replacement trees**
- ► **>4 trees/ha (1.5/ac) and >4 snags/ha (1.5/ac) >13 m (43 ft) in height and 30 cm (12 in) DBH**

POPULATION OBJECTIVES

***Sites*: Where ecologically appropriate in Aspen, maintain or initiate actions to provide the following conditions:**

► **mean target densities <12 ha (30 ac)/pair in suitable habitat**

Assumptions/Data Sources: The landscape objective for patch size was developed based on professional judgment to encourage management for small populations (e.g., >10 pairs) rather than individual pairs. The objective for canopy height was developed based on Walters (1996) and McClelland and McClelland (2000). The objectives for trees and snags were developed based on Dobkin et al. (1995), Trombino (1998), and McClelland and McClelland (2000). The objective for canopy cover was developed based on Dobkin et al. (1995) and Sallabanks et al. (2006). The objective for mean target densities was developed based on McClelland (1977) and Walters (1996).

HABITAT STRATEGIES

- Assess the potential for use of fire in restoration of aspen stands.
- Manual treatment (thinning) may be needed in many areas prior to introducing fire.
- Maintain all snags and initiate active snag creation (e.g., fungal inoculation, topping) where snags are limiting and restoration leading to recruitment of saplings is underway.
- Eliminate or modify grazing to ensure succession and recruitment of young aspen.
- Where European Starling competition for nest cavities is significant, control measures may be necessary.

HABITAT INFORMATION NEEDS

- What are the landscape requirements for Red-naped Sapsucker occurrence in aspen such as size of area or adjacency of coniferous or mixed forest?

Aspen grove.
Photo by Mark Penninger

HABITAT TYPE

Unique Habitat

HABITAT

Mature Juniper Woodland

FOCAL SPECIES

Gray Flycatcher (*Empidonax wrightii*)

Gray Flycatcher. Photo by Russ Morgan

HABITAT/SPECIES COMMENTS

Juniper removal/control is being conducted extensively where invasive juniper has encroached on sagebrush habitats, especially in association with Greater Sage Grouse conservation areas. Gray Flycatcher also regularly breeds in big sagebrush and open pine woodlands.

PRIMARY HABITAT ASSOCIATIONS

- mid and late-successional woodland
- sparsely vegetated ground and an open understory for aerial foraging space
- distant from livestock grazing or agriculture to minimize Brown-headed Cowbird parasitism

HABITAT OBJECTIVES

***Landscapes*: Where ecologically appropriate in Mature Juniper Woodland, maintain or initiate actions to provide the following conditions:**

- **<10% of landscapes in agricultural lands with moderate to heavy grazing pressure or other areas supporting Brown-headed Cowbird populations**

***Sites*: Where ecologically appropriate in Mature Juniper Woodland, maintain or initiate actions to provide the following conditions:**

- **mid or late-successional juniper trees with 5-15 trees/ha (2-6 trees/ac) and >1 tree/ha (0.4 trees/ac) >53 cm (21 in) DBH**
- **canopy cover 10-40% with no areas <5% or >70% cover**
- **shrub layer (i.e., shrubs and sapling junipers) cover 5-20%**
- **herbaceous ground cover 50-80%**

POPULATION OBJECTIVES

***Sites*: Where ecologically appropriate in Mature Juniper Woodland, maintain or initiate actions to provide the following conditions:**

- **mean target densities <3 ha (7 ac)/pair in suitable habitat**
- **Brown-headed Cowbird parasitism rates <10% within project areas**

Assumptions/Data Sources: The objectives for tree size and quantity were developed based on Holmes (2007). The objectives for canopy cover were developed based on Gashwiler (1977), Reinkensmeyer (2000), and East Cascades Bird Conservancy (2007). The objectives for shrub and ground cover were developed based on Altman and Woodruff (2012). The objective for mean target densities was developed based on Altman and Woodruff (2012). This species is highly susceptible to Brown-headed Cowbird parasitism, therefore it is appropriate to maintain parasitism at low levels (<10%).

HABITAT STRATEGIES

- Target conservation efforts distant from agriculture or open landscapes suitable for Brown-headed Cowbird.
- Target conservation efforts where late-successional juniper is the ecologically appropriate condition (e.g., slopes near rocky outcrops).
- Retain all mature and old-growth juniper trees where ecologically appropriate (i.e., non-invasive sites).
- Ensure there is no inappropriate removal of older, naturally occurring juniper during sagebrush restoration that targets invasive juniper.
- Eliminate or manage livestock grazing to ensure adequate levels of shrub and ground cover.
- Eliminate or restrict pesticide use which may reduce flying insect prey populations.
- Where juniper management is occurring, manual cutting and removal of juniper trees is preferable to chaining or mechanical efforts to minimize effects on vegetation and soils.

HABITAT INFORMATION NEEDS

- What are the levels of grazing that can maintain Gray Flycatcher occurrence, abundance, or population viability in juniper woodland?
- Are there landscape factors, patch size, or area requirements that limit Gray Flycatcher occurrence, abundance, or population viability in juniper woodland?

Juniper stand. U.S. Forest Service photo

HABITAT TYPE

Unique Habitat

HABITAT

Montane Shrubland

FOCAL SPECIES

Calliope Hummingbird (*Selasphorus calliope*)

Calliope Hummingbird. Photo by Russ Morgan

HABITAT/SPECIES COMMENTS

Montane shrublands occur naturally at higher elevations where soils and other conditions (e.g., south facing slopes, harsher climate) are more suitable for lower growing shrubby vegetation than large trees and dense forests. Mesic or xeric shrubs are dominant, ranging from 20-100% cover. Calliope Hummingbird also regularly breeds in riparian woodland and forest edges and understory dominated by shrubs, including regrowth areas after logging or fire. It may be adversely impacted if climate change alters blooming phenology.

PRIMARY HABITAT ASSOCIATIONS

- dense shrub patches for nesting
- flowering shrubs/trees for foraging
- mosaic of edges, openings, and patches of shrubland

HABITAT OBJECTIVES

***Landscapes*: Where ecologically appropriate in Montane Shrubland, maintain or initiate actions to provide the following conditions:**

- **areas of suitable habitat >10 ha (25 ac)**

***Sites*: Where ecologically appropriate in Montane Shrubland, maintain or initiate actions to provide the following conditions:**

- **shrub cover >60%**
- **tree cover <25%**

POPULATION OBJECTIVES

***Sites*: Where ecologically appropriate in Montane Shrubland, maintain or initiate actions to provide the following conditions:**

- **mean target densities <0.3 ha (0.7 ac)/pair in suitable habitat**

Assumptions/Data Sources: The landscape objective for patch size was developed based on professional judgment to encourage management for small populations (e.g., >10 pairs) rather than individual pairs. The objectives for shrub cover and canopy cover were developed based on professional judgment. The objective for mean target densities was developed based on Calder and Calder (1994).

HABITAT STRATEGIES

- Target conservation efforts where flowering trees and shrubs are the ecologically appropriate and dominant flora.
- Eliminate or manage livestock grazing to ensure adequate shrub and flowering plant cover.
- Protect productive flowering shrublands from encroaching trees and destructive recreation.

HABITAT INFORMATION NEEDS

- What are the ratios and thresholds for the tree, shrub, and herbaceous mosaic of cover that supports Calliope Hummingbird occurrence, abundance, or population viability in montane shrublands?
- What is the floral composition of montane shrublands necessary for Calliope Hummingbird occurrence, abundance, or population viability?
- Does the floral composition of seral shrublands used by the species in a managed forest adequately mimic natural shrubland habitats in providing the nectar and insect resources needed by Calliope Hummingbird?

Calliope Hummingbird on columbine, stock photo

HABITAT TYPE
Unique Habitat

HABITAT
Sagebrush-Steppe

FOCAL SPECIES
Brewer's Sparrow (*Spizella breweri*)

Brewer's Sparrow. Photo by Frank Lospalluto

HABITAT/SPECIES COMMENTS

Within the East Cascades Mountains of the Interior Columbia Basin, historical habitat for Brewer's Sparrow occurred in patchy distribution throughout most of the Northern Cascades, Southern Cascades, and Upper Klamath ERUs (Wisdom et al. 2000). Declines in habitat were extensive in the Northern Cascades (67%) and Southern Cascades (81%), and moderate in the Upper Klamath ERUs (10%).

PRIMARY HABITAT ASSOCIATIONS

- tall sagebrush with high cover
- high percent open ground cover (i.e., bare ground or cryptogamic crust) for foraging
- large unfragmented patches of sagebrush

HABITAT OBJECTIVES

***Landscapes*: Where ecologically appropriate in Sagebrush-Steppe, maintain or initiate actions to provide the following conditions:**

- **areas of suitable habitat >40 ha (100 ac)**

***Sites*: Where ecologically appropriate in Sagebrush-Steppe, maintain or initiate actions to provide the following conditions:**

- **mean cover sagebrush 10-30% and in patches rather than evenly distributed**
- **mean height sagebrush >60 cm (24 in)**
- **high foliage density in sagebrush shrubs**
- **mean native herbaceous cover >10% with <10% cover of non-native grasses**
- **mean open ground cover (includes bare and/or cryptogamic crust) >20%**

POPULATION OBJECTIVES

***Sites*: Where ecologically appropriate in Sagebrush-Steppe, maintain or initiate actions to provide the following conditions:**

- **mean target densities <1.2 ha (3 ac)/pair in suitable habitat**

Assumptions/Data Sources: The landscape objectives for patch size was developed based on professional judgment to encourage management for small populations (e.g., >10 pairs) rather than individual pairs. The objectives for sagebrush and herbaceous cover are based on Short (1984; with pers. comm. from T. Rich), Bock and Bock (1987). The objective for sagebrush height is based on Rich (1980), Reynolds (1981), and Petersen and Best (1985). The objective for mean target densities was developed based on Rotenberry et al. (1999).

HABITAT STRATEGIES

- Eliminate or manage livestock grazing to ensure adequate vegetative cover for nesting and foraging and to minimize nest disturbance or nest destruction from grazing animals.
- Eliminate or restrict recreational vehicle use during the breeding season to avoid nest disturbance or nest destruction.
- Eliminate or restrict pesticide use which may reduce prey populations.
- When conducting sagebrush management, maintain cover amounts as described above.
- Fire suppression should occur where there is the potential loss of sagebrush.

HABITAT INFORMATION NEEDS

- What are the thresholds of patch size for Brewer's Sparrow occurrence, abundance, or population viability in sagebrush-steppe?
- What are the impacts to Brewer's Sparrow nest success under different sagebrush management techniques (e.g., chemical treatments, mechanical treatments)?
- What is the viability of Brewer's Sparrow populations in small fragments of habitat versus those in large contiguous blocks and under alternate rangeland management and grazing regimes?

Sagebrush-Steppe, stock photo

HABITAT TYPE
Unique Habitat

HABITAT
Montane Meadow

FOCAL SPECIES
Lincoln's Sparrow (*Melospiza lincolnii*)

Lincoln's Sparrow. Photo by Russ Morgan

HABITAT/SPECIES COMMENTS

Montane wet meadows occur above treeline or at higher elevations in the forest where the hydrology is suitable for a wet herbaceous community. Alpine habitats (those above treeline) are one of the most likely habitats to be reduced in size by the effects of climate change. Grazing can reduce the suitability of these fragile habitats by altering the vegetative composition and abundance, and exacerbate the anticipated losses from climate change. Lincoln's Sparrows are near-obligate to montane wet meadows for nesting habitat.

PRIMARY HABITAT ASSOCIATIONS

- wet or mesic conditions
- dense herbaceous vegetation for nesting and foraging
- scattered or patchy shrubs and/or small trees for singing

HABITAT OBJECTIVES

***Landscapes*: Where ecologically appropriate in Montane Meadow, maintain or initiate actions to provide the following conditions:**

- **areas of suitable habitat >12 ha (30 ac)**

***Sites*: Where ecologically appropriate in Montane Meadow, maintain or initiate actions to provide the following conditions:**

- **herbaceous cover >20%**
- **tree cover <15%**
- **shrub cover <15%**
- **shrub height <3 m (100 in) tall**

POPULATION OBJECTIVES

***Sites*: Where ecologically appropriate in Montane Meadow, maintain or initiate actions to provide the following conditions:**

- **mean target densities <0.5 ha (1.3 ac)/pair in suitable habitat**

Assumptions/Data Sources: The landscape objective for patch size was developed based on data from the Umpqua Basin in the Cascade Mountain interpreted for a small population (e.g., >10 pairs) (M. Hunter pers. comm.). The objective for herbaceous cover also was based on data from the Umpqua Basin in the Cascade Mountain (M. Hunter pers. comm.). The objectives for tree and shrub cover were developed based on professional judgment. The objective for shrub height was developed based on Wortman and Wunder (1997) and Stephens and Anderson (2003). The objective for mean target densities was developed based on Farner (1952), Ammon (1995) and Wortman and Wunder (1997).

HABITAT STRATEGIES

- Eliminate or restrict human access and recreational vehicle use during the breeding season to minimize nest disturbance or nest destruction.
- Eliminate or manage livestock grazing to ensure adequate vegetative structure and volume for nesting birds (Cicero 1997).
- Eliminate or restrict pesticide use which may reduce prey base.
- Manage tree/shrub invasion at edge of meadows to maintain patch size and minimize effects on water table.
- Avoid runoff and sedimentation into meadows due to logging or road building.

HABITAT INFORMATION NEEDS

- Are there minimum patch sizes of montane wet meadows for Lincoln Sparrow occurrence, abundance, or population viability?
- Are there acceptable thresholds of livestock grazing that can support Lincoln Sparrow occurrence, abundance, or population viability in montane wet meadows?

Montane meadow. Photo by Mark Penninger

HABITAT TYPE

Unique Habitat

HABITAT

Cliffs And Rock Outcrops

FOCAL SPECIES

Rock Wren (*Salpinctes obsoletus*)

Rock Wren. Photo by Frank Lospalluto

HABITAT/SPECIES COMMENTS

Rock wrens inhabit open, rock-strewn habitats such as cliffs, rock outcrops, and boulder slopes and fields (Lowther et al 2000). Much of this habitat is relatively structurally simple with limited affect from human activities. The latter includes mostly recreational activities, in particular rock-climbing. They generally avoid forested areas.

PRIMARY HABITAT ASSOCIATIONS

- rocky substrates
- extensive crevices or cavities among rocks for nesting sites
- limited and low-statured vegetation

HABITAT OBJECTIVES

Sites: Where ecologically appropriate in Cliffs and Rock Outcrops, maintain or initiate actions to provide the following conditions:

- ► **mean target densities <5 ha (2.5 ac)/pair in suitable habitat**

Assumptions/Data Sources: The objective for mean target densities was developed based on Warning and Benedict (2015).

POPULATION OBJECTIVES

There is insufficient data to support quantifiable population objectives for Rock Wren.

HABITAT STRATEGIES

- In areas of high Rock Wren densities, maintain seasonal protections and/or low use for recreational activities including rock-climbing.

HABITAT INFORMATION NEEDS

- What are the effects of rock climbing on Rock Wren occurrence, abundance, or population viability?

IMPLEMENTATION

There are numerous considerations for implementation to achieve the habitat and population objectives presented in this document. Because of the diversity of landbird species and habitats in the East Cascades Mountains, conservation will require a complex array of conditions within variable landscape patterns. Implementation also will likely require the need for areas that function naturally with limited or no management intervention (e.g., some federal lands), and areas where desired landbird habitat conditions will need to be achieved by incorporating a wide range of habitat management and restoration activities within a working landscape of various land uses (e.g., forestry, agriculture, grazing, recreational).

Management and restoration goals will need to be carefully designed and coordinated among various landowners and land management agencies and organizations to ensure efficiencies and cost effectiveness, and to integrate the diverse values and goals of land managers and landowners with that of bird conservation. The habitat and population objectives in this document are intended to be the foundation for developing these comprehensive, integrated strategies. An overview of the process and example case studies of the integration of multi-species objectives in land management planning and implementation is presented in Bettinger et al. (2001). In particular, the conceptual implementation emphasis in this document is three-fold:

- initiate conservation actions in accordance with the ecological potential of the site (i.e., within the framework of potential vegetation and ecosystem processes)
- emphasize conservation within both strategic priority areas and where opportunities exist (i.e., receptive land owners and land managers)
- emphasize conservation that is integrated across multiple scales such that habitat conditions for one or a few focal species are nested within a landscape that provides a mosaic of conditions for other focal species

ECOLOGICALLY APPROPRIATE

Meeting the goal of healthy landbird populations begins with the maintenance and restoration of properly functioning ecosystems comprised of desired priority and unique habitat conditions. The emphasis on setting habitat objectives is for the most desirable habitat conditions for focal species in areas where those conditions are ecologically appropriate. Thus, the phrase "where ecologically appropriate" is used throughout the document as a reminder that it is essential to consider the ecological appropriateness of the site to support the habitat attribute before initiating the management or restoration (Sidebar: *Avoiding Square Pegs and Round Holes: Be Ecologically Appropriate*).

SCALE AND LANDSCAPE CONSIDERATIONS

Habitat objectives at the site-scale for one focal species or habitat attribute can be in direct conflict with those for another. Indeed, actions designed to manage for one focal species are often detrimental to other focal species. The recognition of ecological appropriateness and the integration of design and management in a complementary manner across the landscape can accommodate conflicting objectives. This will require cooperative decisions by appropriate land managers at the appropriate scale on the proportion and spatial distribution of the area desired in particular habitat conditions.

Conversely, even at smaller scales, some biological objectives for multiple focal species can be achieved simultaneously through a combination of management actions. For example, combining variable-spaced or patchy thinning with retention of old-growth trees can support to

Avoiding Square Pegs and Round Holes: Be Ecologically Appropriate

As part of the planning and implementation process, it is essential to understand the ecological capacity or "potential native vegetation" of the site to support particular habitat conditions or bird species. This includes a suite of biotic and abiotic factors that cannot be manipulated such as soil type, aspect, slope, local weather, etc. Thus, knowing what is possible or ecologically appropriate is essential before any design or management is conducted. If the potential native vegetation is not readily known, the assistance of a professional ecologist can be beneficial. Understanding these factors should guide how to strategize habitat management or restoration. Once the potential native vegetation for the site is known, an evaluation can be conducted to determine the focal species or suites of species that have habitat requirements that a site can reasonably provide.

A large-scale example of the importance of the concept of ecological appropriateness is current versus historical mixed conifer forest. Much of the current mixed conifer forest exists in areas historically dominated by dry forest. These sites, although potentially meeting habitat conditions for mixed conifer forest focal species, are degraded and converted dry forest habitat. They should be targeted for management and restoration of dry forest conditions and focal species, which have been reduced across the landscape, and are ecologically appropriate and desirable within natural or managed disturbance regimes.

varying degrees White-headed Woodpecker and Chipping Sparrow in dry forest habitat, or Olive-sided Flycatcher and Williamson's Sapsucker in mesic mixed conifer forest.

It will also be important to consider where habitat conservation networks are necessary to conserve landbird populations. Although the connectivity of habitats that function as corridors may not be essential for mobile animals like birds, the connectivity may be particularly important for area-sensitive species such as White-headed Woodpecker in dry forest when it results in an expansion of the area of suitable habitat.

REGIONAL PRIORITIZATION

This document encourages habitat management for all focal species and habitat types. However, for those making decisions on allocation of resources at regional scales, the highest priorities for landbird conservation include:

- protection of all remaining late-successional forest
- restoration of dry forest and Pine-Oak Woodland habitat
- management for appropriate natural regeneration of post-wildfire habitat
- manage at the landscape-level to reduce the risk of historically anomalous fire, insect, and disease occurrences

CONSERVATION DESIGN

Because of the complexities of scale, species, and ownerships as described above, efficient and effective implementation of landbird conservation across the region will not only require extensive partnerships and cooperation, but also a strong scientific biological foundation within the context of multiple biological and non-biological goals and objectives. Many agencies and organizations are undertaking this type of conservation design either independently within their ownership (e.g., National Forest Plans) or in partnership across large landscapes (e.g., Ecoregional Planning of The Nature Conservancy). It is beyond the scope of this document to provide a spatially-explicit, integrated design of how habitat conservation should occur to support the habitat and population objectives in this document. However, bird conservation partners can use the objectives in multiple ways as part of the development of spatially-explicit landscapes for bird conservation (Sidebar: *Using Focal Species as Conservation Tools*).

Using Focal Species as Conservation Tools

There are two primary ways to use focal species as a tool for landbird conservation. First, the specifics of their habitat associations (e.g., canopy cover, shrub cover, tree size) can be used in the planning process to set prescriptive habitat objectives for a site or landscape. Secondly, the occurrence or abundance of focal species can be used as a metric to track positive progress of habitat management or restoration towards the habitat objectives they represent. It is important to recognize that although the presence or abundance of a focal species can be used as a positive indicator of success or effectiveness of habitat management or restoration, the absence of these species during monitoring does not necessarily indicate the opposite - failure. There are many reasons why a species may not occur at a site independent of the habitat condition. However, the absence or low abundance of a focal species can be a red flag for further attention to those habitat conditions.

TIMING OF ACTIVITIES

One of the basic tenets of landbird conservation is that reproduction can be negatively affected by land use or management during the breeding season (i.e., April 15 – July 15 for most landbirds). In many cases, avoidance of these dates can be followed (i.e., the actions are not time-sensitive). However, there are some instances where conflict may not be avoidable for desired habitat management results (e.g., spraying invasive species before going to seed). Thus, it is important to evaluate the timing of the management actions (i.e., essential versus convenient), and if there are reasonable alternatives. Local or regional breeding windows can inform project planning to minimize impact.

OPPORTUNITIES FOR PARTICIPATION

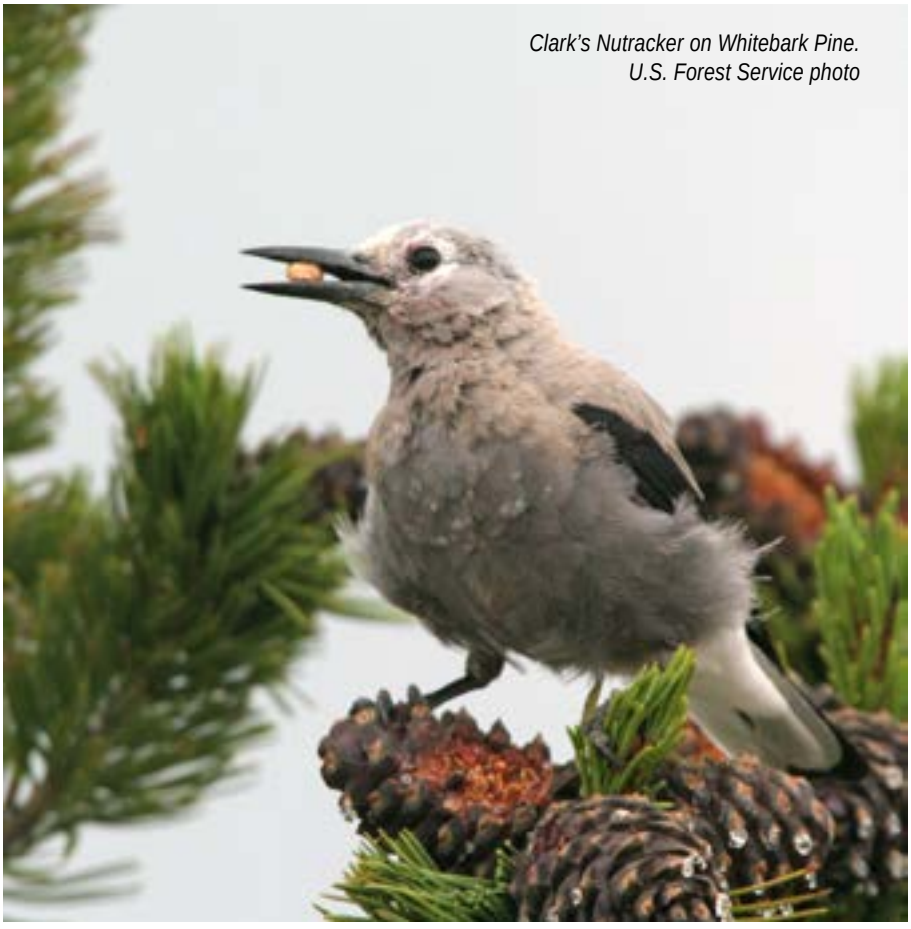
Implementation of landbird conservation activities as described in this document will require a broad range of partnerships, an extensive amount of cooperation, and considerable financial resources. However, there are opportunities for participation at many levels from a small landowner who provides habitat for one focal species, to detailed, complex multi-agency/organization multi-species conservation efforts within large-scale management units such as ecoregions.

As described earlier, Joint Venture partnerships have expanded their mission beyond wetland and waterfowl conservation to function as a delivery mechanism for all-bird, all-habitat conservation. Because of the tremendous habitat diversity within the Intermountain West, the limited amount of resources available for bird and habitat conservation, and the high priority for conservation of Greater Sage Grouse, the IWJV partnership is focusing its current efforts for landbirds on sagebrush and riparian habitats within the landscape of its traditional focus on wetland habitats. Thus, coniferous forest habitats are not a current focus of the IWJV. However, where sagebrush and riparian habitats are embedded within tracts of coniferous forest, there are opportunities to work with IWJV bird conservation partners to provide added value by including adjacent coniferous forest habitat management for landbirds.

In 2012, the U.S. Forest Service adopted "managing for resilience" as the third principle of its climate change response strategy. The final rule (Federal Register, April 9, 2012) emphasized collaboration in the forest planning process through public involvement and dialogue, and the use of the best available scientific information to inform decisions on the protection of land, water, and wildlife. To facilitate this process, Collaborative Forest Cooperatives were established throughout the region to provide stakeholders an opportunity to recommend and participate in forest management activities (Sidebar: *Collaborative Forest Cooperatives*). These cooperatives likely present the best opportunities for large-scale integration of PIF landbird focal species biological objectives into forest management planning and implementation.

Collaborative Forest Cooperatives

Congress established the Collaborative Forest Landscape Restoration Program in 2009 to encourage the collaborative, science-based ecosystem restoration of priority forest landscapes to reduce the risk of large-scale wildfire and benefit rural communities. Furthermore, these projects were expected to encourage "ecological, economic, and social sustainability" and serve as demonstrations for effective restoration techniques and forest product utilization. By requiring collaboration, the idea was to address and resolve potential conflicts around land management by bringing together public and private land managers, conservation interests, and tribes to benefit forest ecosystems and rural economies through accelerated landscape-scale forest restoration. There are numerous collaborative forest cooperatives in Oregon and Washington such as the Deschutes Collaborative Forest Project and the Tapash Sustainable Forest Collaborative.



Clark's Nutracker on Whitebark Pine.
U.S. Forest Service photo

Implementation of landbird conservation activities as described in this document will require a broad range of partnerships, an extensive amount of cooperation, and considerable financial resources. However, there are opportunities for participation at many levels.

MONITORING AND ADAPTIVE MANAGEMENT

When habitat management actions are undertaken as recommended in this document, monitoring programs should be designed and implemented to test the effectiveness of the actions on bird populations, and direct adaptive management to improve desired results. In conjunction with research, monitoring also is important for providing data to evaluate assumptions and revise and update biological objectives. The NABCI monitoring subcommittee (NABCI 2007) recommends that monitoring:

- be fully integrated into bird management and conservation practices,
- be aligned with management and conservation priorities,
- be part of coordinated monitoring programs among organizations, and
- be integrated across spatial scales to effectively solve conservation or management problems

Large-scale monitoring programs, like the BBS, can be used as one tool to track the long term regional response of bird populations to habitat management conducted based on recommendations in this document. However, at the local scale there is a likely weak correlation with BBS data, and the time required to assess statistical changes in the BBS data make this approach less than satisfactory for most purposes. Regional bird monitoring programs like the Klamath Bird Monitoring Network (Alexander et al. 2004) use a variety of monitoring techniques at a variety of spatial and temporal scales to measure landscape level and site specific trends in population abundance and demographics that can help to assess the individual and cumulative effectiveness of local or smaller-scale regional management actions with regards to biological objectives described herein (Stephens et al. 2010). However, local or project-level monitoring is most important to support evaluation of the bird population response to management actions and the biological objectives presented in this document. Further, it should be designed and conducted in a consistent and systematic manner to allow for integration at larger scales (Ralph et al. 1993). Importantly, data should be contributed to Avian Knowledge Network (*www.avianknowledge.net*), which will archive data and allow various levels of data sharing dependent on contributor preferences. Avian Knowledge Northwest, a regional node of Avian Knowledge Network, provides regional-specific data management and delivery resources (*www.avianknowledgenorthwest.net*).

Focal Bird Species and Effectiveness Monitoring

By monitoring both birds and vegetation before and after restoration, we can evaluate whether a project has achieved its intended outcome and guide further restoration actions if needed. While the ultimate metric of the success of the habitat management or restoration actions should be the assessment of the vegetative conditions created to support focal species, the response of focal species provides us with additional understanding of ecological change. The use of a suite of focal species representing a range of the habitat conditions will provide a more robust measure of effectiveness than a single species. The presence or density of a suite of focal bird species can be used as a positive indicator of the "effectiveness or success" of habitat management or restoration activities at a site, but should not be used as the primary metric for effectiveness because of the potential for factors beyond habitat to affect bird species populations. There are many reasons why a bird species may not occur at a site with seemingly appropriate habitat, such as proximity and status of its nearest populations and the ability of those populations to provide recruitment into the site, or that our knowledge of the targeted habitat conditions for the species is incomplete or inaccurate. Thus, it is possible that habitat management or restoration can be successful in achieving the desired habitat conditions, but still not support the targeted focal species. While the absence or low density of some focal species might not indicate failure, it should prompt further evaluation of restoration effectiveness and/or bird species ecology. From a bird conservation perspective, understanding what is limiting populations in restored habitat is critical to both inform future restoration and refine our knowledge of the habitat needs of focal species.

Monitoring results also should inform the design of projects that meet other priority management objectives (e.g., fire hazard reduction) in concert with bird conservation objectives and serve as a catalyst for adaptive management. Bird monitoring data can be used to identify opportunities to integrate PIF conservation objectives within the land management process and influence the design of future projects that fall within land management priorities and funding mechanisms. Effectiveness monitoring can be used to evaluate the compatibility of projects designed to meet other management objectives with bird conservation objectives. By monitoring the ecological effects of management actions using standard bird monitoring methods, land managers can integrate PIF conservation objectives and design treatment projects to meet even potentially competitive management objectives (e.g., fuels reduction and conservation of coniferous forest bird species).

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APPENDIX A

PRIORITY AND RESPONSIBILITY SPECIES MOST LIKELY TO BENEFIT FROM HABITAT MANAGEMENT OR RESTORATION DIRECTED TOWARDS FOCAL SPECIES AND ASSOCIATED HABITAT ATTRIBUTES. [1,2]

HABITAT ATTRIBUTE	DRY FOREST				MESIC MIXED CONIFER FOREST					PINE-OAK WOODLAND		
	large patches, late-succ heterogeneous canopy cover	large trees	herb understory regen pines	large snags	large trees	forest edges, openings scattered trees	multi-layered, high understry volume	large snags	intersp herb openings, patches dense trees	large oak trees and snags	early-succ dense understry with regen	large pine trees and snags
Focal Species	**WHWO**	**PYNU**	**CHSP**	**MOBL WEBL**	**BRCR**	**OSFL**	**SWTH**	**WISA**	**FLOW**	**ATFL**	**NAWA**	**LEWO**
Species to Benefit	**PYNU** **FLOW** **GRFL** **WISA** CAFI GGOW NOGO PIJA PISI	**WHWO** **LEWO** CAFI GGOW PIJA PISI	GRFL GTTO	**PYNU** **WHWO** **LEWO** **MOCH** **OSFL** **WISA** PYNU vasw	**OSFL** **WISA** **RNSA** CAFI EVGR GGOW NOGO PIJA PISI	**BBWO** **CHSP** **WWPE** CAFI EVGR GGOW RNSA	**HETH** CAHU GTTO MOQU RUHU	**MOBL** **MOCH** **OSFL** **RNSA** GGOW TTWO vasw	**CHSP** **WHWO** **GRFL** GGOW	**LEWO** **WEBL** GGOW	**SWTH** **CAHU** GTTO MOQU RUHU	**ATFL** **WEBL** GGOW vasw
UNIQUE HABITATS	**White bark Pine**	**Montane Meadow**	**Aspen**	**Sub-alpine Forest**	**Cliffs Rock Outcrp**	**Mature Riparian Woodland**	**Mature Juniper Woodland**	**Montane Shrubland**	**Sagebrush Steppe**	**Post-Wildfire**	**Mature Lodgepole Pine**	
Focal Species	**CLNU**	**LISP**	**RNSA**	**HETH**	**ROWR**	**WWPE**	**GRFL**	**CAHU**	**BRSP**	**BBWO**	**MOCH**	
Species to Benefit	**MOCH** **WISA** CAFI EVGR PISI	**CAHU** BLSW BRSP RUHU lazb	**FLOW** **LEWO** **MOCH** **WHWO** **WISA** **WWPE** NOGO NOWA RUHU WIFL	**CHSP** **CLNU** **MOCH** **OSFL** CAFI EVGR GGOW NOGO PISI TTWO	**GOEA** BLSW CONI copo vasw	**CAHU** **NAWA** **RNSA** **SWTH** MOQU NOWA RUHU WIFL lazb	**ATFL** **CHSP** **MOCH** **WEBL** PIJA GTTO SWHA	**NAWA** **SWTH** GTTO RUHU WIFL lazb	**GOEA** CONI GTTO SWHA copo	**CLNU** **OSFL** **LEWO** **WHWO** **WWPE** TTWO lazb	**BBWO** **CHSP** **GRFL** GGOW TTWO	

APPENDIX A, CONTINUED

[1] Includes only priority and responsibility species that have a strong breeding season habitat association with the habitat type and/or habitat attribute and would likely benefit from conservation directed towards the focal species and the associated habitat attribute. The potential benefit is only appropriate if the site is within the range of the species to benefit, is large enough to meet the species area requirements, and other specific habitat attributes or conditions required by the species are also available or being managed for. The species to benefit list can provide a good source list for species to use as a surrogate when the focal species is not appropriate for a site due to range, habitat conditions, elevation, etc.

[2] Species to Benefit designations:

CAPS, Bold, and Underline *= Focal species for a different habitat attribute in the same habitat type.*

CAPS and Bold *= Focal species in a different habitat type.*

CAPS = Priority species not designated as focal species.

Lower Case = Responsibility species not designated as focal or priority species.

Species are listed alphabetically within the aforementioned order of status, and not by degree of potential benefit. If species are designated in more than one category, it is listed as the highest category in the following order – focal, priority, responsibility.

ATFL = Ash-throated Flycatcher

BBWO = Black-backed Woodpecker

BLSW = Black Swift

BRSP = Brewer's Sparrow

BRCR = brown creeper

CAFI = Cassin's Finch

CAHU = Calliope Hummingbird

CHSP = Chipping Sparrow

CLNU = Clark's Nutcracker

CONI = Common Nighthawk

COPO = Common Poorwill

EVGR = Evening Grosbeak

FLOW = Flammulated Owl

GGOW = Great Gray Owl

GOEA = Golden Eagle

GRFL = Gray Flycatcher

GTTO = Green-tailed Towhee

HETH = Hermit Thrush

LAZB = Lazuli Bunting

LEWO = Lewis's Woodpecker

LISP = Lincoln's Sparrow

MOBL = Mountain Bluebird

MOCH = Mountain Chickadee

MOQU = Mountain Quail

NAWA = Nashville Warbler

NOGO = Northern Goshawk

NOWA = Northern Waterthrush

OSFL = Olive-sided Flycatcher

PIJA = Pinyon Jay

PISI = Pine Siskin

PYNU = Pygmy Nuthatch

RNSA = Red-naped Sapsucker

RUHU = Rufous Hummingbird

SWHA = Swainson's Hawk

SWTH = Swainson's Thrush

TTWO = Three-toed Woodpecker

VASW = Vaux's Swift

WHWO = White-headed Woodpecker

WIFL = Willow Flycatcher

WISA = Williamson's Sapsucker

WEBL = Western Bluebird

WWPE = Western Wood-Pewee

APPENDIX B

LANDBIRD SPECIES PROJECTED SHORT-TERM POPULATION RESPONSE TO FOREST RESTORATION AND MANAGEMENT IN DRY FORESTS. [1]

Habitat Management Action	Decreasing Crown Density		Understory Thinning (Below Canopy)		Surface Fuels Reduction (Shrubs and Ground)		Increasing Height to Crown (Limbing Up)	Big Tree Retention	Snag Retention or Creation
Species [2]	Heavy [3]	Light [3]	Heavy [3]	Light [3]	Heavy [3]	Light [3]			
Cassin's Finch	-	o	-	o	+	o	+/o	+	o
Chipping Sparrow	+	+	+	o	-	o	-	o	o
Flammulated Owl	-	+	o	+	+	+	o/-	+	+
Gray Flycatcher	-	o	o	+	+	+	o/-	o	o
Great Gray Owl	+/o	+/o	+	+	+	+/o	+/o	+	+
Green-tailed Towhee	+	+	+	o	-	-	+/o	o	o
Lewis's Woodpecker	+	+	+	+	-	-	+/o	+	+
Mountain/Western Bluebird	+	+/o	+	+	+	+	+/o	o	+
Mountain Chickadee	-	-	o/-	o	o	o	o	+	+
Olive-sided Flycatcher	+	+	o	o	-	o	o	+	+
Pine Siskin	-	-/o	o	o	o	o	o	+	o
Pinyon Jay	-	o	+	o	+	+	+/o	+	o
Pygmy Nuthatch	o	+	o	+	o	o	+/o	+	+
White-headed Woodpecker	o	+	+	+	+	o	+/o	+	+
Williamson's Sapsucker	o	+	+	+	+	+	+/o	+	o

[1] *Response is the direct short-term potential response to the action, not indirect or long-term consequences. Response is subjectively projected based on review of several studies (e.g., Sallabanks et al. 2005, Pilliod et al. 2006, Gaines et al. 2007, Lyons et al. 2008, Gaines et al. 2010, Hutto et al. 2014), knowledge of species desired habitat conditions, and knowledge of resulting habitat conditions from the prescribed habitat management or restoration. Landbird species listed here are only those focal, priority, or responsibility species highly associated with dry forest.*

[2] *Colors indicate the species status in this document: Blue = focal species; Underline = priority species; Italics = responsibility species*

[3] *The categories Heavy and Light were used to provide recognition that degrees of the habitat management or restoration action can result in different responses by the species. There are insufficient empirical data to present this information in quantitative metrics. In general, Heavy = low retention of the parameter, Light = higher retention of the parameter. The categories (+ = positive, o = neutral, and - = negative) indicate the projected directional effect of the species response. More than one category indicates greater uncertainty or likely variability in the species response.*

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