Population and Habitat Objectives for Landbirds in Prairie, Oak, and Riparian Habitats of Western Oregon and Washington

Version 2.0

Prepared by:

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Bob Altman | American Bird Conservancy

AMERICAN BIRD CONSERVANCY

FOREST SERVICE U.S. DEPARTMENT OF AGRICULTURE

NATIONAL SYSTEM OF PUBLIC LANDS U.S. DEPARTMENT OF THE INTERIOR BUREAU OF LAND MANAGEMENT

PACIFIC BIRDS HABITAT JOINT VENTURE

OREGON / WASHINGTON PARTNERS IN FLIGHT

PARTNERS IN FLIGHT AVES DE LAS AMERICAS

Klamath Bird Observatory

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Prepared for:
Oregon-Washington Partners in Flight

Pacific Birds Habitat Joint Venture

Bureau of Land Management

U.S. Forest Service

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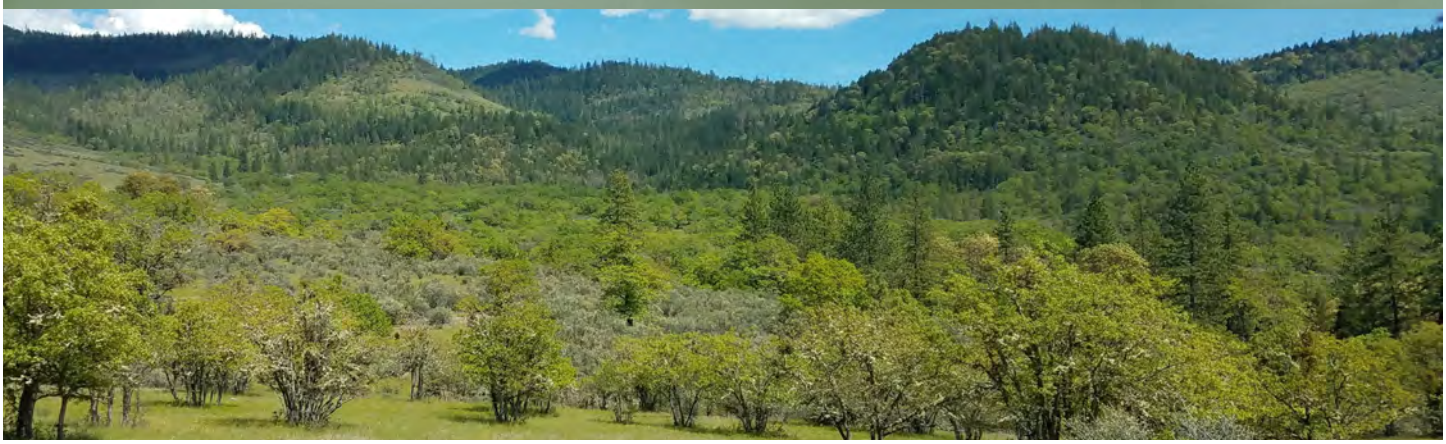
Executive Summary



Oak savannah in the foreground and oak chaparral in the background by KBO

This document provides quantitative and multi-scaled population and habitat objectives for 26 focal and seven imperiled bird species in prairie, oak, and riparian habitats in the Puget Lowlands, Willamette Valley, and Klamath Mountains ecoregions of western Oregon and Washington. It represents the collective efforts of individuals from multiple agencies and organizations within the Oregon-Washington chapter of Partners in Flight.

Recognition and implementation of objectives presented here will support recovery of significantly depleted populations, direct conservation for the array of desired bird-habitat conditions in the three priority habitats, and promote the long-term persistence of healthy populations of native bird species well-distributed across their historic range. Conservation partners are encouraged to use the population and habitat objectives as a numerical context to stimulate and gauge the local and regional perspective of their conservation actions.

Recommendations included in this document are intended to guide planning efforts and management actions of land managers, direct expenditures of government and non-government organizations, and stimulate monitoring and research to support landbird conservation. The recommendations are also expected to be the biological foundation for developing and implementing integrated conservation strategies for multiple species at multiple geographic scales to ensure functional ecosystems with healthy bird populations.

Birds as Indicators

A conservation planning framework that applies what we know about birds as indicators of habitat structure and composition can inform landscape-level planning and site-level restoration. Such planning strives to achieve ecological restoration goals that benefit entire systems. The Partners in Flight conservation planning process uses birds as indicators of habitat components and determines current and desired conditions, recommends prescription components, and implements monitoring to measure treatment effectiveness. Birds are considered excellent indicators of ecosystem health because they respond relatively quickly to habitat change, individual focal species are sensitive to environmental variation at multiple trophic levels and at multiple spatial scales, and as a community, birds are relatively easy and cost -effective to monitor.

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 habitats that are conservation priorities for landbirds.

- Identify desired habitat attributes for landbirds within the priority habitats.
- Identify species representative of priority habitats and desired habitat attributes (i.e., focal species).
- Supplement the focal species list with imperiled species that would benefit from habitat conservation for focal species.
- Establish measurable habitat objectives to achieve the desired habitat conditions based on the habitat associations of focal species.
- Establish measurable population objectives for focal species to be used as one metric for tracking habitat management for the desired habitat attributes.
- Recommend habitat conservation strategies that can be implemented to achieve the habitat and population objectives.
- Conduct monitoring and research to assess habitat and focal species response to conservation strategies and progress towards the habitat and population objectives.
- Implement adaptive management as appropriate to adjust habitat conservation strategies or habitat and population objectives.

The conceptual approach used here emphasizes conservation of both representative (focal) species and vulnerable (imperiled) species within a hierarchical and nested framework – in other words, both coarse-filter and fine-filter objectives. The objectives for focal species include site-level objectives for species densities and habitat conditions that represent moderate or good quality breeding habitat. The objectives for imperiled species include these, and additionally 10-year ecoregional objectives for the number of birds and amount of habitat, and subregional objectives for the size, number, and distribution of subpopulations and habitat areas. Implementation of the process described above should also result in accomplishment of our secondary goal to help prevent 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, and other biodiversity as well.

The Environment

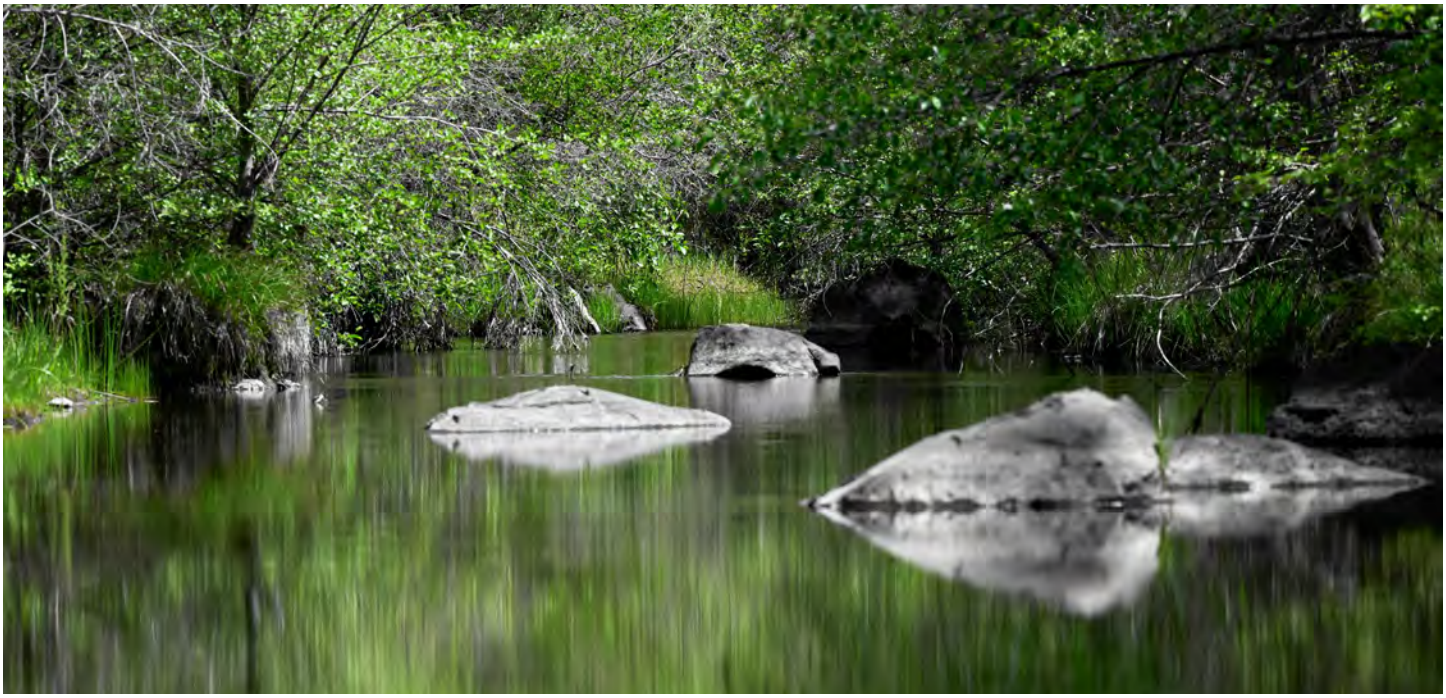
The Northern Pacific Rainforest Bird Conservation Region (BCR 5) within the geographic scope of this document is a coastal linear area of mountains and intermontane valleys covering western Oregon and Washington (the portion of BCR 5 that extends north into British Columbia and Alaska and south into California is not covered in this document). The prairie, oak, and riparian habitats in BCR 5 occur within a series of lowland valleys and foothills distributed on a north-south axis and set within a landscape of primarily coniferous forest.

The Birds

There are approximately 100 regularly breeding landbird species in prairie, oak, and riparian habitats in the Puget Lowlands, Willamette Valley, and Klamath Mountains ecoregions. There are two endemic subspecies unique to this geography: Streaked Horned Lark and Oregon Vesper Sparrow. There are many other bird species unique to this part of Oregon and Washington, including several that are restricted to the southern part of the region (i.e., Klamath Mountains) as the northernmost extent of their range. Among 33 focal and imperiled landbird species highly associated with these habitat types, 20 species are experiencing significant long-term declining population trends in at least one of the ecoregions, or across the entirety of BCR 5.

The Conservation Issues

Landbird conservation in prairie, oak, and riparian habitat faces numerous challenges, most of which are either directly or indirectly associated with an expanding human footprint on the landscape. The primary consequence is profound habitat loss and degradation, due to habitat conversion for urbanization or agriculture, or extensive alteration of natural ecological processes that historically maintained these habitats. For instance, fire suppression has contributed to encroachment of



Jenny Creek in the Rogue Basin by Frank Lospalluto

conifers, particularly Douglas-fir, into open prairies and oak savannahs and woodlands, and in some areas has limited recruitment of young oaks. In riparian areas, flood control and dams have altered the natural hydrology that maintained early successional floodplain habitat, and other human impacts such as irrigation systems, channelizing waterways, drain tiling, wetland draining, fertilizer run -off, and use of pesticides and herbicides are major challenges. Grazing regimes incompatible with conservation goals and invasion by exotic plant species affect all three habitat types.

Priority Habitats

Three habitat types within the lowlands and valleys of western Oregon and Washington are considered priority habitats by Partners in Flight and several of its member state and federal agencies:

- Prairie (grasslands and all herbaceous-dominated habitats, including croplands and pastures that provide some habitat value to certain bird species),
- Oak (from oak savannahs to mixed-oak conifer forests, including oak-chaparral), and
- Riparian (woodlands and shrublands).

Focal, Imperiled, and Priority Species

Our strategy for achieving functioning ecosystems for landbirds is described through the habitat requirements of 26 focal species and seven imperiled species. By managing for a suite of focal species representative of important habitat components, many other species and processes that maintain biodiversity will also be conserved. The following landbird focal species were selected based on their degree of breeding season association with important habitat attributes in prairie, oak, and riparian ecosystems of western Oregon and Washington (Table 1).

Imperiled landbird species were selected based on a population estimate of <2,000 individuals in one or more of the Puget Lowlands, Willamette Valley, or Klamath Mountains ecoregions (or <1,000 birds in a subregion), evidence of being historically more abundant than current population estimates, and a high degree of association with prairie, oak, or riparian ecosystems in these areas (Table 2). Priority species are those designated as species of conservation concern by primary conservation partners (e.g., federal or state agencies, national Partners in Flight); focal and imperiled species can be additionally considered priority species.

Table 1. Focal landbird species and their associations with habitat attributes of prairie, oak, and riparian habitats in western Oregon and Washington. Focal species may additionally be considered priority species (P = Priority) if they are designated as species of conservation concern by primary conservation partners. Note that some species are not present in all three ecoregions. Gray-scale shading indicates absence or limited degree of occurrence in an ecoregion or subregion; see details in footnotes. In rare cases, two focal species are presented for one habitat attribute in the same habitat subtype because different focal species are more appropriate in different ecoregions.

Habitat Subtype	Habitat Attribute	Focal Species	Ecoregion/Subregion					
			Puget Lowlands		Willamette Valley		Klamath Mountains	
			North	South	North	South	Umpqua Valley	Rogue Basin
PRAIRIE								
Dry and Wet Prairie	large habitat patches	Savannah Sparrow	√	√	√	√	√	√
OAK								
Oak Savannah or Open Woodland	low-statured herbaceous ground cover	Chipping Sparrow P	√	√	√	√	√	√
	moderate and patchy shrub cover	Lazuli Bunting		√	√	√	√	√
	large mature trees	California Scrub-Jay	√	√	√	√	√	√
Oak Closed Woodland or Forest	large mature trees	Acorn Woodpecker P			√	√	√	√
	canopy edges and openings	Western Wood-Pewee	√	√	√	√	√	√
	moderate to high canopy and subcanopy cover	Purple Finch P	√	√	√	√	√	√
	moderate shrub cover with open canopy trees	House Wren	√	√	√	√	√	√
	moderate subcanopy or shrub cover	Oak Titmouse P						√
	moderate subcanopy or shrub cover	Bushtit	√	√	√	√	√	√
Oak-Pine	moderate to high canopy and subcanopy cover	Cassin's Vireo				√	√	√
Oak-Hardwood	moderate subcanopy or shrub cover	Hutton's Vireo	√	√	√	√	√	√
Oak-Chaparral	dense shrub cover with herbaceous openings	California Towhee						√
	moderate to high shrub cover	Blue-gray Gnatcatcher						√
RIPARIAN								
Open Floodplain	interspersion of bare ground and herbaceous vegetation	Spotted Sandpiper	√	√	√	√	√	√
Riparian Shrubland	early successional	Song Sparrow	√	√	√	√	√	√
	moderate to high shrub cover	Willow Flycatcher P	√	√	√	√		
	moderate to high shrub cover	Yellow-breasted Chat P					√	√
Riparian Open Woodland	cavities in snags or decadent limbs	Black-capped Chickadee	√	√	√	√	√	√
	large mature trees	Bullock's Oriole	√	√	√	√	√	√
	scattered shrubs with herbaceous openings	Spotted Towhee	√	√	√	√	√	√
Riparian Closed Woodland or Forest	moderate to high subcanopy and shrub cover	Yellow Warbler	√	√	√	√	√	√
	cavities in snags or decadent limbs	Downy Woodpecker	√	√	√	√	√	√
	mixed hardwood and conifer trees	Black-headed Grosbeak	√	√	√	√	√	√
	flowering plants	Rufous Hummingbird P	√	√	√	√	√	√
	moderate to high shrub cover	Bewick's Wren	√	√	√	√	√	√

√ species suggested as focal species to be used in planning, implementation, and monitoring.

Light Gray species is limited as a breeding species in this subregion (i.e., local or low breeding densities), and may not be useful as a focal species. Consider other potential focal species for this habitat attribute (e.g., species to benefit [Appendix A], imperiled species in subregions where not imperiled) if needed.

Dark Gray species does not regularly breed in this subregion in this habitat type; use other potential focal species for this habitat attribute (e.g., species to benefit [Appendix A], imperiled species in subregions where not imperiled).

Black habitat type is absent or limited and local in occurrence in this subregion.

Oak woodland with camas lilies by KBO

Table 2. Imperiled landbird species and their associations with habitat attributes of prairie, oak, and riparian habitats in western Oregon and Washington. Species marked with a √ are considered imperiled in that geography (i.e., current population <2,000 birds in an ecoregion or <1,000 birds in a subregion and reduced from historic levels as common or abundant) or are extirpated as regularly occurring breeders, and have a high degree of association with these habitat types. Imperiled species may additionally be considered priority species (P = Priority) if they are designated as species of conservation concern by primary conservation partners. Note that some species are not present or not considered imperiled in all subregions (see footnotes).

Imperiled Species	Ecoregion/Subregion						Habitat Type(s)	Desired Habitat Condition(s)
	Puget Lowlands		Willamette Valley		Klamath Mountains			
	North	South	North	South	Umpqua Valley	Rogue Basin		
Horned Lark (Streaked) P	√	√	√	√	√*	√*	Prairie	*large, open landscapes with low-statured and sparse vegetation*
Vesper Sparrow (Oregon) P	√	√	√	√		√	Prairie and Oak Savannah	*low to moderate statured vegetation and scattered woody cover*
Western Meadowlark P	√	√					Prairie and Oak Savannah	*large areas with diverse herbaceous structure*
Lark Sparrow					√	√	Prairie and Oak Savannah	*low to moderate statured vegetation and scattered woody cover*
Western Bluebird P	√	√					Prairie, Oak Savannah, and Open Woodland	*cavities in trees with open access and low-statured herbaceous vegetation*
White-breasted Nuthatch (Slender-billed) P		√					Oak Savannah, Open or Closed Woodland, and Forest	*mature oak trees or snags with cavities*
Lewis's Woodpecker P	√	√	√	√	√	√	Oak Savannah, Open Woodland, and Riparian	*large, old trees with cavities or soft areas for excavation*

*We follow the USFWS Recovery Plan for Streaked Horned Lark (USFWS 2019), and do not provide population objectives for the Klamath Mountains ecoregion.

Green	present as a regularly occurring breeding species in this subregion; did not meet definition of imperiled.
Dark Gray	not present as a regularly occurring breeding species in this subregion, but was present historically (i.e., extirpated).
Black	was never present as a regularly occurring breeding species, or was not historically common and abundant, in this subregion (i.e., outside of range).

Biological Objectives and Conservation Strategies

Quantitative population and habitat objectives (collectively referred to as biological objectives) are the cornerstone of this document. Biological objectives are not regulatory, nor do they represent the policies of any agency or organization. Quantitative biological objectives serve several purposes:

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

The types of biological objectives presented include:

- ecoregional habitat objectives for each priority habitat type,
- ecoregional and subregional population and habitat objectives for imperiled species, and
- site-scale population and habitat objectives for focal and imperiled species.

Yellow Warbler by James Livaudais

Implementation

Because of the diversity of landbird species and habitats in the lowlands and valleys of western Oregon and Washington, conservation will require a complex array of conditions within variable landscape patterns. Implementation of landbird conservation as described in this document will require conservation actions that are:

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

Implementation 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 can be achieved by incorporating a wide range of habitat management and restoration activities within working landscapes (e.g., forestry, agriculture, grazing, recreational). Thus, implementation will 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 should be used as the foundation for the bird conservation part of comprehensive, integrated, landscape designs for conservation of all natural resources.

This document encourages habitat management for all focal species. However, for those making decisions on allocation of resources at regional scales, the highest priorities for landbird conservation in the three priority habitats are as follows:

- Seek to maintain “no net loss” of prairie, oak, and riparian habitats (i.e., mitigate habitat losses with equal or greater restoration efforts).
- Maintain or provide moderate to high quality prairie habitat in areas >80 ha (200 ac).

- Seek opportunities to manage all or portions of non-native grasslands (e.g., pastures, agricultural fields, open spaces) for grassland bird species without compromising population health (e.g., population sinks, ecological traps).
- Maintain or provide moderate to high quality oak habitats in areas >16 ha (40 ac).
- Retain all oak trees >50 cm (20 in) diameter at breast height (DBH), regardless of landscape context.
- Maintain or provide contiguous riparian woodlands or shrublands in areas >20 ha (50 ac).
- At the subregion level, maintain or provide >30% of the historical extent of riparian habitat within each major watershed.
- Maintain riparian corridor width >30 m (100 ft).

Monitoring, Research, and Adaptive Management

When habitat management actions are implemented as described in this document, monitoring and/or research programs should be designed and executed to:

- test the effectiveness of the actions on bird populations,
- evaluate assumptions built into biological objectives, and
- direct adaptive management to improve desired results.

The direct outgrowth of monitoring and research conducted to support the recommendations in this document should be adaptive management.

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 as necessary and advance the effectiveness of conservation actions.

Western Wood-Pewee by Frank Lospalluto

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Introduction to Landbird Conservation

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 1990, Partners in Flight (PIF; www.partnersinflight.org) was conceived as a voluntary, international coalition of government agencies, conservation groups, academic institutions, private organizations, and community members dedicated to "keeping common birds common" and "reversing the downward trends of declining bird 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 1994a, 1994b), 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 that 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.

Bird Conservation Regions (BCRs) are the ecological units that have been identified through NABCI for the delivery and tracking of bird conservation (Sidebar: *Bird Conservation Regions*). There are 67 BCRs within North America and Hawai'i (NABCI 2000), including the Northern Pacific Rainforest Bird Conservation Region (BCR 5) which encompasses the geographic scope of this document (Figure 1).

Figure 1. Northern Pacific Rainforest Bird Conservation Region (BCR 5) with Puget Lowlands, Willamette Valley, and Klamath Mountains ecoregions. Dashed lines mark approximate subregion boundaries.

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 (www.nabci-us.org/bcrs.html).

Migratory Bird Joint Ventures

Under the vision of NABCI, Migratory Bird Joint Venture partnerships are 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 currently 22 habitat Joint Venture partnerships within North America, including the Pacific Birds Habitat Joint Venture (Pacific Birds; www.pacificbirds.org), which encompasses the geographic scope of this document. The focus of Pacific Birds is on empowering partnerships to enhance delivery of science-based habitat conservation. The United States portion of Pacific Birds, created in 1991, prepared a Strategic Plan in 1993 that covered wetland habitats in coastal areas of Washington, Oregon and a portion of northwestern California. The plan included habitat objectives for wetland habitats and population objectives for waterfowl, shorebirds, and colonial waterbirds that were subjective and based on professional judgment. Geographic expansion of Pacific Birds resulted in the development of new Strategic Plans for southeast Alaska (2003), the Willamette Valley of Oregon (2004), coastal northern California (2004), Hawai'i (2005), and the North Puget Lowlands (2013) – all focused on waterfowl, shorebird, and/or wading bird conservation in wetland habitats with limited or no development of quantitative objectives for other species or habitats. One notable exception is the Puget Lowlands plan (Altman 2010), which includes quantitative habitat and population objectives for landbirds in priority upland and riparian habitats in the Puget Lowlands ecoregion.

In recent years, with the emergence of the North American Bird Conservation Initiative, Joint Ventures are being viewed as an important delivery mechanism for the conservation of all birds and their associated habitats. Currently the Pacific Birds partnership is advancing landbird conservation consistent with this document through its oak and prairie conservation initiative. Additionally, there has been an increased emphasis on strengthening the science of the biological foundations on which the Joint Ventures deliver conservation. This document supports those objectives and meets the comprehensive content technical expectations for population objectives and habitat objectives in the desired characteristics for Habitat Joint Venture Partnerships put forth by PIF (Andres et al. 2020).

Ash-throated Flycatcher by Frank Lospalluto

Purpose and Scope

Purpose

The population and habitat objectives presented herein are the first attempt of Oregon-Washington PIF and Pacific Birds to develop quantitative population and habitat objectives to support and direct actions for landbird conservation in prairie, oak, and riparian habitats in western Oregon and Washington.

This document is intended to support both the development of conservation or management plans and the implementation of on-the-ground habitat management or restoration activities that have the potential to benefit breeding landbird populations. 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 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 this document. The assumption is 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.

While it is beyond the scope of this document to discuss how to integrate bird conservation with other management objectives, this document provides those interested in bird conservation with information and recommendations to integrate into their planning processes.

Specifically, it provides:

- Landbird species and habitat attributes that should be emphasized for conservation, and
- Quantitative, spatially explicit, and measurable objectives to support conservation of those landbird species, habitat attributes, and the ecosystems in which they occur.

Oak savannah in the Willamette Valley by Bruce Taylor

Geographic Scope

The geographic scope of this document includes three Level III ecoregions (Omernik 1987) within the Northern Pacific Rainforest Bird Conservation Region (BCR 5) in the United States – Puget Lowlands, Willamette Valley, and Klamath Mountains (Figure 1). It does not include the Coast Ranges and Cascade Mountains ecoregions of western Oregon and Washington which is the focus of another Oregon-Washington PIF planning effort (Altman and Alexander 2012). Within each of the three ecoregions, there are subregions that provide opportunities for establishing biological objectives at smaller geographic scales (Table 3).

Table 3. Ecoregions and subregions for establishing population and habitat objectives within the Puget Lowlands, Willamette Valley, and Klamath Mountains ecoregions of Oregon and Washington.

Ecoregion	Subregion	General Location
Puget Lowlands, WA	North Puget Sound	north of Seattle
	South Puget Sound	south of Seattle
Willamette Valley, OR	North Valley	north of Salem
	South Valley	Salem to Roseburg
Klamath Mountains, OR	Umpqua Valley	Roseburg to Canyonville
	Rogue Basin	south of Canyonville

Version 2.0

This document is an update of *Conservation Strategy for Landbirds in the Lowlands and Valleys of Western Oregon and Washington* (Altman 2000). 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, the biological objectives and habitat attributes for focal species are updated based on the most recent available data. We also continue to lead conservation planning innovation by adding a progressive approach that provides objectives for site -level target densities for focal and imperiled species, as well as for the size, number, distribution, and population growth rate (i.e., lambda) for subpopulations of imperiled species. 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 and validate 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), significant advancement in knowledge of limiting factors that influence landbird species demographics (Sidebar: *Vital Rates of North American Landbirds*), and the

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.VitalRatesOfNorthAmerican Landbirds.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. These analyses 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 a population was most strongly affected by factors acting on the breeding or wintering grounds. Results are presented 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 use and value of this information on productivity, survivorship, and recruitment is to enable a deeper understanding of the causes of population change, which will enable conservationists to more effectively target conservation actions to the times and places in the annual cycle where they will do the most good.

emerging recognition of the importance of full life cycle conservation for migratory birds (Berlanga et al. 2010). Additionally, the PIF North American Landbird Conservation Plan (i.e., Continental Plan) was completed for the United States and Canada with the first attempt to establish continental population estimates and population objectives for landbird species (Rich et al. 2004). A follow-up document that included Mexico (i.e., the 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).

Integration with Other Regional 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, subregional, site). The use and implementation of these recommendations can be done independently for landbird-specific conservation, or complementarily within the context of broader conservation goals to support and strengthen other plans. Examples of other efforts that apply to multiple ecoregions within this document include:

- *Partners in Flight North American Landbird Conservation Plan* (Rich et al. 2004) and the updated *Partners in Flight Landbird Conservation Plan* (Rosenberg et al. 2016).

- PIF landbird conservation plans for Washington and Oregon, which use focal species to emphasize conservation of important components of the habitat type (e.g., Altman 2000).

- The Nature Conservancy's *Willamette Valley, Puget Trough, and Georgia Basin Ecoregional Assessment* (Floberg et al. 2004) and *Klamath Mountains Ecoregional Conservation Assessment* (Vander Schaaf et al. 2004), which established biological objectives for imperiled species, communities, and ecological systems. It also provides a portfolio of finer-scaled, spatially explicit priority conservation areas, although for broader conservation goals than landbirds alone.

- Species prioritization in various plans and strategies of partners in bird conservation including USFWS Birds of Conservation Concern (USFWS 2021), and state wildlife agencies' Species of Greatest Conservation Need (WDFW 2015, ODFW 2016).

- A more spatially explicit aspect of landbird conservation has been partially addressed by the Important Bird Areas program of State Audubon chapters (e.g., wa.audubon.org/conservation/important-bird-areas).

- *The Land Manager's Guide to Bird Habitat and Populations in Oak Ecosystems of the Pacific Northwest* (Altman and Stephens 2012) is intended to provide land managers with information on oak-associated bird species' population status, distribution, density, habitat needs, and potential responses to restoration actions, in order to facilitate sound decisions to support oak bird conservation.

- OakBirdPop (https://avianknowledge northwest.net/dsts/interactive-tools) serves as an interactive supplement to the above guide (Altman et al. 2017b). It is an online tool to inform planning and implementation of oak habitat management and restoration actions and to help assess the projected population response of 31 oak-associated bird species to oak habitat changes.

- *Prairie, Oaks, and People: a conservation business plan to revitalize the prairie-oak habitats of the Pacific Northwest* (Altman et al. 2017a) seeks to create the economic, social, and political climate to fund and support the interventions necessary to preserve and enhance prairie-oak habitat and the species that rely on it throughout the Pacific Northwest for the use and enjoyment of future generations. With this overarching strategic framework, the business plan presents

the case for a 10- to 15-year investment strategy for prairie-oak conservation.

- U.S. Fish and Wildlife Service's draft *Recovery Plan for the Streaked Horned Lark (Eremophila alpestris strigata)* includes specific goals, objectives, and criteria that should be met to remove the species from the Federal List of Endangered and Threatened Wildlife (USFWS 2019).

One additional conservation plan is relevant to the Puget Lowlands ecoregion:

- *Habitat and population objectives for landbirds in priority upland and riparian habitats in the Puget Lowlands ecoregion* (Altman 2010) provides quantitative habitat and population objectives for this geography.

Several additional efforts are applicable to the Willamette Valley ecoregion:

- *The Willamette Valley Conservation Study: Strategic Habitat Conservation in Oregon's Willamette Valley* (USFWS 2017), in which the USFWS under the America's Great Outdoors Initiative is identifying spatially explicit Priority Conservation Areas using data from birds and other taxa to meet regional population objectives for imperiled wildlife.

- *The Willamette Valley Oak and Prairie Cooperative Strategic Action Plan* (WVOPC 2020) describes steps to achieve a long-term vision to conserve and maintain prairie and oak habitats within the Willamette Valley ecoregion through a regionally-focused, collaborative, and sustainable program.

- *The Intertwine Alliance Oak and Prairie Working Group Strategic Action Plan* (Intertwine Alliance 2018) serves as a guide to address the need for better science, stewardship, restoration, and education to improve the ecological future of oak and prairie habitats in the greater Portland-Vancouver, WA, region.

Oak savannah overlooking Emigrant Lake in the Rogue Basin by KBO

Several planning documents are applicable to the Klamath Mountains ecoregion:

- *Restoring Oak Habitats in Southern Oregon and Northern California: A Guide for Private Landowners* aims to provide easily digestible guidelines for landowners to apply best conservation practices for oak habitats on their private lands, and to direct conservation-minded landowners to supplemental resources (KBO and LRP 2020).
- *The Klamath Siskiyou Oak Network Strategic Conservation Action Plan* serves as a road map for achieving continued and accelerated oak woodland conservation on private and public lands in southern Oregon and northern California for the benefit of all native species associated with deciduous oak ecosystems (Alexander et al. 2020). There is a companion summary available that introduces the fundamentals of the plan and describes and summarizes the major components, identifying how the plan can be used to implement oak woodland conservation strategies in an adaptive management framework.
- *The Riparian Bird Conservation Plan: A strategy for reversing the decline of riparian-associated birds in California* is focused on California, but many elements are also applicable to the Klamath Mountains ecoregion (RHJV 2004).

The biological objectives and conservation strategies described in this document provide a biological foundation for landbirds that can be

Large oak with spreading limbs by Bob Altman

Implementation efforts to support functioning ecosystems for the region's diverse array of landbird species. Where available, this can be complemented with spatially explicit guidance for landbird conservation from the aforementioned plans and others that provide these types of recommendations.

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, and
- to comparatively assess how alternatives in environmental analyses meet conservation objectives at multiple scales.

Birds and Habitats

Prairie, oak, and riparian are priority habitats for landbirds in the three ecoregions based on their prioritization in other conservation plans (e.g., Altman 2000, Floberg et al. 2004, WDFW 2008, WDFW 2015, ODFW 2016), importance to one or more priority species (WDFW 2015, ODFW 2016, ISSSSP 2020, USFWS 2021), and/or loss, alteration, and current condition of the habitat relative to that of historic conditions. Note that chaparral habitat, present only in the Klamath Mountains ecoregion, is considered part of oak habitats. The conservation emphasis here is native landbird species that regularly breed in and are highly associated with these three habitat types. Because breeding bird species occur in all habitats and conditions that support non-breeding bird species, the assumption is that habitat management for breeding birds will likely support most, if not all, of the habitat needs of non-breeding birds in these habitat types.

An essential component for establishing biological objectives and recommending appropriate habitat strategies to support the biological objectives is an

Riparian vegetation and gravel bar by Ian Ausprey

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 state-level 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.

Although only the conservation of landbirds during the breeding season is emphasized, factors that operate outside of the breeding season may adversely affect their populations. This may be particularly true for migratory birds subject to habitat change 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 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).

Full Life Cycle Stewardship of Migratory Birds

Conservation of migratory birds requires actions that provide habitat and ensure 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 if birds arrive later in the spring (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 up to 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 migration routes for most species or the hazards they face along the way, 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, including breeding, migration and winter – has become an essential component of landbird conservation (Marra et al. 2011).

The Environment

Ecoregions

The Northern Pacific Rainforest BCR within the geographic scope of this document is a coastal linear area of mountains and intermontane valleys covering western Oregon and Washington (the portions of BCR 5 that extend north into British Columbia and Alaska, and south into northern California, are not covered in this document). The prairie, oak, and riparian habitats in BCR 5 occur within a series of north-south distributed lowland valleys and foothills amid coniferous forests.

The information presented below is a cursory overview of the principal features of the environment and vegetation with an emphasis on the habitat provided for landbirds.

Puget Lowlands

The Puget Lowlands is a low elevation glacial trough of approximately 17,612 km^2 (6,800 mi^2) bounded by the Olympic Mountains to the west and the Cascade Mountains to the east and extending from the Canadian border to the Willamette Valley of southwestern Washington (Figure 1). The northern portion is a glaciated depression, much of which is now under water (Puget Sound). The southern portion is largely the Cowlitz River Valley and the upper basin of the Chehalis River.

Willamette Valley

The Willamette Valley is a low elevation, broad alluvial plain of approximately 9,065 km^2 (3,500 mi^2) in northwestern Oregon (Figure 1). It is bound by mountain ranges on three sides and the Columbia River on the north. The mountain ranges include the Coast Range to the west, Cascade Mountains to the east, and Calapooya Mountains to the south. The drainage system is dominated by the northward flowing Willamette River for approximately 300 river km (187 mi).

Klamath Mountains

The Klamath Mountains includes approximately 48,433 km^2 (18,700 mi^2) across the Klamath and Siskiyou Mountains of southwestern Oregon and northern California (Figure 1). The Rogue and Umpqua Valleys in Oregon are interior valleys and rolling foothills embedded within several mountain ranges that transition between the mesic lowlands of the Willamette Valley and the xeric interior valleys of northern California. This region extends into northwestern California, but that geography is not within the scope of this document.

Vegetation

Pre-European settlement vegetation of this region's lowlands and valleys was a mosaic of prairies, savannahs, oak woodlands and forest, chaparral (Klamath Mountains only), riparian forest and shrublands, wetlands, and patches of coniferous forest (Habeck 1961, Franklin and Dyrness 1973, Towle 1974). The mosaic of prairie, savannah, and oak habitats was maintained by periodic natural fires and fires set by Native Americans (Johannessen et al. 1971, Alexander et al. 2020).

Prairie habitat in the Umpqua Valley by Bob Altman

Large oak tree in fall in the Rogue Basin by Frank Lospalluto

Wet prairies are seasonally flooded ecosystems that occur primarily on poorly drained soils at low elevations (Wilson 1998), especially in the southern half of the Willamette Valley. Common species are tufted hairgrass, camas, rushes, and sedges. Dry prairies occur on better drained soils in the valley lowlands and particularly along valley margins (Wilson et al. 1995). They are dominated by perennial grasses and forbs with diagnostic species including Idaho fescue, California oatgrass, Lemmon's needlegrass, and red fescue.

Savannah includes the same dry prairie herbaceous vegetation with singular widely spaced trees or small, open tree groves, usually Oregon white oak with wide spreading canopies, but in some areas ponderosa pine or Douglas-fir. Tree canopy cover is generally <25% (Agee 1993, Larsen and Morgan 1998), and the understory – where still dominated by native plants – is comprised of grasses and forbs such as Roemer's fescue, blue wildrye, and California oatgrass. Periodic fire, the degree of seasonal flooding, and local variation in soils likely created a mosaic of vegetation and successional conditions within native grasslands (Altman et al. 2001). Perennial bunchgrasses dominate native sites (Agee 1993), but exotic annual grasses are prevalent in many remnant grasslands (Sugihara et al. 1987, Franklin and Dyrness 1973).

Oak woodlands and forest are characterized by a canopy of Oregon white oak mixed with California black oak in the Klamath Mountains and southern part of the Willamette Valley (Altman and Stephens 2012). Bigleaf maple, Douglas-fir, and Pacific madrone are other canopy associates (Franklin and Dyrness 1973). Understory species composition is dominated by poison oak, California hazel, snowberry, oceanspray, serviceberry, and sword fern (Franklin and Dyrness 1973). Historic distribution was generally limited to low elevation and relatively dry areas with limited conifer competition.

Chaparral includes medium to tall shrublands that range from closed canopy to widely spaced shrubs with an herbaceous understory, depending on the fire history. Valley chaparral is the northernmost extension of the California chaparral types, and generally occurs below 1,000 m (3,280 ft) in elevation. Primary species include wedgeleaf ceanothus and whiteleaf manzanita (Detling 1961), and a scattered component of a scrub form of Oregon white oak. A higher elevation chaparral type with different species composition occurs between 1,100-2,100 m (3,600-6,900 ft) on south-facing slopes of the Siskiyou Mountains in the Klamath River drainage. This montane chaparral is dominated by greenleaf manzanita, snowbrush, and chinquapin, and is not addressed in this document.

Riparian zones include primarily the woody vegetative structure (i.e., shrubs and trees) that occurs at the interface with bodies of water (e.g., streamside or lakeside) or in association with wet meadows and wetlands. Riparian woodland and shrub communities are dominated by deciduous canopies of pure or mixed stands of willow, Oregon ash, and black cottonwood (Titus et al. 1996), with red alder, bigleaf maple, and a conifer component of western redcedar, Douglas-fir, and grand fir significant in some lowland areas. Understory dominants typically include red-osier dogwood, snowberry, Nootka rose, and Pacific ninebark, depending on factors such as soil type, deposition, and hydrology.

Riparian habitat in the Puget Lowlands by Rod Gilbert

Conservation Issues and Opportunities

Land Ownership and Use

Native Americans have lived in this region for at least 10,000 years. Historically, aboriginal fire was an essential component of the ecological processes that maintained oak and prairie ecosystems (Lewis 1990, 1993; LaLande and Pullen 1999; Alexander et al. 2020). Native American burning practices favored more open oak savannahs and woodlands over mixed conifer habitats (Cole 1977, Blackburn and Anderson 1993), and were commonly used to manage for desired oak habitat conditions and traditional food resources (Boyd 1999, WVOPC 2020). Tribes have a cultural knowledge of these habitats, and traditional ecological knowledge is an important source of information for planning restoration and land management actions.

Current land ownership has a highly variable and significant influence on landbird populations that exacerbates the issues of habitat loss and degradation. For example, in the Puget Lowlands, approximately 64% of the oak habitat is on private land, and nearly all the public land oak habitat is on one site, Joint Base Lewis McChord (Crawford and Hall 1997, Altman 2010). Land ownership in the Willamette Valley is approximately 93% private (WVOPC 2020). Conversely, 83% of the Klamath Mountains ecoregion is managed by the federal government (Sleeter and Calzia 2014). Both of these extremes represent unique challenges for landbird conservation. In the former, it is problematic to achieve landscape-scale conservation to attain meaningful population-level increases in bird populations. In the latter, it is essential, yet challenging, to institutionalize broad-scale policy or guidelines for implementation across large areas. Unique strategies are needed to address opportunities specific to different land ownerships. While outside the purview of this document, the population and habitat objectives could be integrated with other planning processes to inform policies and regulations that will be necessary to support landbird conservation.

Current primary land uses in the three priority habitats include developed areas associated with human settlement, especially in oak and riparian habitats, and various types of agriculture in grassland habitats.

The Willamette Valley supports most of Oregon's economic activity including extensive agricultural, industrial, and recreational activities, and a forecast of significant human population growth (WVOPC 2020). Agricultural activities occur throughout the valley, but are dominant in the central and southern valley. Land use in the Puget Lowlands is similar to the Willamette Valley, but less dominated by large areas of monoculture (e.g., grass-seed fields), and with more diversification in agriculture types and smaller areas of coverage. While 82% of Douglas County is

coniferous forest managed for timber, not many of these lands are in the Umpqua Valley bottomlands. Douglas County produces more sheep and cattle than any other western Oregon county, and the principal land use in the Umpqua Valley is livestock pasture (Douglas County 2017). Private land use in the Klamath Mountains is mixed, and includes forest management, agriculture, and rural development (Alexander et al. 2020). The Rogue Valley is more diverse agriculturally, with extensive fruit production (i.e., orchards) in addition to livestock grazing.

Habitat Loss and Degradation

Historic and ongoing challenges affect landbird conservation in prairie, oak, and riparian habitats. Today, habitat loss is largely associated with an expanding human footprint on the landscape of the Puget Lowlands, Willamette Valley, and Klamath Mountains ecoregions. Habitat degradation has resulted from extensive alteration of ecological and historical cultural processes that formerly maintained these vegetative communities, such as fire and flooding (Altman et al. 2001).

Habitat losses have been profound from a historical perspective and continue in recent times (Sidebar: *Historic to Current Changes in Priority Habitats*). For example, the Willamette Valley is the fastest growing and most populated ecoregion in Oregon (Population Research Center 2019, WVOPC 2020). It includes approximately 70% of the state's population (Bonn et al. 1995), and the five largest cities (Population Research Center 2019). The Puget Lowlands has the highest percent of land cover change since 1973 (28.7%) of any ecoregion in the western United States (Sorenson 2014). Agricultural development, primarily for livestock grazing and cropland, has resulted in the conversion of many of these ecoregions' valley bottoms, including prairie, oak, and riparian habitats. Urbanization, especially in the Willamette Valley and Puget Lowlands, has also contributed to habitat loss and degradation. Recently, additional habitat conversion has taken place in valley bottoms of all three ecoregions for commercial timber, vineyards, and cannabis production. Conversion to vineyards, cannabis, and orchards was recently identified as one of the highest rated threats to oak habitats in the Klamath Mountains (Alexander et al. 2020). Further, these direct losses are compounded by negative effects of habitat fragmentation where remaining patches may be too small or isolated to provide ecologically functional habitat.

Conifer suppression of oak trees by Bob Altman

Cattle grazing in an oak savannah by Bob Altman

Historic to Current Changes in Priority Habitats

Prairie

The greatest change in priority habitats has been the near extirpation of native prairie and savannah habitat. In the Willamette Valley, native prairie and savannah has been reduced from the most abundant vegetative community (45%) to a few small, scattered parcels of semi-natural remnants amid farmland and urban and rural residential development. Current estimates are <1% of the historic extent of prairie and savannah habitats remain in this ecoregion (Christy et al. 1999).

In the Umpqua Valley, there has been a reduction in prairie, savannah, and oak woodland from 80% land cover historically to 31% cover currently (TNC and Krueger 2013). This includes a 64% loss of prairie/ savannah from 55% to 20% of the landscape.

In the Puget Lowlands and Klamath Mountains, prairies were a less significant part of the pre-European settlement landscape than in the Willamette Valley (approximately 10% and 11% of the landscape respectively (Crawford and Hall 1997, Hickman and Christy 2011). In the Puget Lowlands, prairie vegetation has been reduced by greater than 90% from pre-settlement conditions (Crawford and Hall 1997). In the Rogue and Umpqua valleys, no estimates of the extent of pre-European prairie habitat are available (Altman et al. 2001).

In addition to the negative aspects of habitat loss and conversion, there has been some expansion of suitable habitat for grassland birds through the creation of agricultural grassland habitat where prairies did not previously exist. Some grassland birds such as Western Meadowlark have been able to maintain populations in select types of agricultural grasslands.

Oak

Oak habitats have also experienced significant declines from their historic extent. In Washington on Joint Base Lewis McChord, which contains approximately 35% of the oak in the Puget Lowlands (Chappell et al. 2000), <35% of pre-settlement oak habitat remains (Public Forestry Foundation 1995). In the Willamette Valley, <10% of the historic oak woodlands and savannah remains (WVOPC 2020), including <1% of the pre-settlement oak savannah (Hulse et al. 2000). In the Umpqua Valley, there has been a 56% loss of oak habitat from 25% to 11% of the landscape (TNC and Krueger 2013).

Riparian

A large portion of riparian woodland and shrub communities in these ecoregions have also been lost (ODFW 2016). In the Willamette Valley, over 70% of the bottomland hardwood riparian forest habitat has been lost (Defenders of Wildlife 1988). Riparian forest and shrubland stands once 2-11 km (1-7 mi) wide along the Willamette River are now mostly less than a few hundred feet, with some just a narrow strip of trees. Detailed information regarding habitat loss is not available for the Puget Lowlands and Klamath Mountains, although these ecoregions have also suffered loss and degradation of riparian habitat (Altman 2000).

Dramatic changes to the structure and composition of oak and prairie ecosystems coincides with the forced removal of Native Americans and their land stewardship practices, and has been further exacerbated by European land management practices including fire suppression efforts that began in the 1850s (Skinner et al. 2006, Metlen et al. 2018). The loss of fire on the landscape has contributed to encroachment of conifers, particularly Douglas-fir, into oak savannahs and woodlands (Franklin and Dyrness 1973, Riegel et al. 1992, Fuchs 2001, Altman and Stephens 2012). Oak habitats that remain somewhat intact may be missing key ecological components. For instance, there has been a general loss of large, legacy oak trees due to increased competition from conifers, woody shrubs, and small oaks in the absence of fire, and when fires burn, fire severity can be unnaturally high. Overcrowded stands typically lack the structurally diverse traits (e.g., extensive branching, large lateral limbs, many cavities) and microhabitat features required by many oak-associated wildlife species. Over time, without disturbance, oak habitats typically succeed to conifer forest except in the driest areas where conifers do not survive well. Oak habitats are also suffering from a lack of recruitment of young trees in many areas. Causes include fire suppression and lack of fire-stimulated sprouting (Riegel et al. 1992, Agee 1993), reduced acorn production, and overgrazing by livestock and/or native ungulates (Altman and Stephens 2012).

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, Metlen et al. 2018), are informative for restoration prioritization and planning. Restoration must balance protecting and promoting oaks and associated habitat attributes and reducing unnatural fire severity through reduced fuel loads. In the Klamath Mountains, reduction of chaparral shrubs to reduce wildfire risk can pose its own threat to oak habitats.

Spotted Towhee by Frank Lospalluto

Most remaining riparian habitat has been highly altered due to human impacts like flood control, irrigation systems, drain tiling, channelizing waterways, wetland draining, invasive plant species, grazing, fertilizer runoff, use of pesticides and herbicides, intensive development of bottomlands for urbanization and agriculture, and remnants of past mining practices, such as large mine tailings piles that remain unvegetated in areas where riparian habitat should be. Hydrological diversions and loss of natural flooding regimes (e.g., dams) result in reduction of overall area of riparian habitat, loss of vertical stratification in riparian vegetation, and lack of recruitment of young cottonwoods, ash, willows, etc. Associated stream bank stabilization (e.g., riprap) narrows stream channels, reduces the flood zone, and reduces extent of riparian vegetation. Flood control has contributed to reducing the extent of wet prairies and altered a dynamic riparian system that provided young willow floodplain shrub habitat by allowing a forest community to develop in areas formerly maintained as early successional habitat by regular flooding. Stream dewatering and chemical applications from illegal marijuana cultivation have become important issues. Changes in fire regimes in riparian areas are less well-studied, but there is evidence that certain riparian corridors in the Klamath Mountains ecoregion burned with comparable frequencies to their associated upland areas (Messier et al. 2012).

Snags are an important structural and functional component of ecologically functional oak and riparian forests but are deficient in many habitat types. They are often removed for safety or fuel reduction reasons, especially on private property, but also during post-fire management on public lands. Many species of cavity-nesting birds rely on decadent limbs or snags for nesting, foraging, and roosting habitat.

While too many snags may indicate unhealthy conditions, a healthy forest always contains some amount of diseased, dying, and dead trees. Snags are deficient in many forest types, but especially in dry forests and on private lands.

Song Sparrow by Frank Lospalluto

Agriculture can have varying effects based on timing and extent. For example, mowing and haying may result in direct or indirect nest failure if the practice is implemented during the bird breeding season. Increased use of pesticide and herbicides associated with agricultural practices may reduce insect food base for many landbirds. Landscapes in proximity to agricultural and residential areas may have high densities of non-native competitive bird species (e.g., European Starling, House Sparrow), brood parasites (Brown-headed Cowbird), native (e.g., raccoons) and non-native (e.g., cats) predators, and be subject to high levels of human disturbance.

Grazing can functionally mimic natural disturbance, particularly in prairie habitats, but if not implemented appropriately can reduce habitat suitability. Livestock grazing in Oregon and Washington began shortly after European settlement and 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). Ecological effects are many and include soil compaction and reduced water infiltration, disruption of ecological succession, alteration of vegetation structure, 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). There have been extensive research and review papers on the effect of livestock grazing on bird abundance and populations across multiple habitat types (e.g., Bock et al. 1993, Saab et al. 1995, Tewksbury et al. 2002). Responses are often species-specific, but some grassland birds respond positively to certain grazing regimes (Saab et al. 1995). Studies of avian response to grazing in oak habitats are very uncommon; some suggest that appropriately implemented grazing can be compatible with bird conservation goals (e.g., Smythe and Haukos 2010), but more investigation is needed. However, any level of livestock grazing is potentially detrimental in riparian habitats, especially for species dependent on understory vegetation composition and structure (Kauffman et al. 1983, Krueper et al. 2003, Martin and McIntyre 2007, Earnst et al. 2012).

Emerald Ash Borer: An Emerging Threat

The emerald ash borer is an invasive beetle that arrived in Denver in 2013 and is predicted to reach Oregon in the next 5-10 years (City of Portland Environmental Services 2021). Its larvae and adults feed exclusively on ash tree species in the genus *Fraxinus*. In the eastern and midwestern U.S., it has been one of the most destructive forest pests to date and can kill nearly 100% of ash trees in invaded areas. Oregon ash is the only native ash found in our region, is common in riparian woodlands, and is susceptible to damage by emerald ash borers (ODF 2018). A future invasion could result in the loss of a substantial proportion of riparian canopy in areas with Oregon ash.

Finally, all three habitat types in this document have been affected by invasion with exotic plant species. Non-native plants, including exotic grasses like cheatgrass and meadow foxtail in prairies, Scotch broom and English hawthorn in oak habitats, or Himalayan blackberry and English ivy in riparian areas, have fundamentally altered many of our native ecosystems. English ivy can climb and kill trees, and dense thickets of Himalayan blackberry can prevent the germination of native trees and shrubs. Dominance of non-native grasses can change historic fire regimes, resulting in more frequent or severe wildfires (Brooks et al. 2004, Davies et al. 2021), which in turn can further promote transition to exotic annual grassland species (Allen-Diaz and Bartolome

1998, West 2000). Exotic plants may compete with native vegetation, prevent its establishment, and threaten to degrade habitat quality for native wildlife that are not adapted to them. In the eastern U.S., exotic plants have been found to host fewer insect food resources than native plants do (e.g., Narango et al. 2017), but this is not well-studied in the western habitat types in this document. Exotic insects may also present a threat to native habitats (Sidebar: *Emerald Ash Borer: An Emerging Threat*).

Climate Change

Western forest birds are predicted to fare better in a changing climate than birds in other habitats (Peterson 2003, NABCI 2010), although habitat specialists with small distributions and long-distance migrants are exceptions. Birds in prairie habitats show intermediate levels of vulnerability; more than half of grassland species continent-wide are expected to face pressure due to climate change, particularly drought, which may exacerbate current declines (NABCI 2010). Fire suppression and the resulting lack of natural fires with a diversity of intensities may be further exacerbated by climate change. Oaks are more fire-resilient and drought-tolerant than many other tree species (e.g., Nemens et al. 2019), but significant warming trends and a recent increase in the frequency of large, high-severity fires and annual acres burned (Westerling et al. 2006, Balch et al. 2018) will continue to affect lowland ecosystems of western Oregon and Washington (Mote et al. 2014).

Herein, there is no attempt to address the issue of climate change relative to the setting of biological objectives. For those interested in further investigation, there is a substantial and growing body of information on climate change with regards to these priority habitats and birds. For example, the Pacific Northwest Climate Change Avian Vulnerability Tool can be used to project future distributions of 26 bird species and a future conservation priority index in conifer, oak woodland, prairie, and riparian habitats (www.avianknowledgenorthwest.net/dsts/interactive-maps/pnw-models/). 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).

Lazuli Bunting by Frank Lospalluto

The Process

Conceptual Approach

The two primary goals for bird conservation under the PIF initiative are 1) keeping common birds common, and 2) helping species at risk (Rosenberg et al. 2016). Planning to meet both of 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 different species.

Within PIF, bird conservation is prioritized by the quantitative scoring system of the Species Assessment Database (www.pif.birdconservancy.org/avian-conservation-assessment-database/; PIF 2019), 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 have that status because they are habitat specialists. Thus, conservation of an ecosystem or habitat type using priority birds is likely to be inadequate because desired conditions for some or many habitat features are dependent on the chance that a priority species is associated with those desired conditions. Salwasser (2001) suggested that coarse-filter (i.e., habitats, landscapes, ecosystems) and fine-filter (i.e., individual species and their habitat needs) approaches that are nested and overlapping is most likely to provide effective wildlife conservation. 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 potential limitations of the priority species approach for habitat or ecosystem conservation, and the recommendations of Salwasser (2001), this document emphasizes a multi-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 attributes (fine filter).

At the core of this approach is the use of focal species (Sidebar: *Focal Species: A Tool for Ecosystem Conservation*), an approach increasingly used for conservation of biodiversity (Hannon and McCallum 2004, Wiens et al. 2008). The emphasis of this approach is on the representativeness of the species relative to the desired habitat conditions. This concept was initially described by Lambeck (1997), with the term "focal species," and has been extensively used in PIF planning (Chase and Geupel 2005, Stephens et al. 2019), including all Oregon-Washington plans (Altman 2000, Altman and Holmes 2000, Altman and Alexander 2012, Altman and Bresson 2017, Altman and Stephens 2022). The same concept has been promulgated by the U.S. Fish and Wildlife Service as "surrogate species" (e.g., Murphy and Weiland 2014). 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 more generic use of the term by many conservation or research entities to mean "the particular species that we are studying."

Blue-gray Gnatcatcher by Frank Lospalluto

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 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 premise is that conservation directed towards the collective needs of a suite of focal species that represent the range of desired habitat conditions for birds in that habitat type should also address the needs of most, if not all, of the other bird species occurring in that habitat type (Lambeck 1997), and likely other species of wildlife as well. 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).

Yellow-breasted Chat by Frank Lospalluto

Bushtit by Frank Lospalluto

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 (Sidebar: *Using Focal Species: Practical Considerations*). 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 current and future priority species, because the habitat component(s) needed by those species are likely already addressed through the suite of focal species. It also provides the opportunity to include imperiled species with species-level recommendations for their conservation. This hybrid approach of using both vulnerable and representative

species (i.e., imperiled and focal, respectively), should provide a solid framework for achieving broad-scale conservation of all landbirds in priority habitats throughout the region (Stephens et al. 2019). Species are much easier to monitor than ecological processes and can be readily used both as indicators of functional ecological processes and as metrics of conservation progress (Temple and Wiens 1989, Hutto 1998, Chase and Geupel 2005, Stephens et al. 2019).

Using Focal Species: Practical Considerations

There are two ways to use focal species as a tool for ecosystem conservation. First, the specifics of their representative 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 subregion. Second, their occurrence or abundance can be used as a metric to track positive progress of management or restoration towards the habitat objectives they represent. It is important to recognize that although the presence or abundance of focal species can be used as a positive indicator of success or effectiveness of management or restoration, the absence of these species during monitoring does not necessarily indicate the opposite: failure. There are a number of reasons why a species may not occur at a site independent of the habitat condition. However, the absence or low abundance of focal species can be a red flag for further attention to those habitat conditions.

An additional and unique component of this document is to establish quantitative population and habitat objectives for a suite of imperiled species to support recovery of their significantly depleted populations. This approach is species-centric and population-centric, due in large part to extensive species population declines and extirpations, but also due to limited spatial opportunities to recover and/or maintain populations and enhance habitat conditions for these species in our highly developed landscapes, especially in the Puget Lowlands and Willamette Valley ecoregions. Further, this supports the PIF goal for "helping species at risk" (Rosenberg et al. 2016), and the ultimate measure of a functioning ecosystem is the full complement of biodiversity (i.e., species).

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 habitats that are conservation priorities for landbirds.
- Identify desired habitat attributes for landbirds within the priority habitats.
- Identify species representative of priority habitats and desired habitat attributes (i.e., focal species).
- Supplement the focal species list with imperiled species that would benefit from habitat conservation for focal species.
- Establish measurable habitat objectives to achieve the desired habitat conditions based on the habitat associations of focal species.
- Establish measurable population objectives for focal species to be used as one metric for tracking habitat management for the desired habitat attributes.
- Recommend habitat conservation strategies that can be implemented to achieve the habitat and population objectives.
- Conduct monitoring and research to assess habitat and focal species response to conservation strategies and progress towards the habitat and population objectives.
- Implement adaptive management as appropriate to adjust habitat conservation strategies or habitat and population objectives.

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 ecologically

Decadent limbs with cavities in a mature oak by Bob Altman

desired conditions for the priority habitats. This does not explicitly include habitat attributes which may be important to other taxa but are not a primary habitat feature for landbirds (e.g., seeps for amphibians), but this approach is expected to benefit the broader ecological community because it promotes a functioning ecosystem (e.g., snags for cavity-nesting birds eventually become downed logs for mammals and herps).

Habitat Attributes

The term "habitat attribute" is used to describe those habitat features, conditions, or elements that function as important life requisites for a focal species. 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 ecological communities. However, there are no absolutes in bird-habitat relationships, and these broad-scale characterizations should not replace local knowledge or data available for the conservation of focal species and their associated habitat types and habitat attributes (e.g., Stephens et al. 2019).

Focal Species

Focal species were selected based on a combination of factors including review of scientific literature, inclusion as focal species in the previous Oregon-Washington PIF bird conservation plan for this region and these habitat types (Altman 2000), and the following criteria:

- regularly occurring breeding species throughout the geographic area under consideration,
- strongly associated with the habitat 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 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, and
- readily monitored using standard techniques to be able to track progress towards objectives at multiple scales.

When more than one species would potentially make a good focal species for a particular habitat attribute, preference was given to priority species and/or

species for which more knowledge exists about its life history and ecology to provide the information for setting biological objectives. There also was an attempt to ensure the completeness of the geographic representation of each focal species, but there are some areas where some focal species may not occur as breeding species. In these cases, a second focal species is provided for that habitat attribute in those geographies (e.g., Willow Flycatcher and Yellow-breasted Chat for "moderate to high shrub cover" in different ecoregions; Table 1). Further, in Appendix A we provide a list of species that may benefit from the conservation actions for the focal species or function as potential substitutes for focal species where appropriate (Sidebar: *Species to Benefit*).

Species to Benefit

Species to benefit are those imperiled 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, large enough to meet the species' area requirements, and if 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 is also a good source for species to use as substitutes when a focal species is not appropriate for a specific site due to range, habitat conditions, elevation, etc.

Readers familiar with the *Land Manager's Guide to Bird Habitat and Populations in Oak Ecosystems of the Pacific Northwest* (Altman and Stephens 2012) will notice that some focal species, habitat types or subtypes, and habitat attributes differ from what is presented in that document. There are several reasons why these revisions were made (Sidebar: *Updates to Oak Focal Species Presented in Altman and Stephens [2012]*).

Updates to Oak Focal Species Presented in Altman and Stephens (2012)

Focal species, habitat types or subtypes, and habitat attributes from Table 3 in Altman and Stephens (2012) have generally been used in this document as the best available information; however, several key updates were made. Where focal species and/or habitat attributes differ from Altman and Stephens (2012), it was done for the following reasons:

- Species that fit the criteria for imperiled within this document have been removed as focal species.
- Species with limited ranges within Oregon and Washington were removed as focal species where possible.
- Some species that are associated with broad-leafed deciduous trees in general were moved from focal species for oak to riparian habitats to represent habitat attributes there.
- A characteristic of large, mature trees was added to the habitat attributes for oak habitats. It is presumed that if this habitat objective is met, then there will also be decadent limbs or snags that provide nest cavities.
- The attribute of habitat edges and openings in oak savannah and open oak woodland was eliminated, as this feature is an inherent characteristic of more open habitats.

Large mature oak tree with spreading limbs by Frank Lospalluto

Imperiled Species

Imperiled species are a category unique to this Oregon-Washington PIF plan. Imperiled species were selected based on a population estimate of <2,000 individuals in any of the three ecoregions; a high degree of association with prairie, oak, and riparian habitats; and a historic anecdotal baseline as a relatively common species. An assumption of the focal species approach is that the suite of focal species will cover the habitat requirements of imperiled bird species, but this may not hold true for imperiled species that are ecological specialists. In this region, we are fortunate to have uniquely detailed data regarding the population status and conservation needs of many of our imperiled species.

Purple Martin by Lorelle Sherman

To ensure their conservation, imperiled species were recognized and given their own biological objectives and habitat attributes, as well as integrated where appropriate as species to benefit from conservation actions directed towards focal species.

Priority Species

Many PIF partner agencies and organizations have prioritized bird species for conservation based on vulnerability factors such as small populations, limited distribution, declining population trends, or threats to habitat. An assumption of the focal species approach is that the suite of focal species will 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; thus, there is established interest in tracking conservation of these species. For these reasons, they are included in this document as either focal species for unique habitat attributes with biological objectives when appropriate, or integrated as species to benefit from conservation actions directed towards focal species (Appendix A). However, it is important to recognize that their conservation alone does not address the broader goals of conservation of ecological communities, processes, or habitat types (Sidebar: *Priority Species Represent Only One Piece of Ecosystem Conservation*).

Priority Species Represent Only One Piece of Ecosystem Conservation

Many agencies and organizations have prioritized bird species for conservation based on factors related to each species' vulnerability, threats, and/or declining population size/trend relative to some previous baseline. When using these lists of "priority" species to direct conservation, the emphasis is on single-species conservation. There is an underlying assumption that their compromised status is indicative of broader concerns within the habitat or ecosystem they occur, and that conservation of priority species supports habitat or ecosystem conservation because other species will likely benefit from actions implemented to conserve priority species. Although there are varying degrees of truth to this rationale, it is important to recognize that the conservation of any particular feature or condition within the habitat or ecosystem is dependent on the chance that a priority species is associated with it. Further, priority lists tend to be dominated by specialist species which have narrower ecological niches and are less likely to be representative of broader ecological values. Thus, conservation using priority species alone is an opportunistic and often incomplete approach to the conservation of habitats or ecosystems.

Priority species were designated based on their primary association with a priority habitat(s) for breeding and their occurrence on one or more of the following lists:

- USFWS Birds of Conservation Concern (USFWS 2021),
- Interagency Special Status and Sensitive Species Program (ISSSSP 2020) of the USFS Region 6 and OR/WA BLM (https://www.fs.fed.us/r6/sfpnw/issssp/agency-policy/),
- ODFW Strategy Species (ODFW 2016),
- WDFW Strategy Species (WDFW 2015),
- PIF Landbird Conservation Plan Species of Continental Importance (Rosenberg et al. 2016), or
- PIF Regional Stewardship Species (i.e., with >25% of their global population breeding in BCR 5 and a regional threats-to-breeding score >1) (PIF 2019).

Biological Objectives

Quantitative population and habitat objectives (collectively referred to as biological objectives) are the cornerstone of this document. They are presented to provide land managers and other conservation practitioners with guidance and support for undertaking local actions that are targeted towards the highest regional priorities for landbirds.

Population and habitat objectives were established based on the premise that measurable, prescriptive targets for landbirds and associated habitat attributes are what is most needed by those working on-the-ground for landbird conservation. They are also more likely to stimulate conservation action than a descriptive, qualitative target that does not provide any numerical context for the desired outcome or a means of tracking progress towards it. Further, quantitative population and habitat objectives are increasingly the conservation metrics being required by conservation partners. We encourage land managers to use them 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*). Quantitative biological objectives serve several purposes:

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

Lewis's Woodpecker by Frank Lospalluto

Quantitative Biological Objectives

The quantitative biological objectives in this document 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. It is important to recognize that the biological objectives have been established solely for the voluntary and collaborative 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 of 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 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 a means of tracking progress towards it. Simply stated, most land managers want to know the measurable parameters—how much, where, and by when—to plan and implement bird conservation actions in an effective and integrated manner with other objectives, and perhaps just as importantly to provide context for tracking their progress towards objectives.

Landbird conservation includes many components that are not a part of the process for setting population and habitat objectives (e.g., policy, education, research). Although objectives for these conservation activities are not provided herein, many conservation partners address these types of activities as part of their mandate or mission. Conservation partners should use the population and habitat objectives in concert with or in support of their work on other important aspects of landbird conservation.

Development of the biological objectives was based on species-habitat relationship information generally limited to Oregon and Washington. When limited information was available from this region, references were used from elsewhere in western North America. Because of variability in the type, quality, and amount of data on focal and imperiled species, some biological objectives are based on empirical data and others are based on professional judgment and experience of the authors and other collaborators. This information is provided in the section on data sources and assumptions, and these objectives become testable hypotheses for research. All of the biological objectives should be viewed as dynamic, with an emphasis on the need for research, refinement, and improvement over time.

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 to maintain 2016 population levels or stabilize (at minimum) or reverse population declines (Rosenberg et al. 2016). Objectives differ in the rate at which declines should be slowed or reversed, and are based on species' overall vulnerability, abundance, and threat level.

The long-term objectives provide targets for longer range conservation planning and reflect the desire to return declining Watch List species to at least a portion of their former abundance (Rosenberg et al. 2016). 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 (Sidebar: *Population Objectives: Key Concepts*).

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, such as to provide:

- a marketing tool to emphasize the magnitude of the conservation actions needed,
- 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 where changes need to occur,
- the bottom line metric for the ultimate assessment of bird conservation, and
- a communication tool that is compelling and understandable for public outreach.

Population Objectives: Key Concepts

- Population objectives are emphasized because populations reflect the bottom line in bird conservation. If a population objective is achieved, then sufficient habitat was also achieved; whereas the opposite is not necessarily true – sufficient breeding habitat may exist but not be occupied because of other limiting factors.
- The overriding premise is that ecoregional and finer-scaled population objectives are derived from regional data and appropriate analyses, modeling, and professional knowledge. Thus, "bottom-up" population objectives reflect regional and local conditions (i.e., ecological, political, economic), rather than adoption of the "top-down" continental population objectives (Rich et al. 2004).
- The rationale and methods for setting population objectives are different depending on the species status (i.e., imperiled) or purpose (i.e., focal). For imperiled species, the emphasis is on the urgency to put the species on a population trajectory towards a secure status. For focal species, the emphasis is on achieving target densities at the site level.
- The long-term timeframe for population objectives for imperiled species is 25 years. Those are stepped down to short-term objectives of 10 years to reflect the desire for tracking progress in a timely manner, and the potential need to revisit the objectives in the near future.
- Heuristic, rule of thumb applications (guidance based on pragmatism and practical experience) are used to establish population and habitat objectives where appropriate to complement data and scientific processes. This is necessary because the metrics and data on population levels of self-sustaining, viable breeding populations (e.g., species-specific Population Viability Analyses) are lacking and perhaps not realistically attainable considering the extensive data and resources needed, and just as importantly because extensive amounts of the priority habitats are on private land.
- The metrics used (i.e., number of birds, amount of habitat) in establishing population objectives are presented at both coarse scales (e.g., ecoregions, habitat types) and at finer scales (e.g., subregions, sites) where habitat management occurs.
- The priority habitats are characterized by significant historic and ongoing habitat loss and degradation, and population declines and/or extirpations of their associated bird species. In particular, the Puget Lowlands and Willamette Valley are the most populated and developed ecoregions in their respective states. Thus, the population objectives are ambitious yet practical within the context of the current and projected future ecological, political, and economic environment in this primarily human-dominated landscape.

At the regional scale, quantitative population objectives are presented to increase populations of imperiled species as measured by multiple metrics. Species-specific population objectives, including the size, number, and distribution of subpopulations, are also provided at ecoregional and subregional scales for imperiled species. At smaller scales (i.e., sites), target densities are provided as an evaluation tool for land managers for both focal and imperiled species (Sidebar: *Target Density Estimates: A Metric for Land Managers).* The methods used to establish population objectives are presented in Appendix B.

Habitat Objectives

Several types of habitat objectives are presented at different spatial scales in this document. At the regional scale, quantitative habitat objectives are presented for various habitat conditions (e.g., patch size, retention of old trees, canopy cover) for the three priority habitats. Imperiled species additionally have objectives for subpopulation areas at ecoregional and subregional scales.

At smaller scales (i.e., sites), prescriptive habitat objectives are presented for specific habitat attributes such as canopy cover, tree or snag size, and shrub cover for each focal and imperiled species. These were derived from an evaluation of bird-habitat relationship data in the scientific literature. For details on the methods used to establish habitat objectives, see Appendix B.

Horned Lark by James Livaudais

Target Densities: A Metric for Land Managers

Target densities by subregion provide land managers with measurable metrics at the scale in which habitat management or restoration usually occurs (site- or project-level), and thus can stimulate actions and inform progress towards conservation goals. Much of the recent emphasis on setting population abundance objectives for birds, especially for landbirds within PIF, has been at relatively large scales (e.g., national, BCR, state). These have value as a benchmark for a limited subset of conservation partners who assess things at those scales, but are not applicable at the site scale, which is where habitat management or restoration actions occur. Local land managers need quantitative targets to assess the progress of their actions towards site goals, and the status and contribution of their site towards larger-scale bird conservation goals. Ecoregional habitat objectives and site-level, species-specific habitat objectives provide opportunities to evaluate habitat conditions to meet those goals. However, the bottom line in bird conservation is bird populations not amount or condition of habitat alone, and population metrics are needed to confidently assess progress towards bird conservation. The target densities provided herein are based on extensive data from multiple methods across a range of habitat conditions and from numerous sites throughout each ecoregion. They are presented at the level of subregion to provide a metric for land managers to use in planning their actions and monitoring for success at an appropriate spatial scale. However, it is important to recognize that failure to achieve the target densities at a particular site is not necessarily a failure to meet the desired habitat conditions. Many factors beyond breeding habitat can affect bird population status, particularly for migratory birds. Thus, target densities are a tool for evaluation that can support a land manger's actions if achieved or raise concerns and additional evaluations if not achieved. The combination of ecoregional population abundance objectives at larger scales for particular purposes and conservation partners, and site-scale density estimates for local land managers provides a more complete platform for action, and a broader partnership that is more likely to be engaged and successful in meeting bird conservation goals.

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 was 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. It is also important to note that the site-level habitat objectives for each focal species are not only specific to the habitat attribute that a particular species is representing, but also for other conditions essential to the species' conservation. For example, in addition to the habitat objective for large, mature trees that California Scrub-Jay represents in open oak woodland habitat, there are habitat objectives for subcanopy cover and shrub cover required to make the habitat suitable beyond the large trees attribute. These habitat objectives are provided to recognize that the species' overall conservation may include important features beyond just the habitat attributes they represent.


Acorn Woodpecker granary by KBO

Subregional 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. Thus, 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 the importance of landscape-level considerations for bird conservation is receiving more recent attention (Aubry 2007, Halstead et al. 2019), subregional (landscape-level) objectives are provided in this document for imperiled species.

Subregional objectives for imperiled 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). Further, some subregional objectives for the amount of suitable habitat were established for many imperiled species to encourage habitat management for small populations (e.g., >10 pairs) rather than individual pairs. For details on the methods used to establish subregional objectives, see Appendix B. All of these objectives need to be tested in an effort to expand our knowledge of landbird ecology and management at the landscape scale.

The Birds

We considered approximately 100 native landbird species to be highly associated breeding species in all or parts of the prairie, oak, and riparian habitats of western Oregon and Washington (Johnson and O'Neil 2001). There are two endemic (i.e., unique to the region) subspecies highly associated with priority habitats that occur within the geographic scope of this document: Streaked Horned Lark and Oregon Vesper Sparrow (Altman 2011). There are many bird species unique to this part of Oregon and Washington, including Acorn Woodpecker, Blue-gray Gnatcatcher, Bewick's Wren, California Scrub-Jay, California Towhee, Hutton's Vireo, Oak Titmouse, Red-shouldered Hawk, White-tailed Kite, and Wrentit. Several are restricted to the southern part of this region (i.e., Klamath Mountains), which represents the northern extent of their range, including Blue-gray Gnatcatcher, California Towhee, and Oak Titmouse.

Landbird Populations

Vesper Sparrow by Frank Lospalluto

Declining Landbird Populations

At the core of our concern for landbirds in prairie, oak, and riparian habitats are the population declines being experienced by many species. The Breeding Bird Survey (BBS) (Robbins et al. 1986), administered by the U.S. Geological Survey (USGS) is the primary source of population trend information for North American landbirds (Sidebar: *The Breeding Bird Survey: A Source for Landbird Population Trends*). Extensive habitat changes prior to the initiation of this survey effort in 1968 undoubtedly affected bird populations, but there are no quantitative data to document them.

The Breeding Bird Survey: A Source for Landbird Population Trends

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

Long-term population trends derived from BBS data are presented in Table 4 for our 33 focal and imperiled species. There is no standard analysis of BBS data specifically for the geographic scope of this document. However, we used four scales of BBS analyses as the closest approximations to provide insights into population trends for landbird species for the three ecoregions covered in this document. This includes all of BCR 5 for the entire geography, BCR 5 in Washington to represent the Puget Lowlands, a dated trend for the Willamette Valley (1968-2007) that is no longer analyzed separately in BBS online tools (Sauer et al. 2008), and BCR 5 in California to represent the Klamath Mountains in Oregon. The latter was used because the Klamath Mountains in southern Oregon are more similar ecologically to northern California than to the rest of Oregon, and BCR 5 in Oregon would conflate the Willamette Valley and Klamath Mountains ecoregions.

A cursory examination of species population trends indicates some noteworthy patterns. Among 33 focal and imperiled species, 20 are experiencing significant long-term (1968 to 2007 or 2015) declining population trends in at least one of the four analysis regions (Sauer et al. 2017; www.mbr.pwrc.usgs.gov/bbs/bbs.html) (Table 4). Conversely, only eight species are experiencing significantly increasing long-term population trends in at least one analysis region.

At least 50% of the species in each of the three habitat types have experienced significantly declining population trends in at least one of the four analysis regions. Four imperiled species associated with prairies (Western Meadowlark, Oregon Vesper Sparrow, Streaked Horned Lark, and Lark Sparrow) all have significantly declining population trends of 4-6% per year in BCR 5, which amounts to a loss of 85-94% of their population size in this region since the beginning of the BBS in 1968 (Sauer et al. 2017). Western Meadowlark is additionally the only species with significantly declining trends in all four analysis regions. Some additional landbird species may be experiencing population declines, but numbers are already so low that they are not adequately sampled by BBS survey methods (e.g., Lewis's Woodpecker).

Extirpated Landbird Populations

Several of the imperiled species have been extirpated or nearly extirpated as regularly occurring breeding species at the scale of the ecoregion or subregion (i.e., there may be occasional detections but no known breeding population exists):

- Lewis's Woodpecker has been extirpated from the Puget Lowlands, Willamette Valley, and Klamath Mountains (Altman 2011).
- Streaked Horned Lark has been extirpated from the north Puget Lowlands and Klamath Mountains (USFWS 2019).
- Western Meadowlark has been nearly extirpated from the north Puget Lowlands (Altman 2011).
- Oregon Vesper Sparrow has been nearly extirpated from the north Puget Lowlands
- Slender-billed White-breasted Nuthatch has been nearly extirpated from the south Puget Lowlands (Altman 2011).
- Western Bluebird was extirpated from the north Puget Lowlands until recent translocation and reintroduction efforts (Slater and Altman 2013).
- Lark Sparrow has been extirpated from the Umpqua Valley of the Klamath Mountains (Altman 2011).

Table 4. Breeding Bird Survey (BBS) long-term population trends and overall percent population change from 1968-2015 for focal and imperiled species in prairie, oak, and riparian habitats of Bird Conservation Region (BCR) 5 (U. S. portion only), and the Puget Lowlands (represented by BCR 5 – WA only), Willamette Valley (1968-2007 only), and Klamath Mountains (represented by BCR 5 – CA only) ecoregions. BBS trend gives annual percent population change based on BBS data. Population change gives positive or negative percent of a species' population lost or gained since 1968 based on the BBS trend. Red indicates a statistically significant declining trend, and green indicates a statistically significant increasing trend. A cell with dashes indicates that the species does not commonly breed in that region, or that there are insufficient data (i.e., a "red" credibility rating in the BBS database indicating an important data deficiency), and thus no trend information is available.

	BCR 5		Puget Lowlands		Willamette Valley[2]		Klamath Mountains	
Species (subspecies)	BBS Trend (%)	Population Change (%)	BBS Trend (%)	Population Change (%)	BBS Trend (%) [2]	Population Change (%)	BBS Trend (%)	Population Change (%)
Imperiled Species								
Vesper Sparrow (Oregon)	-5.48	-93	--	--	-8.6	-97	--	--
Horned Lark (Streaked)	-5.74	-94	--	--	3.7	4	--	--
Western Meadowlark	-4.75	-90	-10.88	-100	-10.0	-98	-4.44	-88
Lark Sparrow	-4.02	-85	--	--	--	--	-3.62	-82
Western Bluebird	-1.34	-47	--	--	--	--	-1.99	-61
White-breasted Nuthatch (Slender-billed)	-1.96	-61	--	--	-3.0	-70	-0.47	-20
Lewis's Woodpecker	--	--	--	--	--	--	--	--

Table 4 continued

	BCR 5		Puget Lowlands		Willamette Valley[2]		Klamath Mountains	
Species (subspecies)	BBS Trend (%)	Population Change (%)	BBS Trend (%)	Population Change (%)	BBS Trend (%) [2]	Population Change (%)	BBS Trend (%)	Population Change (%)
Focal Species: Prairie Habitats [1]								
Savannah Sparrow	-2.41	-68	-2.78	-73	-1.5	-45	-0.78	-31
Focal Species: Oak Habitats [1]								
Chipping Sparrow	-3.46	-81	-1.24	-44	-6.9	-94	-3.77	-84
House Wren	-2.33	-67	6.34	1698	-4.1	-82	-0.74	-29
Purple Finch	-1.38	-48	-0.20	-9	-0.1	-4	-2.32	-67
California Scrub-Jay	1.18	74	6.81	2112	4.0	362	0.96	57
Acorn Woodpecker	0.47	25	--	--	7.2	1405	-0.14	-6
Lazuli Bunting	-0.81	-32	6.56	1881	4.2	398	-0.95	-36
Western Wood-Pewee	-1.60	-53	1.58	109	0.6	26	-1.45	-50
Blue-gray Gnatcatcher	-0.05	-2	--	--	--	--	-0.17	-8
Oak Titmouse	-0.04	-2	--	--	--	--	-0.20	-9
Bushtit	-3.49	-81	-2.65	-72	1.5	84	-2.11	-63
Cassin's Vireo	0.11	5	-3.09	-77	-1.2	-41	0.87	50
Hutton's Vireo	0.96	57	0.95	56	-0.7	-27	0.51	27
California Towhee	0.08	4	--	--	--	--	0.14	7
Focal Species: Riparian Habitats [1]								
Bullock's Oriole	-1.64	-54	-2.65	-72	2.0	116	-1.63	-54
Downy Woodpecker	-0.42	-18	-0.29	-13	1.9	108	-1.17	-42
Bewick's Wren	-0.32	-14	0.93	55	3.9	380	-2.35	-67
Song Sparrow	-1.32	-46	-0.61	-25	-1.0	-34	-0.87	-34
Spotted Sandpiper	-1.55	-52	2.26	186	--	--	-1.27	-45
Yellow Warbler	-2.63	-71	-1.96	-61	2.5	4	-1.38	-48
Spotted Towhee	0.09	4	1.73	124	-0.2	-8	0.64	35
Willow Flycatcher	-3.01	-76	-1.34	-47	-3.3	-73	1.97	150
Yellow-breasted Chat	-0.20	-9	2.36	199	-2.4	-61	0.68	38
Black-headed Grosbeak	0.80	45	4.71	870	-1.9	-54	0.66	36
Rufous Hummingbird	-2.91	-75	-2.39	-68	-2.2	-62	0.19	9
Black-capped Chickadee	-0.80	-31	-0.27	-12	-1.0	-32	15.54	88,702

[1] Species are listed under their predominant breeding season priority habitat type, but they may occur in other habitats including ones not addressed here. Their BBS trends reflect detections in all habitat types.

[2] The small sample size of routes in the Willamette Valley likely precludes trends of statistical significance for most species, although note exceptions: Western Meadowlark and Bewick's Wren.

- Yellow-billed Cuckoo was considered for designation as an imperiled species, but it only meets the criteria of an historically common species in the period prior to Euro-American settlement along the Columbia River (Jobanek and Marshall 1992). By the late 1800s and early 1900s, it was considered rare and has not been documented as a breeding species in nearly 100 years (Marshall et al. 2003).

PIF Population Estimates Derived from Breeding Bird Survey Data

Establishing population estimates for landbirds is a desirable and likely essential component of landbird conservation based on the successes of this approach under the North American Waterfowl Management Plan (Rosenberg and Blancher 2005). The PIF population estimation process for landbirds is a pragmatic and repeatable approach that uses BBS relative abundance data, extrapolation across geographies and species' ranges, and some basic correction factors and assumptions (Blancher et al. 2013). Publication and critique of the process (Thogmartin et al. 2006), and significant improvements made since the original effort (Version 2: Blancher et al. 2013), have improved the estimates. Most population estimates appear to be within a correct order of magnitude when compared with independent sources (Rosenberg and Blancher 2005), and this "first approximation" of landbird population estimates appears to provide a good starting point for quantifying a population-level context for landbird conservation.

Landbird Population Estimates

Another quantitative tool that provides conservation context for declining and extirpated landbird populations is population size estimation (Sidebar: *PIF Population Estimates Derived from Breeding Bird Survey Data).* The methods for calculating current population estimates for focal and imperiled species are described in Appendix B, and the estimates are presented in each species account and also in Appendices C and D.

Focal, Imperiled, and Priority Species

Focal Species by Habitat

A list of focal species and the habitat attributes they represent is presented below for each of the three priority habitat types. For a summary of habitat objectives for all focal species, see Appendix E.

Prairie

The desired condition in prairie habitats is to maintain grasslands in a mosaic of habitat conditions. These include areas of both homogenous and diverse herbaceous layers, and sparse, low-statured vegetation in open prairies, and a mix of bare ground, low- and moderately statured herbaceous vegetation, and scattered or limited woody cover in more savannah-like prairies. A balance of these different habitat types and desired attributes should be maintained across the landscape. Landbird conservation in prairies emphasizes maintaining healthy ecosystems for one representative focal species and one habitat attribute: large habitat patches (Table 5). Many grassland species are considered imperiled because they are associated with habitat conditions that have become rare on the landscape, and managers may want to refer to the Imperiled Species section for additional important prairie habitat attributes to promote.

Oak

The desired condition in oak woodlands is widely spaced, heavily branched, large, open-grown oak trees with a park-like understory dominated by fire-

Table 5. Habitat attributes and associated landbird focal species for conservation of prairie habitats in the Puget Lowlands, Willamette Valley, and Klamath Mountains ecoregions and subregions in which they are present as a breeding bird.

Habitat Sub-type	Habitat Attribute	Focal Species	Ecoregion/Subregion					
			Puget Lowlands		Willamette Valley		Klamath Mountains	
			North	South	North	South	Umpqua Valley	Rogue Basin
Dry and Wet Prairie	Large habitat patches	Savannah Sparrow	√	√	√	√	√	√

Table 6. Habitat attributes and associated landbird focal species for conservation of oak habitats in the Puget Lowlands, Willamette Valley, and Klamath Mountains ecoregions and subregions in which they are present as a breeding bird. Note that some species are not present in all three ecoregions. Gray-scale shading indicates absence or limited degree of occurrence in an ecoregion or subregion; see details in footnotes. In one case, two focal species are presented for one habitat attribute in the same habitat subtype because different focal species are more appropriate in different ecoregions. Focal species may additionally be considered priority species (Priority = [P]) if they are designated as species of conservation concern by primary conservation partners.

Habitat Sub-type	Habitat Attribute	Focal Species	Ecoregion/Subregion					
			Puget Lowlands		Willamette Valley		Klamath Mountains	
			North	South	North	South	Umpqua Valley	Rogue Basin
Oak Savannah or Open Woodland	*low-statured herbaceous ground cover*	Chipping Sparrow [P]	√	√	√	√	√	√
	moderate and patchy shrub cover	Lazuli Bunting		√	√	√	√	√
	large mature trees	California Scrub-Jay	√	√	√	√	√	√
Oak Closed Woodland or Forest	*large mature trees*	Acorn Woodpecker [P]			√	√	√	√
	canopy edges and openings	Western Wood-Pewee	√	√	√	√	√	√
	moderate to high canopy and subcanopy cover	Purple Finch [P]	√	√	√	√	√	√
	moderate shrub cover with open canopy trees	House Wren	√	√	√	√	√	√
	moderate subcanopy or shrub cover	Oak Titmouse [P]						√
	moderate subcanopy or shrub cover	Bushtit	√	√	√	√	√	√
Oak-Pine	*moderate to high canopy and subcanopy cover*	Cassin's Vireo				√	√	√
Oak-Hardwood	*moderate subcanopy or shrub cover*	Hutton's Vireo	√	√	√	√	√	√
Oak-Chaparral	*dense shrub cover with herbaceous openings*	California Towhee						√
	moderate to high shrub cover	Blue-gray Gnatcatcher						√

√ species suggested as focal species to be used in planning, implementation, and monitoring.

Light Gray species is limited as a breeding species in this subregion (i.e., local or low breeding densities), and may not be useful as a focal species. Consider other potential focal species for this habitat attribute (e.g., species to benefit [Appendix A], imperiled species in subregions where not imperiled) if needed.

Dark Gray species does not regularly breed in this subregion; use other potential focal species for this habitat attribute (i.e., species to benefit [Appendix A], imperiled species in subregions where not imperiled).

Black habitat type is absent or limited and local in occurrence in this subregion.

tolerant, native grasses and forbs with some scattered shrubs and small trees. Distribution of the range of oak habitats, from oak savannah, oak chaparral, open and closed oak woodland, and mixed oak forests should occur in their natural levels of abundance, depending on local climate and soil conditions. Landbird conservation in oak habitats emphasizes maintaining healthy ecosystems that include 13 focal species representative of nine habitat attributes include snags or decadent limbs with cavities), low-statured ground cover, canopy edges and openings, moderate and patchy shrub cover, moderate to high canopy and subcanopy cover, moderate subcanopy within five different oak habitat subtypes (Table 6). These include: large mature trees (presumed to or shrub cover, moderate shrub cover with open canopy trees, dense shrub cover with herbaceous openings, and moderate to high shrub cover. No one site can have all the desired attributes, but it is important that a mosaic of these habitat conditions is represented in ecologically appropriate sites across the landscape.

Riparian

The desired condition in riparian woodland and shrubland is a structurally diverse vegetative community of native plant species in a somewhat patchy (i.e., not homogeneous) distribution with a robust shrub layer and variable canopy layer, occurring in the plant species' natural levels of abundance according to hydrological regime. Landbird conservation in riparian zones emphasizes maintaining healthy ecosystems that include 12 focal species representative of nine habitat attributes within four different riparian habitat subtypes (Table 7). These include: interspersion of bare ground and herbaceous vegetation on floodplains, early successional shrubs, moderate to high canopy and subcanopy cover, moderate to high shrub cover, scattered shrubs with herbaceous openings, large mature trees, sufficient snags or decadent limbs to provide nest cavities, a mix of hardwood and conifer trees, and flowering plants. Some of these desired attributes conflict with each other – for example, a given location cannot have both scattered shrubs and dense shrub cover – but it is important that a mosaic of these habitat conditions is represented at ecologically appropriate sites across the landscape.

Imperiled Species

Seven species are considered imperiled in at least one ecoregion of the Puget Lowlands, Willamette Valley, or Klamath Mountains (Table 8). Two grassland-associated species, Oregon Vesper Sparrow and Streaked Horned Lark, and one species that can be found in open oak or riparian habitats, Lewis's Woodpecker, are imperiled in all three ecoregions. Three of the other four species, Lark Sparrow, Western Bluebird, and Slender-billed White-breasted Nuthatch, are imperiled in only one ecoregion, and the last species, Western Meadowlark, is imperiled in two ecoregions.

Priority Species

There are 25 landbird species regularly associated with the priority habitat types and recognized as priority species by federal and state agencies and non-governmental partnerships (Table 9). This includes seven focal species and seven imperiled species in this document. Six of the seven species considered imperiled in this document (excluding Lark Sparrow) have received some level of recognition of conservation concern by state and/or federal wildlife agencies in at least one of the ecoregions (Table 9). Streaked Horned Lark has been listed as Threatened under the Federal Endangered Species Act (Federal Register, October 3, 2013, 78 FR 6 1451, pp 61451-61503). Oregon Vesper Sparrow has been petitioned for listing as Threatened under the Federal Endangered Species Act and is currently under review (https://ecos.fws.gov/ecp/report/table/petitions-received.html).

Slender-billed White-breasted Nuthatch and Oregon Vesper Sparrow are Candidates for listing under the Washington State Endangered Species Act (https://wdfw.wa.gov/species-habitats/at-risk/listed). Outside of the geographic scope of this document, Oregon Vesper Sparrow and Streaked Horned Lark are both listed as Endangered in British Columbia by COSEWIC (Committee on the Status of Endangered Wildlife in Canada) (https://www.canada.ca/en/environment-climate-change/services/species-risk-public-registry/publications/canadian-wildlife-species-risk-2019.html).

Table 7. Habitat attributes and associated landbird focal species for conservation of riparian habitats in the Puget Lowlands, Willamette Valley, and Klamath Mountains ecoregions and subregions in which they are present as a breeding bird. Note that some species are not present in all three ecoregions. Gray-scale shading indicates absence or limited degree of occurrence; see details in footnotes. In one case, two focal species are presented for one habitat attribute in the same habitat subtype because different focal species are more appropriate in different ecoregions. Focal species may additionally be considered priority species (Priority = [P]) if they are designated as species of conservation concern by primary conservation partners.

Habitat Sub-type	Habitat Attribute	Focal Species	Ecoregion/Subregion					
			Puget Lowlands		Willamette Valley		Klamath Mountains	
			North	South	North	South	Umpqua Valley	Rogue Basin
Open Floodplain	interspersion of bare ground and herbaceous vegetation	Spotted Sandpiper	√	√	√	√	√	√
Riparian Shrubland	early successional	Song Sparrow	√	√	√	√	√	√
	moderate to high shrub cover	Willow Flycatcher [P]	√	√	√	√		
	moderate to high shrub cover	Yellow-breasted Chat [P]					√	√
Riparian Open Woodland	cavities in snags or decadent limbs	Black-capped Chickadee	√	√	√	√	√	√
	large mature trees	Bullock's Oriole	√	√	√	√	√	√
	scattered shrubs with herbaceous openings	Spotted Towhee	√	√	√	√	√	√
Riparian Closed Woodland or Forest	moderate to high sub-canopy and shrub cover	Yellow Warbler	√	√	√	√	√	√
	cavities in snags or decadent limbs	Downy Woodpecker	√	√	√	√	√	√
	mixed hardwood and conifer trees	Black-headed Grosbeak	√	√	√	√	√	√
	flowering plants	Rufous Hummingbird [P]	√	√	√	√	√	√
	moderate to high shrub cover	Bewick's Wren	√	√	√	√	√	√

√ species suggested as focal species to be used in planning, implementation, and monitoring.

Light Gray species is limited as a breeding species in this subregion (i.e., local or low breeding densities), and may not be useful as a focal species. Consider other potential focal species for this habitat attribute (e.g., species to benefit [Appendix A], imperiled species in subregions where not imperiled) if needed.

Dark Gray species does not regularly breed in this subregion; use other potential focal species for this habitat attribute (i.e., species to benefit [Appendix A], imperiled species in subregions where not imperiled).

Table 8. Imperiled landbird species and their associations with habitat attributes of prairie, oak, and riparian habitats in western Oregon and Washington. Species marked with an "√" are considered imperiled in that geography (i.e., current population <2,000 birds in an ecoregion or <1,000 birds in a subregion and reduced from historic levels as common or abundant) or are extirpated as regularly occurring breeders, and have a high degree of association with these habitat types. Imperiled species may additionally be considered priority species (Priority = P) if they are designated as species of conservation concern by primary conservation partners. Note that some species are not present or not considered imperiled in all subregions (see footnotes).

Imperiled Species	Ecoregion/Subregion						Habitat Type(s)	Desired Habitat Condition(s)
	Puget Lowlands		Willamette Valley		Klamath Mountains			
	North	South	North	South	Umpqua Valley	Rogue Basin		
Horned Lark (Streaked) P	√	√	√	√	√*	√*	Prairie	*large, open landscapes with low-statured and sparse vegetation*
Vesper Sparrow (Oregon) P	√	√	√	√		√	Prairie and Oak Savannah	*low to moderate statured vegetation and scattered woody cover*
Western Meadowlark P	√	√					Prairie and Oak Savannah	*large areas with diverse herbaceous structure*
Lark Sparrow					√	√	Prairie and Oak Savannah	*low to moderate statured vegetation and scattered woody cover*
Western Bluebird P	√	√					Prairie, Oak Savannah, and Open Woodland	*cavities in trees with open access and low-statured herbaceous vegetation*
White-breasted Nuthatch (Slender-billed) P		√					Oak Savannah, Open or Closed Woodland, and Forest	*mature oak trees or snags with cavities*
Lewis's Woodpecker P	√	√	√	√	√	√	Oak Savannah, Open Woodland, and Riparian	*large, old trees with cavities or soft areas for excavation*

*We follow the USFWS Recovery Plan for Streaked Horned Lark (USFWS 2019), and do not provide population objectives for the Klamath Mountains ecoregion.

Green present as a regularly occurring breeding species in this subregion; did not meet definition of imperiled.

Dark Gray not present as a regularly occurring breeding species in this subregion, but was present historically (i.e., extirpated).

Black was never present as a regularly occurring breeding species, or was not historically common and abundant, in this subregion (i.e., outside of range).

Table 9. Priority breeding bird species and subspecies in prairie, oak, and riparian habitats in the Puget Lowlands, Willamette Valley, and Klamath Mountains ecoregions, and their designations by primary conservation partners (see footnotes for letter codes). Orange cells highlight imperiled species in this document; teal cells highlight focal species in this document.

Species (Subspecies)	USFWS BCR 5[1]	USFWS CON[2]	ISSSSP USFS[3]	ISSSSP BLM[3]	WDFW[4]	ODFW - Willamette Valley[5]	ODFW - Klamath Mtns[5]	PIF Cont. Plan[6,7]
Horned Lark (Streaked)	T	T			E	√		
Vesper Sparrow (Oregon)	√			OR	C	√	√	
Western Meadowlark						√		
White-breasted Nuthatch (Slender-billed)	√				C	√		
Western Bluebird					X	√		
Willow Flycatcher						√		
Yellow-breasted Chat						√	√	
Lewis's Woodpecker		√	OR, WA	OR, WA	√*		√*	Y
Ash-throated Flycatcher			WA	WA				
Oak Titmouse	√	√						Y
Rufous Hummingbird	√	√						Y, S
Grasshopper Sparrow			OR	OR		√	√	
Lesser Goldfinch			WA	WA				
Short-eared Owl				WA	√	√		
Purple Finch								
Purple Martin			OR	OR	√	√	√	
Mountain Quail			WA	WA				Y
Acorn Woodpecker			WA	WA		√	√	
Chipping Sparrow						√		
Wrentit	√							Y
Common Nighthawk						√	√	
Western Screech-Owl	√				√			
Black-throated Gray Warbler								S
Red-breasted Sapsucker								S
Bald Eagle			OR, WA	OR, WA				S

[1] √ = USFWS Species of Conservation Concern in Bird Conservation Region 5 (BCR 5) which includes northwestern California; western Oregon, Washington, and British Columbia; and southeast Alaska; T = listed as federally threatened under the Endangered Species Act (USFWS 2021).
[2] √ = USFWS Species of Conservation Concern on a continental scale; T = listed as federally threatened under the Endangered Species Act (USFWS 2021).
[3] = Interagency Special Status and Sensitive Species Program of the USFS Region 6 and OR/WA BLM (USFS 2019, BLM 2021); text in column displays whether species is considered sensitive in OR, WA, or both.
[4] √ = Species of Greatest Conservation Need in the Washington State Wildlife Action Plan; E = endangered in the state of Washington; C = candidate species for listing as threatened or endangered in the state of Washington (WDFW 2015).
[5] √ = Species of Greatest Conservation Need for the Klamath Mountains or Willamette Valley ecoregions in the Oregon State Wildlife Action Plan (ODFW 2016).
[6] Y = Partners in Flight yellow watch list for Species of Continental Concern in BCR 5 with population declines and moderate to high threats (Rosenberg et al. 2016)
[7] S = Partners in Flight Regional Stewardship Species with >25% of global population breeding in BCR 5 and a score >1 for regional threats to breeding (PIF 2019)
* = Extirpated as a breeding species from the ecoregion.

Biological Objectives

In the following sections, several types of biological objectives are presented for focal and imperiled species. These include ecoregional and subregional population objectives to increase the population of imperiled species with measures including population growth rate, density estimates, and population trends; ecoregional habitat objectives for each of the three priority habitat types; and species-specific population and habitat objectives at site scales for the 26 focal and seven imperiled species listed in Tables 5-8.

Each focal species account includes its primary habitat association and habitat attribute along with ecoregional population estimates, site-level population objectives (i.e., target densities) and habitat objectives, and data sources and assumptions upon which the biological objectives are based. Similar information is presented for imperiled species in the ecoregions where they are considered imperiled, along with ecoregional and subregional population and habitat objectives. These include population abundance objectives at ecoregional and subregional scales, and also objectives for the size, number and distribution of subpopulations. Details on the methods used to establish population and habitat objectives are provided in Appendix B.

White-breasted Nuthatch by James Livaudais

Riparian shrubland by Bob Altman

Ecoregional Population Objectives

Qualitative:

- Maintain or enhance focal species' population sizes.
- Improve imperiled species' population trajectories to be "more secure than imperiled" over the short term (10 years) and to reach a status of "apparently secure" in the longer term (25 years).

Quantitative:

- Increase the population size for each imperiled species.
- Metrics:
    - Population growth rate (i.e., lambda) >1.0 for >60% of the medium and large subpopulations over a five-year period.
    - Density at or above target densities in >60% of the medium and large subpopulations over a five-year period.
    - Positive ecoregional BBS trend over the most recent 10-year period (Sidebar: *Using BBS Population Trends for Tracking Bird Conservation Progress*).

Using BBS Population Trends for Tracking Bird Conservation Progress

Evaluating BBS population trends provides a coarse means of assessing ecoregional progress of broad-scale conservation actions relative to a known baseline using annual analyses by the U. S. Geological Survey (www.mbr-pwrc.usgs.gov/bbs/bbs.html). The use of BBS trend monitoring as an indicator of population status assumes that many actions to improve habitat or populations of a species throughout an ecoregion will be reflected through increased species abundance on the randomly located BBS routes. These are not intended to replace essential monitoring to track progress at specific locations where conservation actions are occurring.

Ecoregional Habitat Objectives

Prairie, Oak, and Riparian

- Seek "no net loss" of habitat (i.e., mitigate losses with equal or greater restoration efforts).
- Maintain all moderate to high quality habitat and actively manage to promote its sustainability.
- Improve quality of degraded habitat through appropriate management actions.
- Initiate actions to enhance size and connectivity of existing habitat (i.e., reduce fragmentation).
- Conduct habitat management or restoration activities outside of the primary landbird nesting season (April 15 - July 15), or in conjunction with bird monitoring to provide opportunities for protection of sensitive areas (e.g., nesting sites for imperiled species).

For a summary of habitat objectives for all focal species, see Appendix E.

Open oak woodland by Bob Altman

PRAIRIE

Willamette Valley prairie by Bob Altman

- Initiate actions to maintain or increase moderate to high quality prairie habitat in contiguous areas >80 ha (200 ac) in a mosaic of conditions to support populations of multiple grassland-associated bird species.
- Seek opportunities to manage all or portions of non-native grasslands (e.g., pastures, agricultural fields, airports, open spaces) for grassland-associated bird species without compromising the health of the population (e.g., population sinks, ecological traps).
- Manage grazing intensity and duration (i.e., rotational grazing) to provide appropriate habitat conditions for one or more bird species.
- Ensure that <10% of the prairie landscape is in "hostile habitat" (e.g., near residences, populations of starlings and cowbirds).

Rationale: Reduction of prairie patch size (i.e., fragmentation) and loss of quality within patches are prominent threats for grassland birds throughout the region. Much of the current prairie landscape is dominated by agriculture or other non-native grasslands, especially in the Willamette Valley. Within some of these areas, there is an opportunity to provide conditions suitable for some grassland-associated bird species. However, many of these areas are subject to regular threats to nesting birds (e.g., mowing, harvesting, heavy grazing) and may function as ecological traps (where birds are attracted to nest in habitats where they have low reproductive success).

Focal species population and habitat objectives for prairie habitats are presented here. Many bird species associated with prairie habitat conditions that have become rare on the landscape are considered imperiled, and managers may want to refer to the Imperiled Species section for additional important prairie habitat attributes to promote.

Savannah Sparrow by James Livaudais

SAVANNAH SPARROW

(*Passerculus sandwichensis*)

Habitat: Dry and Wet Prairie

Habitat Attribute: large habitat patches

Status	Ecoregion/Subregion						Priority
	Puget Lowlands		Willamette Valley		Klamath Mountains		
	North	South	North	South	Umpqua Valley	Rogue Basin	
Focal	√	√	√	√	√	√	

Current Population Estimates (Ecoregions)

- Puget Lowlands: 284,700
- Willamette Valley: 235,900
- Klamath Mountains: 67,400

Population Objectives (Sites)

Target Densities in Suitable Habitat:

Puget Lowlands:

North: >1.39 birds/ha (0.56 birds/ac)

South: >1.72 birds/ha (0.69 birds/ac)

Willamette Valley:

North: >2.06 birds/ha (>0.83 birds/ac)

South: >0.90 birds/ha (>0.36 birds/ac)

Klamath Mountains:

Umpqua: >0.15 birds/ha (>0.06 birds/ac)

Rogue: >0.15 birds/ha (>0.06 birds/ac)

Habitat Objectives (Sites)

Prairie habitat in the following conditions:

- patches >16 ha (40 ac)
- <5% tree cover
- <10% shrub cover
- <10% bare ground
- >10% forb cover

Data Sources, Assumptions, and Comments

- Population estimates are based on BBS data and ecoregional calculations using the process described in Blancher et al. (2013).
- Site-level population objectives were based on Altman (1999), B. Altman (unpublished database), and Stephens and Alexander (2014) (grassland inventory data available from Avian Knowledge Northwest).
- Site-level habitat objectives were based on Swanson (1998) and professional experience.

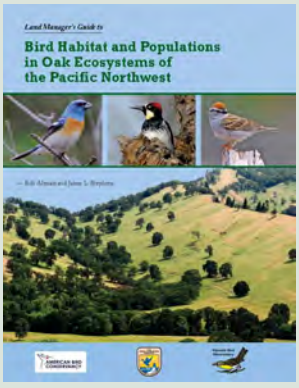
OAK

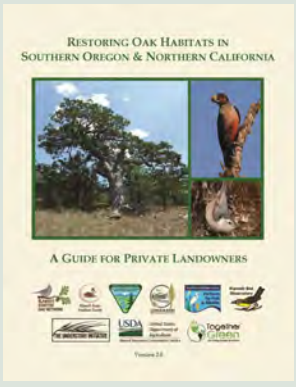
Oak Forest by Bob Altman

- Maintain oak habitats wherever they occur, especially those >16 ha (40 ac).
- Emphasize conservation of large diameter and wide-spreading open-form oaks and older trees with dead/dying branches; retain all oak trees >50 cm (20 in) DBH, regardless of landscape context.
- Maintain snags and downed wood, maintain dead limbs on live oak trees.
- Consider frequent, low-intensity prescribed burning as a restoration tool.

Rationale: Loss of large oak trees and degradation of oak habitat from encroachment of conifer species as a result of fire suppression are prominent threats for oak-associated birds throughout the region. Large patches of oak woodland may be less susceptible to competition from European Starlings and nest parasitism from Brown-headed Cowbirds. Open-form oaks have more cavities (Farrier-Gumtow 1991) and produce more acorns for oak regeneration and wildlife consumption (Larsen and Morgan 1998).

Focal species population and habitat objectives for oak habitats are presented here. Some imperiled species also use oak habitats; please refer to the Imperiled Species section below.





Practical Applications for Oak Restoration

Refer to the *Land Manager's Guide to Bird Habitat and Population in Oak Ecosystems of the Pacific Northwest* (Altman and Stephens 2012) and *Restoring Oak Habitats in Southern Oregon and Northern California v2.0* (KBO and LRP 2020) for detailed guidance on oak restoration practices.

CHIPPING SPARROW

(Spizella passerina)

Habitat: Oak Savannah or Open Woodland

Habitat Attribute: low-statured herbaceous ground cover

Chipping Sparrow by James Livaudais

Status	Ecoregion/Subregion						Priority
	Puget Lowlands		Willamette Valley		Klamath Mountains		
	North	South	North	South	Umpqua Valley	Rogue Basin	
Focal	√	√	√	√	√	√	√

Current Population Estimates (Ecoregions)

- Puget Lowlands: 80,500
- Willamette Valley: 66,000
- Klamath Mountains: 87,700

Population Objectives (Sites)
Target Densities in Suitable Habitat:

Puget Lowlands:
North: >0.71 birds/ha (0.29 birds/ac)
South: >0.52 birds/ha (0.21 birds/ac)

Willamette Valley:
North: >0.04 birds/ha (>0.02 birds/ac)
South: >0.13 birds/ha (>0.05 birds/ac)

Klamath Mountains:
Umpqua: >0.22 birds/ha (>0.09 birds/ac
Rogue: >0.33 birds/ha (>0.13 birds/ac)

Habitat Objectives (Sites)
Oak Savannah or Open Woodland in the following conditions:

- canopy cover <50%
- shrub cover <20% interspersed with herbaceous openings
- herbaceous cover >50%
- herbaceous cover <15 cm (6 in) high
- maintain cowbird parasitism rates <10%

Data Sources, Assumptions, and Comments

- Population estimates are based on BBS data and ecoregional calculations using the process described in Blancher et al. (2013).
- Site-level population objectives were based on Altman and Stephens (2012), Altman et al. (2017), B. Altman (unpublished database), and G. Slater (unpublished data).
- Site-level habitat objectives were based on Cross and Simmons (1983), Resources Northwest and Pentec Environmental (1995), Alexander et al. (2007), and Altman and Lloyd (2012) as summarized in Altman and Stephens (2012).
- Shrub/canopy cover is necessary for nesting sites, and herbaceous cover for foraging.
- This species is highly susceptible to cowbird parasitism, and cowbird parasitism has been suggested as a principal contributing factor for declining populations in western Washington (Lewis and Shape 1987).

Lazuli Bunting by James Livaudais

LAZULI BUNTING

(Passerina amoena)

Habitat: Oak Savannah or Open Woodland

Habitat Attribute: moderate and patchy shrub cover

Status	Ecoregion/Subregion						Priority
	Puget Lowlands		Willamette Valley		Klamath Mountains		
	North	South	North	South	Umpqua Valley	Rogue Basin	
Focal		√	√	√	√	√	

Current Population Estimates (Ecoregions)

- Puget Lowlands: 8,200
- Willamette Valley: 32,100
- Klamath Mountains: 152,300

Population Objectives (Sites)

Target Densities in Suitable Habitat:

Puget Lowlands:

South: >0.10 birds/ha (>0.04 birds/ac)

Willamette Valley:

North: >0.13 birds/ha (>0.05 birds/ac)

South: >0.22 birds/ha (>0.09 birds/ac)

Klamath Mountains:

Umpqua: >0.65 birds/ha (>0.26 birds/ac)

Rogue: >0.60 birds/ha (>0.24 birds/ac)

Habitat Objectives (Sites)

Oak Savannah or Open Woodland in the following conditions:

- canopy cover <40%
- shrub cover 20-50% with an interspersion of herbaceous areas

Data Sources, Assumptions, and Comments

- Population estimates are based on BBS data and ecoregional calculations using the process described in Blancher et al. (2013).
- Site-level population objectives were based on Altman and Stephens (2012), Altman et al. (2017), and B. Altman (unpublished database).
- Site-level habitat objectives were based on Hagar and Stern (1997), Alexander et al. (2008), and Altman and Lloyd (2012) as summarized in Altman and Stephens (2012).

California Scrub-Jay by James Livaudais

CALIFORNIA SCRUB-JAY

(Aphelocoma californica)

Habitat: Oak Savannah or Open Woodland

Habitat Attribute: large mature trees

Status	Ecoregion/Subregion						Priority
	Puget Lowlands		Willamette Valley		Klamath Mountains		
	North	South	North	South	Umpqua Valley	Rogue Basin	
Focal	√	√	√	√	√	√	

Current Population Estimates (Ecoregions)

- Puget Lowlands: 1,400
- Willamette Valley: 39,900
- Klamath Mountains: 22,400

Population Objectives (Sites)
Target Densities in Suitable Habitat:

Puget Lowlands:
North: >0.01 birds/ha (>0.004 birds/ac)
South: >0.02 birds/ha (>0.004 birds/ac)

Willamette Valley:
North: >0.03 birds/ha (>0.01 birds/ac)
South: >0.11 birds/ha (>0.04 birds/ac)

Klamath Mountains:
Umpqua: >0.03 birds/ha (>0.01 birds/ac)
Rogue: >0.13 birds/ha (>0.05 birds/ac)

Habitat Objectives (Sites)
Oak Savannah or Open Woodland in the following conditions:

- canopy cover 20-60%
- subcanopy cover <25%
- shrub cover 20-60%
- low-statured herbaceous ground cover <30 cm (12 in)
- mean tree DBH >38 cm (15 in)

Data Sources, Assumptions, and Comments

- Population estimates are based on BBS data and ecoregional calculations using the process described in Blancher et al. (2013). The Puget Lowlands population estimate represents a range expansion and does not meet criteria for imperiled status in this document.
- Site-level population objectives were based on Altman and Stephens (2012), Altman et al. (2017), B. Altman (unpublished database), and G. Slater (unpublished data).
- Site-level habitat objectives were based on Anderson (1970), Hagar and Stern (1997), and Altman and Lloyd (2012), as summarized in Altman and Stephens (2012).
- It is a recent range-expansion resident of the south Puget Lowlands with no data yet available, but given a minimum target density to indicate occurrence.

Acorn Woodpecker by James Livaudais

ACORN WOODPECKER

(Melanerpes formicivorus)

Habitat: Oak Closed Woodland or Forest

Habitat Attribute: large mature trees

Status	Ecoregion/Subregion						Priority
	Puget Lowlands		Willamette Valley		Klamath Mountains		
	North	South	North	South	Umpqua Valley	Rogue Basin	
Focal			√	√	√	√	√

Current Population Estimates (Ecoregions)

- Willamette Valley: 3,900
- Klamath Mountains: 30,900

Population Objectives (Sites)

Target Densities in Suitable Habitat:

Willamette Valley:

North: >0.01 birds/ha (>0.004 birds/ac)

South: >0.01 birds/ha (>0.004 birds/ac)

Klamath Mountains:

Umpqua: >0.01 birds/ha (>0.004 birds/ac)

Rogue: >0.03 birds/ha (>0.01 birds/ac)

Habitat Objectives (Sites)

Oak Closed Woodland or Forest in the following conditions:

- canopy cover >40%
- subcanopy cover <15%
- mean tree DBH >38 cm (15 in), with >20% of trees >53 cm (21 in) DBH

Data Sources, Assumptions, and Comments

- Population estimates are based on BBS data and ecoregional calculations using the process described in Blancher et al. (2013).
- Site-level population objectives were based on Altman and Stephens (2012), Altman et al. (2017), and B. Altman (unpublished database).
- Site-level habitat objectives were based on Doerge (1979), Wilson et al. (1991), Hagar and Stern (1997), and Altman and Lloyd (2012) as summarized in Altman and Stephens (2012).

WESTERN WOOD-PEWEE

(Contopus sordidulus)

Habitat: Oak Closed Woodland or Forest

Habitat Attribute: canopy edges and openings

Western Wood-Pewee by James Livaudais

Status	Ecoregion/Subregion						Priority
	Puget Lowlands		Willamette Valley		Klamath Mountains		
	North	South	North	South	Umpqua Valley	Rogue Basin	
Focal	√	√	√	√	√	√	

Current Population Estimates (Ecoregions)

- Puget Lowlands: 53,000
- Willamette Valley: 79,200
- Klamath Mountains: 83,400

Population Objectives (Sites)

Target Densities in Suitable Habitat:

Puget Lowlands:

North: >0.69 birds/ha (>0.28 birds/ac)
South: >0.69 birds/ha (>0.28 birds/ac)

Willamette Valley:

North: >1.19 birds/ha (>0.48 birds/ac)
South: >0.62 birds/ha (>0.25 birds/ac)

Klamath Mountains:

Umpqua: >0.54 birds/ha (>0.22 birds/ac)
Rogue: >0.18 birds/ha (>0.07 birds/ac)

Habitat Objectives (Sites)

Oak Closed Woodland or Forest in the following conditions:

- canopy cover 35-85%
- mean tree DBH >38 cm (15 in)
- <5% conifer cover in the canopy
- high edge to opening ratios

Data Sources, Assumptions, and Comments

- Population estimates are based on BBS data and ecoregional calculations using the process described in Blancher et al. (2013).
- Site-level population objectives were based on B. Altman (unpublished database).
- Site-level habitat objectives were based on Anderson (1970), Hagar and Stern (1997), Resources Northwest and Pentec Environmental (1995), Rolph (1998), Alexander et al. (2007), and Altman and Lloyd (2012) as summarized in Altman and Stephens (2012).

PURPLE FINCH

(Carpodacus purpureus)

Habitat: Oak Closed Woodland or Forest

Habitat Attribute: moderate to high canopy and subcanopy cover

Purple Finch by Frank Lospalluto

Status	Ecoregion/Subregion						Priority
	Puget Lowlands		Willamette Valley		Klamath Mountains		
	North	South	North	South	Umpqua Valley	Rogue Basin	
Focal	√	√	√	√	√	√	√

Current Population Estimates (Ecoregions)

- Puget Lowlands: 135,100
- Willamette Valley: 53,500
- Klamath Mountains: 38,400

Population Objectives (Sites)

Target Densities in Suitable Habitat:

Puget Lowlands

North: >0.09 birds/ha (>0.04 birds/ac)

South: >0.42 birds/ha (>0.17 birds/ac)

Willamette Valley:

North: >0.35 birds/ha (>0.14 birds/ac)

South: >0.10 birds/ha (>0.04 birds/ac)

Klamath Mountains:

Umpqua: >0.02 birds/ha (>0.01 birds/ac)

Rogue: >0.08 birds/ha (>0.03 birds/ac)

Habitat Objectives (Sites)

Oak Closed Woodland or Forest in the following conditions:

- canopy cover >40%
- subcanopy cover >20%
- shrub cover <50%
- mean tree DBH >30 cm (12 in)
- patches >10 ha (25 ac)

Data Sources, Assumptions, and Comments

- Population estimates are based on BBS data and ecoregional calculations using the process described in Blancher et al. (2013).
- Site-level population objectives were based on Altman and Stephens (2012), Altman et al. (2017), and B. Altman (unpublished database).
- Site-level habitat objectives were based on Cross and Simmons (1983), Hagar and Stern (1997), Altman (2008), and Altman and Lloyd (2012) as summarized in Altman and Stephens (2012).

House Wren by James Livaudais

HOUSE WREN

(Troglodytes aedon)

Habitat: Oak Closed Woodland or Forest

Habitat Attribute: moderate shrub cover with open canopy trees

Status	Ecoregion/Subregion						Priority
	Puget Lowlands		Willamette Valley		Klamath Mountains		
	North	South	North	South	Umpqua Valley	Rogue Basin	
Focal	√	√	√	√	√	√	

Current Population Estimates (Ecoregions)

- Puget Lowlands: 31,900
- Willamette Valley: 16,200
- Klamath Mountains: 47,800

Population Objectives (Sites)

Target Densities in Suitable Habitat:

Puget Lowlands:
North: >0.63 birds/ha (>0.25 birds/ac)
South: >0.73 birds/ha (>0.29 birds/ac)

Willamette Valley:
North: >0.38 birds/ha (>0.15 birds/ac)
South: >0.16 birds/ha (>0.07 birds/ac)

Klamath Mountains:
Umpqua: >0.12 birds/ha (>0.05 birds/ac)
Rogue: >0.18 birds/ha (>0.07 birds/ac)

Habitat Objectives (Sites)

Oak Closed Woodland or Forest in the following conditions:

- canopy cover 25-70%
- canopy and subcanopy conifer cover <10%
- shrub cover >30% with >50% of that cover in native species such as snowberry, poison oak, etc.; exotic blackberry cover <10%
- herbaceous openings in the shrub layer should account for <25% of the understory
- mean tree DBH >38 cm (15 in), with >20% of trees >53 cm (21 in) DBH

Data Sources, Assumptions, and Comments

- Population estimates are based on BBS data and ecoregional calculations using the process described in Blancher et al. (2013).
- Site-level population objectives were based on Altman and Stephens (2012), Altman et al. (2017), and B. Altman (unpublished database).
- Site-level habitat objectives were based on Cross and Simmons (1983), Resources Northwest and Pentec Environmental (1995), Hagar and Stern (1997), Rolph (1998), and Altman and Lloyd (2012) as summarized in Altman and Stephens (2012).

OAK TITMOUSE

(Parus inornatus)

Habitat: Oak Closed Woodland or Forest

Habitat Attribute: moderate subcanopy or shrub cover

Oak Titmouse by James Livaudais

Status	Ecoregion/Subregion						Priority
	Puget Lowlands		Willamette Valley		Klamath Mountains		
	North	South	North	South	Umpqua Valley	Rogue Basin	
Focal						√	√

Current Population Estimates (Ecoregions)

- Klamath Mountains: 3,400

Population Objectives (Sites)

Target Densities in Suitable Habitat:

Klamath Mountains:

Rogue: >0.23 birds/ha (>0.09 birds/ac)

Habitat Objectives (Sites)

Oak Closed Woodland or Forest in the following conditions:

- canopy cover 20-70%
- shrub cover 20-70%
- >5 snags/ha (2/ac) >10 cm (4 in) DBH
- mean tree DBH >23 cm (9 in), with >5 trees/ha (2/ac) >40 cm (16 in) DBH

Data Sources, Assumptions, and Comments

- Population estimates are based on BBS data and ecoregional calculations using the process described in Blancher et al. (2013).
- Site-level population objectives were based on Altman and Stephens (2012), Altman et al. (2017), and B. Altman (unpublished database).
- Site-level habitat objectives were based on Schroeder (1983), Wilson et al. (1991), California Partners in Flight (2002), and Altman and Lloyd (2012) as summarized in Altman and Stephens (2012).
- The objective for canopy cover assumes a closed canopy will have less value due to lack of foliage in middle and lower canopy layers (Schroeder 1983).
- The objective for size of oak trees is to increase the likelihood of natural cavities.
- It occurs as a regular breeding species only in the Rogue Basin of the Klamath Mountains ecoregion.

Bushtit by James Livaudais

BUSHTIT

(Psaltriparus minimus)

Habitat: Oak Closed Woodland or Forest

Habitat Attribute: moderate subcanopy or shrub cover

Status	Ecoregion/Subregion						Priority
	Puget Lowlands		Willamette Valley		Klamath Mountains		
	North	South	North	South	Umpqua Valley	Rogue Basin	
Focal	√	√	√	√	√	√	

Current Population Estimates (Ecoregions)

- Puget Lowlands: 19,900
- Willamette Valley: 34,500
- Klamath Mountains: 10,400

Population Objectives (Sites)

Target Densities in Suitable Habitat:

Puget Lowlands:

North: >0.04 birds/ha (>0.02 birds /ac)

South: >0.03 birds/ha (>0.01 birds/ac)

Willamette Valley:

North: >0.14 birds/ha (>0.06 birds/ac)

South: >0.04 birds/ha (>0.02 birds/ac)

Klamath Mountains:

Umpqua: >0.01 birds/ha (>0.004 birds/ac)

Rogue: >0.19 birds/ha (>0.08 birds/ac)

Habitat Objectives (Sites)

Oak Closed Woodland or Forest in the following conditions:

- canopy cover 30-70%
- subcanopy cover >25%
- shrub cover 30-70%

Data Sources, Assumptions, and Comments

- Population estimates are based on BBS data and ecoregional calculations using the process described in Blancher et al. (2013).
- Site-level population objectives were based on Altman and Stephens (2012), Altman et al. (2017), and B. Altman (unpublished database).
- Site-level habitat objectives were based Anderson (1970), Cross and Simmons (1983), Hagar and Stern (1997), Altman (2008), and Altman and Lloyd (2012) as summarized in Altman and Stephens (2012).

CASSIN'S VIREO

(Vireo cassinii)

Habitat: Oak-Pine

Habitat Attribute: moderate to high canopy and subcanopy cover

Cassin's Vireo by James Livaudais

Status	Ecoregion/Subregion						Priority
	Puget Lowlands		Willamette Valley		Klamath Mountains		
	North	South	North	South	Umpqua Valley	Rogue Basin	
Focal				√	√	√	

Current Population Estimates (Ecoregions)

- Puget Lowlands: 2,000
- Willamette Valley: 1,800
- Klamath Mountains: 84,400

Population Objectives (Sites)

Target Densities in Suitable Habitat:

Willamette Valley:

South: >0.14 birds/ha (>0.06 birds/ac)

Klamath Mountains:

Umpqua: >0.07 birds/ha (>0.03 birds/ac)

Rogue: >0.17 birds/ha (>0.07 birds/ac)

Habitat Objectives (Sites)

Oak-Pine habitat in the following conditions:

- canopy cover >65%
- subcanopy cover >20%
- shrub cover 30-70%
- mean tree DBH >23 cm (9 in)

Data Sources, Assumptions, and Comments

- Population estimates are based on BBS data and ecoregional calculations using the process described in Blancher et al. (2013). These estimates would indicate imperiled status in the Puget Lowlands and Willamette Valley. However, expert opinion and other data sources suggest higher population numbers than the BBS estimates.
- Site-level population objectives were based on Altman and Stephens (2012), Altman et al. (2017), B. Altman (unpublished database), and G. Slater (unpublished data).
- Site-level habitat objectives were based on Hagar and Stern (1997) and Altman and Lloyd (2012) as summarized in Altman and Stephens (2012).
- Oak-Pine habitat has limited occurrence in the Willamette Valley (mostly central and south) and even less so in the Puget Lowlands (south only, at one location).

Hutton's Vireo by James Livaudais

HUTTON'S VIREO

(Vireo huttoni)

Habitat: Oak-Hardwood

Habitat Attribute: moderate subcanopy or shrub cover

Status	Ecoregion/Subregion						Priority
	Puget Lowlands		Willamette Valley		Klamath Mountains		
	North	South	North	South	Umpqua Valley	Rogue Basin	
Focal	√	√	√	√	√	√	

Current Population Estimates (Ecoregions)

- Puget Lowlands: 12,300
- Willamette Valley: 6,100
- Klamath Mountains: 21,800

Population Objectives (Sites)

Target Densities in Suitable Habitat:

Puget Lowlands:

North: >0.07 birds/ha (>0.03 birds/ac)

South: >0.02 birds/ha (>0.01 birds/ac)

Willamette Valley:

North: >0.03 birds/ha (>0.01 birds/ac)

South: >0.06 birds/ha (>0.02 birds/ac)

Klamath Mountains:

Umpqua: >0.06 birds/ha (>0.02 birds/ac)

Rogue: >0.09 birds/ha (>0.04 birds/ac)

Habitat Objectives (Sites)

Oak-Hardwood habitat in the following conditions:

- canopy cover >50%
- subcanopy and/or shrub cover combined >60%

Data Sources, Assumptions, and Comments

- Population estimates are based on BBS data and ecoregional calculations using the process described in Blancher et al. (2013).
- Site-level population objectives were based on Altman and Stephens (2012), Altman et al. (2017), and B. Altman (unpublished database).
- Site-level habitat objectives were based on Manley (1988), Viste-Sparkman (2005), and Altman and Lloyd (2012) as summarized by Altman and Stephens (2012).

California Towhee by James Livaudais

CALIFORNIA TOWHEE

(Pipilo crissalis)

Habitat: Oak-Chaparral

Habitat Attribute: dense shrub cover with herbaceous openings

Status	Ecoregion/Subregion						Priority
	Puget Lowlands		Willamette Valley		Klamath Mountains		
	North	South	North	South	Umpqua Valley	Rogue Basin	
Focal						√	

Current Population Estimates (Ecoregions)

- Klamath Mountains: 4,600

Population Objectives (Sites)

Target Densities in Suitable Habitat:

Klamath Mountains:

Rogue: >0.21 birds/ha (>0.09 birds/ac)

Habitat Objectives (Sites)

Oak-Chaparral habitat in the following conditions:

- canopy cover <30%
- canopy and subcanopy conifer cover <10%
- shrub cover 40-70%
- interspersion of shrub and herbaceous cover with each >30%
- patch size >2-5+ ha (5-12+ ac)

Data Sources, Assumptions, and Comments

- Population estimates are based on BBS data and ecoregional calculations using the process described in Blancher et al. (2013).
- Site-level population objectives were based on Altman and Stephens (2012), Altman et al. (2017), and B. Altman (unpublished database).
- Site-level habitat objectives were based on Alexander et al. (2007) and Altman and Lloyd (2012) as summarized in Altman and Stephens (2012), and Stephens and Gillespie (2016).
- It occurs as a breeding species almost exclusively in the Rogue Basin, except breeds very locally south of Roseburg in the Umpqua Valley.

BLUE-GRAY GNATCATCHER

(Polioptila caerulea)

Habitat: Oak-Chaparral

Habitat Attribute: moderate to high shrub cover

Blue-gray Gnatcatcher by James Livaudais

Status	Ecoregion/Subregion						Priority
	Puget Lowlands		Willamette Valley		Klamath Mountains		
	North	South	North	South	Umpqua Valley	Rogue Basin	
Focal						√	

Current Population Estimates (Ecoregions)

- Klamath Mountains: 3,300

Population Objectives (Sites)

Target Densities in Suitable Habitat:

Klamath Mountains:

Rogue: >0.51 birds/ha (>0.21 birds/ac)

Habitat Objectives (Sites)

Oak-Chaparral habitat in the following conditions:

- canopy cover <45%
- shrub cover >40%
- patch size >2-5+ ha (5-12+ ac)
- maintain cowbird parasitism levels <10% within specific study sites

Data Sources, Assumptions, and Comments

- Population estimates are based on BBS data and ecoregional calculations using the process described in Blancher et al. (2013).
- Site-level population objectives were based on Altman and Stephens (2012), Altman et al. (2017), and B. Altman (unpublished database).
- Site-level habitat objectives were based on Alexander et al. (2007) and Altman and Lloyd (2012) as summarized in Altman and Stephens (2012), Stephens and Gillespie (in prep).
- It occurs as a regular breeding species only in the Rogue Basin of the Klamath Mountains ecoregion.
- It appears to be highly susceptible to cowbird parasitism (Speer and Felker 1991).

Riparian floodplain by Sarah Rockwell

- At the subregion level, maintain or provide >30% of the historical extent of riparian habitat within each major watershed.
- Maintain or provide contiguous riparian woodlands or shrublands in areas >20 ha (50 ac).
- Maintain riparian corridor width >30 m (100 ft) where ecologically appropriate.
- Retain all trees >56 cm (22 in) DBH within the riparian corridor.
- Maintain >5 snags/ha (2 snags/ac) >30 cm (12 in) DBH.
- Eliminate livestock grazing access to riparian zones (e.g., fencing).

Rationale: Loss of mature trees and reductions in area of riparian habitat are prominent threats for riparian birds throughout the region. The objective for restoration of >30% of each riparian system as a percent of the historical area of riparian woodland was developed based on professional judgment and is intended to stimulate restoration actions at various locations within watersheds.

Focal species population and habitat objectives for riparian habitats are presented here. One imperiled species also uses riparian habitats (Lewis's Woodpecker); please refer to the Imperiled Species section below.

SPOTTED SANDPIPER

(Actitis macularia)

Habitat: Open Floodplain

Habitat Attribute: interspersion of bare ground and herbaceous vegetation

Spotted Sandpiper by Frank Lospalluto

Status	Ecoregion/Subregion						Priority
	Puget Lowlands		Willamette Valley		Klamath Mountains		
	North	South	North	South	Umpqua Valley	Rogue Basin	
Focal	√	√	√	√	√	√	

Current Population Estimates (Ecoregions)

- Puget Lowlands: 1,600
- Willamette Valley: 1,000
- Klamath Mountains: 0*

Population Objectives (Sites)

Target Densities in Suitable Habitat:

Puget Lowlands:
>0.64 birds/river km (1.03 birds/river mi)

Willamette Valley:
>0.64 birds/river km (1.03 birds/river mi)

Klamath Mountains:
>0.64 birds/river km (1.03 birds/river mi)

Habitat Objectives (Sites)

Riparian Open Floodplain in the following conditions:

- immediate shoreline >90% non-vegetated for foraging
- shoreline <100 m (328 ft) inland 10-50% patchy herbaceous cover for nesting

Data Sources, Assumptions, and Comments

- Population estimates are based on BBS data and ecoregional calculations using the process described in Blancher et al. (2013). *However, BBS routes may not adequately survey for this species (e.g., they do breed regularly in the Klamath Mountains ecoregion).
- BBS correction factors for detection distance, likelihood of detecting the pair, and time of day are not available for this species; 200 m was used as the detection distance, and pair and time adjustments were given the mean value for all other focal and imperiled species in these habitat types to make the population estimate calculations.
- Site-level population objectives were based on Wilson et al. (1991) and Rockwell and Stephens (2016).
- Site-level habitat objectives were based on Reed et al. (2020) and professional judgment.

SONG SPARROW

(Melospiza melodia)

Habitat: Riparian Shrubland

Habitat Attribute: early successional

Song Sparrow by Frank Lospalluto

Status	Ecoregion/Subregion						Priority
	Puget Lowlands		Willamette Valley		Klamath Mountains		
	North	South	North	South	Umpqua Valley	Rogue Basin	
Focal	√	√	√	√	√	√	

Current Population Estimates (Ecoregions)

- Puget Lowlands: 722,500
- Willamette Valley: 451,000
- Klamath Mountains: 157,200

Population Objectives (Sites)

Target Densities in Suitable Habitat:

Puget Lowlands:

North: >0.53 birds/ha (>0.22 birds/ac)

South: >0.53 birds/ha (>0/22 birds/ac)

Willamette Valley:

North: >1.11 birds/ha (>0.45 birds/ac)

South: >1.11 birds/ha (>0.45 birds/ac)

Klamath Mountains:

Umpqua Valley: >1.24 birds/ha (>0.50 birds/ha

Rogue Valley: >1.31 birds/ha (>0.53 birds/ha)

Habitat Objectives (Sites)

Riparian Shrubland in the following conditions:

- canopy cover <5%
- shrub cover 40-70% with scattered herbaceous openings

Data Sources, Assumptions, and Comments

- Population estimates are based on BBS data and ecoregional calculations using the process described in Blancher et al. (2013).
- Site-level population objectives were based on B. Altman (unpublished data) and Klamath Bird Observatory (unpublished data); riparian inventory data available from Avian Knowledge Northwest.
- Site-level habitat objectives were based on B. Altman (unpublished data), Marshall et al. (2003), and professional judgment.

WILLOW FLYCATCHER

(Empidonax trallii)

Habitat: Riparian Shrubland

Habitat Attribute: moderate to high shrub cover

Willow Flycatcher by Frank Lospalluto

Status	Ecoregion/Subregion						Priority
	Puget Lowlands		Willamette Valley		Klamath Mountains		
	North	South	North	South	Umpqua Valley	Rogue Basin	
Focal	√	√	√	√			√

Current Population Estimates (Ecoregions)

- Puget Lowlands: 241,300
- Willamette Valley: 51,100

Population Objectives (Sites)

Target Densities in Suitable Habitat:

Puget Lowlands:

North: >0.30 birds/ha (>0.12 birds/ac)
South: >0.46 birds/ha (>0/19 birds/ac)

Willamette Valley:

North: >0.11 birds/ha (>0.04 birds/ac)
South: >0.11 birds/ha (>0.04 birds/ac)

Habitat Objectives (Sites)

Riparian Shrubland in the following conditions:

- canopy cover <15%
- shrub cover 50-80% with scattered herbaceous openings
- habitat areas >2 ha (5 ac) and >30 m (100 ft) in width
- maintain cowbird parasitism rates below 10%

Data Sources, Assumptions, and Comments

- Population estimates are based on BBS data and ecoregional calculations using the process described in Blancher et al. (2013).
- Site-level population objectives were based on B. Altman (unpublished database).
- Site-level habitat objectives were based on B. Altman (unpublished data), Altman (2000), Altman et al. (2003), Marshall et al. (2003), and Smith (2010).
- Species is highly susceptible to cowbird parasitism (Sedgwick 2000).

YELLOW-BREASTED CHAT

(Icteria virens)

Habitat: Riparian Shrubland

Habitat Attribute: moderate to high shrub cover

Yellow-breasted Chat by James Livaudais

Status	Ecoregion/Subregion						Priority
	Puget Lowlands		Willamette Valley		Klamath Mountains		
	North	South	North	South	Umpqua Valley	Rogue Basin	
Focal					√	√	√

Current Population Estimates (Ecoregions)

- Klamath Mountains: 79,000

Population Objectives (Sites)

Target Densities in Suitable Habitat:

Klamath Mountains:

Umpqua: >0.27 birds/ha (>0.11 birds/ac)

Rogue: >0.66 birds/ha (>0.27 birds/ac)

Habitat Objectives (Sites)

Riparian Shrubland in the following conditions:

- canopy cover <20%
- shrub cover 30-80% with scattered herbaceous openings
- habitat areas >4 ha (10 ac) and >30 m (100 ft) in width
- maintain cowbird parasitism rates below 10%

Data Sources, Assumptions, and Comments

- Population estimates are based on BBS data and ecoregional calculations using the process described in Blancher et al. (2013). It is a regular breeder in parts of the Puget Lowlands ecoregion, but BBS routes do not adequately reflect this.
- Site-level population objectives were based on B. Altman (unpublished database).
- Site-level habitat objectives were based on B. Altman (unpublished data), Altman (2000), and Marshall et al. (2003).
- Species is highly susceptible to cowbird parasitism (Eckerle and Thompson 2001).

BLACK-CAPPED CHICKADEE

(Parus atricapillus)

Habitat: Riparian Open Woodland

Habitat Attribute: cavities in snags or decadent limbs

Black-capped Chickadee by James Livaudais

Status	Ecoregion/Subregion						Priority
	Puget Lowlands		Willamette Valley		Klamath Mountains		
	North	South	North	South	Umpqua Valley	Rogue Basin	
Focal	√	√	√	√	√	√	

Current Population Estimates (Ecoregions)

- Puget Lowlands: 262,900
- Willamette Valley: 212,000
- Klamath Mountains: 113,100

Population Objectives (Sites)

Target Densities in Suitable Habitat:

Puget Lowlands:

North: >0.07 birds/ha (>0.03 birds/ac)
South: >0.07 birds/ha (>0.03 birds/ac)

Willamette Valley:

North: >0.43 birds/ha (>0.17 birds/ac)
South: >0.43 birds/ha (>0.17 birds/ac)

Klamath Mountains:

Umpqua: >0.75 birds/ha (>0.30 birds/ac)
Rogue: >0.37 birds/ha (>0.15 birds/ac)

Habitat Objectives (Sites)

Riparian Open Woodland in the following conditions:

- canopy cover 30-80%
- subcanopy cover 20-40%
- mean tree DBH >23 cm (9 in)

Data Sources, Assumptions, and Comments

- Population estimates are based on BBS data and ecoregional calculations using the process described in Blancher et al. (2013).
- Site-level population objectives were based on B. Altman (unpublished database).
- Site-level habitat objectives were based on Cross and Simmons (1983), Hagar and Stern (1997), and Altman and Lloyd (2012) as summarized in Altman and Stephens (2012) (Note: based on oak habitats).

BULLOCK'S ORIOLE

(Icterus bullockii)

Habitat: Riparian Open Woodland

Habitat Attribute: large mature trees

Bullock's Oriole by James Livaudais

Status	Ecoregion/Subregion						Priority
	Puget Lowlands		Willamette Valley		Klamath Mountains		
	North	South	North	South	Umpqua Valley	Rogue Basin	
Focal					√	√	√

Current Population Estimates (Ecoregions)

- Puget Lowlands: 7,600
- Willamette Valley: 13,700
- Klamath Mountains: 51,000

Population Objectives (Sites)

Target Densities in Suitable Habitat:

Puget Lowlands:

North: >0.02 birds/ha (>0.01 birds/ac)

South: >0.02 birds/ha (>0.01 birds/ac)

Willamette Valley:

North: >0.06 birds/ha (>0.02 birds/ac)

South: >0.06 birds/ha (>0.02 birds/ac)

Klamath Mountains:

Umpqua: >0.27 birds/ha (>0.11 birds/ac)

Rogue: >0.21 birds/ha (>0.09 birds/ac)

Habitat Objectives (Sites)

Riparian Open Woodland in the following conditions:

- dominance of cottonwood trees
- mean canopy tree height >15 m (50 ft)
- canopy cover 30-60%
- subcanopy cover <20%

Data Sources, Assumptions, and Comments

- Population estimates are based on BBS data and ecoregional calculations using the process described in Blancher et al. (2013).
- Site-level population objectives were based on B. Altman (unpublished database).
- Site-level habitat objectives were based on Schaefer (1976), Stauffer and Best (1980), Saab (1999), Altman (2000), and Marshall et al. (2003).

SPOTTED TOWHEE

(Pipilo maculatus)

Habitat: Riparian Open Woodland

Habitat Attribute: scattered shrubs with herbaceous openings

Spotted Towhee by James Livaudais

Status	Ecoregion/Subregion						Priority
	Puget Lowlands		Willamette Valley		Klamath Mountains		
	North	South	North	South	Umpqua Valley	Rogue Basin	
Focal	√	√	√	√	√	√	

Current Population Estimates (Ecoregions)

- Puget Lowlands: 973,100
- Willamette Valley: 645,600
- Klamath Mountains: 531,000

Population Objectives (Sites)

Target Densities in Suitable Habitat:

Puget Lowlands:

North: >0.27 birds/ha (>0.11 birds/ac)

South: >0.27 birds/ha (>0.11 birds/ac)

Willamette Valley:

North: >0.60 birds/ha (>0.24 birds/ac)

South: >0.60 birds/ha (>0.24 birds/ac)

Klamath Mountains:

Umpqua: >0.80 birds/ha (>0.32 birds/ac)

Rogue: >1.09 birds/ha (>0.44 birds/ac)

Habitat Objectives (Sites)

Riparian Open Woodland in the following conditions:

- subcanopy cover >20%
- shrub cover >50%

Data Sources, Assumptions, and Comments

- Population estimates are based on BBS data and ecoregional calculations using the process described in Blancher et al. (2013).
- Site-level population objectives were based on B. Altman (unpublished database).
- Site-level habitat objectives were based on Hagar and Stern (1997) and Altman and Lloyd (2012), as summarized in Altman and Stephens (2012). (Note: based on oak habitats).

YELLOW WARBLER

(Setophaga petechia)

Habitat: Riparian Closed Woodland or Forest

Habitat Attribute: moderate to high subcanopy and shrub cover

Yellow Warbler by James Livaudais

Status	Ecoregion/Subregion						Priority
	Puget Lowlands		Willamette Valley		Klamath Mountains		
	North	South	North	South	Umpqua Valley	Rogue Basin	
Focal	√	√	√	√	√	√	

Current Population Estimates (Ecoregions)

- Puget Lowlands: 113,100
- Willamette Valley: 13,400
- Klamath Mountains: 6,200

Population Objectives (Sites)

Target Densities in Suitable Habitat:

Puget Lowlands:
North: >0.08 birds/ha (>0.03 birds/ac)
South: >0.38 birds/ha (>0.15 birds/ac)

Willamette Valley:
North: >0.25 birds/ha (>0.10 birds/ac)
South: >0.25 birds/ha (>0.10 birds/ac)

Klamath Mountains:
Umpqua: >0.30 birds/ha (>0.12 birds/ac)
Rogue: >0.47 birds/ha (>0.19 birds/ac)

Habitat Objectives (Sites)

Riparian Closed Woodland or Forest in the following conditions:

- canopy cover 25-50%
- subcanopy and shrub cover >70%, with subcanopy cover contributing >40%
- habitat patches >4 ha (10 ac) and >40 m (130 ft) in width
- ≤10% of the habitat area should be hostile habitat (i.e., urban, residential, high density rural, agriculture)
  - >1 km (0.6 mi) from urban/residential areas
  - >5 km (3 mi) from high-use cowbird areas
- maintain cowbird parasitism rates below 10%

Data Sources, Assumptions, and Comments

- Population estimates are based on BBS data and ecoregional calculations using the process described in Blancher et al. (2013).
- Site-level population objectives were based on Altman (2009) and B. Altman (unpublished database).
- Site-level habitat objectives were based on Schroeder (1982), Altman (2000), Marshall et al. (2003), and Strusis-Timmer (2009).
- This species is highly susceptible to cowbird parasitism Lowther et al. (1999). The objective for limited hostile habitat is to minimize the potential for cowbird parasitism.

DOWNY WOODPECKER

(Picoides pubescens)

Habitat: Riparian Closed Woodland or Forest

Habitat Attribute: cavities in snags or decadent limbs

Downy Woodpecker by James Livaudais

Status	Ecoregion/Subregion						Priority
	Puget Lowlands		Willamette Valley		Klamath Mountains		
	North	South	North	South	Umpqua Valley	Rogue Basin	
Focal	√	√	√	√	√	√	

Current Population Estimates (Ecoregions)

- Puget Lowlands: 25,700
- Willamette Valley: 15,500
- Klamath Mountains: 11,600

Population Objectives (Sites)

Target Densities in Suitable Habitat:

Puget Lowlands:

North: >0.09 birds/ha (>0.04 birds/ac)

South: >0.02 birds/ha (>0.01 birds/ac)

Willamette Valley:

North: >0.09 birds/ha (>0.04 birds/ac)

South: >0.09 birds/ha (>0.04 birds/ac)

Klamath Mountains:

Umpqua: >0.18 birds/ha (>0.07 birds/ac)

Rogue: >0.06 birds/ha (>0.02 birds/ac)

Habitat Objectives (Sites)

Riparian Closed Woodland or Forest in the following conditions:

- canopy cover >50%
- subcanopy cover >20%
- canopy and subcanopy conifer cover <10%
- >12 snags/ha (5/ac) >15 cm (6 in) DBH and >1.8 m (6 ft) tall; of these >5/ha (2/ac) should be >25 cm (10 in) DBH

Data Sources, Assumptions, and Comments

- Population estimates are based on BBS data and ecoregional calculations using the process described in Blancher et al. (2013).
- Site-level population objectives were based on Altman (2009) and B. Altman (unpublished database).
- Site-level habitat objectives were based on Schroeder (1983), Hagar and Stern (1997), and Altman and Lloyd (2012) as summarized in Altman and Stephens (2012). (Note: latter two based on oak habitats).

BLACK-HEADED GROSBEAK

(Pheucticus melanocephalus)

Habitat: Riparian Closed Woodland or Forest

Habitat Attribute: mixed hardwood and conifer trees

Black-headed Grosbeak by James Livaudais

Status	Ecoregion/Subregion						Priority
	Puget Lowlands		Willamette Valley		Klamath Mountains		
	North	South	North	South	Umpqua Valley	Rogue Basin	
Focal	√	√	√	√	√	√	

Current Population Estimates (Ecoregions)

- Puget Lowlands: 2,577,300
- Willamette Valley: 1,195,000
- Klamath Mountains: 2,711,500

Population Objectives (Sites)

Target Densities in Suitable Habitat:

Puget Lowlands:

North: >0.20 birds/ha

South: >0.20 birds/ha

Willamette Valley:

North: >0.51 birds/ha (>0.21 birds/ac)

South: >0.51 birds/ha (>0.21 birds/ac)

Klamath Mountains:

Umpqua: >0.54 birds/ha (>0.22 birds/ac)

Rogue: >0.29 birds/ha (>0.12 birds/ac)

Habitat Objectives (Sites)

Riparian Closed Woodland or Forest in the following conditions:

- >40% canopy cover
- >20% canopy cover of both hardwood and conifer trees
- >20% subcanopy cover
- mean tree DBH >23 cm (9 in)

Data Sources, Assumptions, and Comments

- Population estimates are based on BBS data and ecoregional calculations using the process described in Blancher et al. (2013).
- Site-level population objectives were based on B. Altman (unpublished database).
- Site-level habitat objectives were based on Hagar and Stern (1997) and Altman and Lloyd (2012) as summarized in Altman and Stephens (2012) (note: both based on oak habitats), as well as professional judgment.

RUFOUS HUMMINGBIRD

(Selasphorus rufus)

Habitat: Riparian Closed Woodland or Forest

Habitat Attribute: flowering plants

Rufous Hummingbird by James Livaudais

Status	Ecoregion/Subregion						Priority
	Puget Lowlands		Willamette Valley		Klamath Mountains		
	North	South	North	South	Umpqua Valley	Rogue Basin	
Focal	√	√	√	√	√	√	√

Current Population Estimates (Ecoregions)

- Puget Lowlands: 197,300
- Willamette Valley: 58,400
- Klamath Mountains: 97,100

Population Objectives (Sites)

Target Densities in Suitable Habitat:

Puget Lowlands:

North: >0.01 birds/ha (>0.004 birds/ac)

South: >0.01 birds/ha (>0.004 birds/ac

Willamette Valley:

North: >0.10 birds/ha (>0.04 birds/ac)

South: > 0.10 birds/ha (>0.04 birds/ac

Klamath Mountains:

Umpqua: >0.02 birds/ha (>0.01 birds/ac)

Rogue: >0.08 birds/ha (>0.03 birds/ac)

Habitat Objectives (Sites)

Riparian Closed Woodland or Forest in the following conditions:

- shrub/herbaceous cover >20% in nectar-producing plants
- increase the abundance and diversity of native plants where appropriate

Data Sources, Assumptions, and Comments

- Population estimates are based on BBS data and ecoregional calculations using the process described in Blancher et al. (2013).
- Site-level population objectives were based on B. Altman (unpublished database).
- Site-level habitat objectives were based on Gillespie et al. (2020) and professional experience.

Bewick's Wren by James Livaudais

BEWICK'S WREN

(Thyromanes bewickii)

Habitat: Riparian Closed Woodland or Forest

Habitat Attribute: moderate to high shrub cover

Status	Ecoregion/Subregion						Priority
	Puget Lowlands		Willamette Valley		Klamath Mountains		
	North	South	North	South	Umpqua Valley	Rogue Basin	
Focal	√	√	√	√	√	√	

Current Population Estimates (Ecoregions)

- Puget Lowlands: 34,900
- Willamette Valley: 31,000
- Klamath Mountains: 15,300

Population Objectives (Sites)

Target Densities in Suitable Habitat:

Puget Lowlands:

North: >0.09 birds/ha (>0.04 birds/ac)

South: >0.09 birds/ha (>0.04 birds/ac)

Willamette Valley:

North: >0.28 birds/ha (>0.11 birds/ac)

South: >0.28 birds/ha (>0.11 birds/ac)

Klamath Mountains:

Umpqua: >0.06 birds/ha (>0.02 birds/ac)

Rogue: >0.18 birds/ha (>0.07 birds/ac)

Habitat Objectives (Sites)

Riparian Closed Woodland or Forest in the following conditions:

- patchy shrub layer with 30-80% cover
- 16.4 snags/ha (6.6 snags/ac) >15 cm (6 in) DBH
- maintain cowbird parasitism rates below 10%

Data Sources, Assumptions, and Comments

- Population estimates are based on BBS data and ecoregional calculations using the process described in Blancher et al. (2013).
- Site-level population objectives were based on B. Altman (unpublished database).
- Site-level habitat objectives were based on Altman (2000), Marshall et al. (2003), and Tirpak et al. (2009).

Imperiled Species Biological Objectives

STREAKED HORNED LARK

(Eremophila alpestris strigata)

Habitat: Prairie

Habitat Attribute: large, open landscapes with low-statured and sparse vegetation

Horned Lark by James Livaudais

Status	Ecoregion/Subregion						Priority
	Puget Lowlands		Willamette Valley		Klamath Mountains		
	North	South	North	South	Umpqua Valley	Rogue Basin	
Imperiled	√	√	√	√ *	√ *	√	√

* was present as regularly breeding species historically, but objectives to reestablish populations are not included in the USFWS Recovery Plan

√ = Imperiled, Green = not imperiled, Dark Gray = extirpated, Black = outside of historic range

Current Population Estimates (Ecoregions)

- Puget Lowlands: 252
- Willamette Valley: 1,100

Population Objectives (Ecoregions)

Puget Lowlands:

By 2030, increase the current estimated population of 252 birds by ≥50.8% to ≥380 birds (4.2% annual exponential growth), with ≥280 birds in ≥8 subpopulations, and another ≥100 birds elsewhere throughout the ecoregion.

Willamette Valley (North):

By 2030, increase the current estimated population of 195 birds by ≥26.7% (2.4% annual exponential growth) to ≥247 birds, with ≥90 birds in ≥3 subpopulations, and another ≥157 birds elsewhere throughout the ecoregion.

Willamette Valley (West):

By 2030, increase the current estimated population of 449 birds by ≥61.3% (4.9% annual exponential growth) to ≥724 birds, with ≥600 birds in ≥9 subpopulations, and another ≥124 birds elsewhere throughout the ecoregion.

Willamette Valley (Southeast):

By 2030, increase the current estimated population of 456 birds by ≥61.2% (4.9% annual exponential increase) to ≥735 birds, with ≥600 birds in ≥9 subpopulations, and another ≥135 birds elsewhere throughout the ecoregion.

Area	Subpopulations			Habitat [up to X hectares (acres)]		
	Large	Medium	Total	Large	Medium	Total
South	6	2	8	1,518 (3,750)	303 (750)	1,821 (4,500)
Total	6	2	8	1,518 (3,750)	303 (750)	1,821 (4,500)

Habitat Objectives (Ecoregions)

Puget Lowlands:

By 2030, maintain ≥8 suitable habitat areas as described below that include ≤1,821 ha (4,500 ac).

Willamette Valley (North):

By 2030, maintain ≥3 suitable habitat areas as described below that include ≤209 ha (516 ac).

Willamette Valley (West):

By 2030, maintain ≥9 suitable habitat areas as described below that include ≤1,420 ha (3,509 ac).

Willamette Valley (Southeast):

By 2030, maintain ≥9 suitable habitat areas as described below that include ≤1,420 ha (3,509 ac).

Area	Subpopulations			Habitat [up to X hectares (acres)]		
	Large	Medium	Total	Large	Medium	Total
North	0	3	3	0	209 (516)	209 (516)
West	3	6	9	1548	794 (1,961)	1,420 (3,509)
Southeast	3	6	9	1548	794 (1,961)	1,420 (3,509)
Total	8	15	23	3096	1,796 (4,438)	3,049 (7,534)

Population and Habitat Objectives (Subregions)

Puget Lowlands:

Size, Number, and Distribution of Subpopulations and Habitat Areas by 2030:

- ≥6 large subpopulations (i.e., >20 pairs) in <1,518 ha (3,750 ac)/subpopulation
- ≥2 medium subpopulations (i.e., 10-20 pairs) in <303 ha (750 ac)/subpopulation

Willamette Valley (North):

Size, Number, and Distribution of Subpopulations and Habitat Areas by 2030:

- ≥3 medium subpopulations (i.e., >15 pairs) in <209 ha (516 ac)/subpopulation

Willamette Valley (West):

Size, Number, and Distribution of Subpopulations and Habitat Areas by 2030:

- ≥3 large subpopulations (i.e., >50 pairs) in <626 ha (1,548 ac)/subpopulation
- ≥6 medium subpopulations (i.e., 25-50 pairs) in <794 ha (1,961 ac)/subpopulation

Willamette Valley (Southeast):

Size, Number, and Distribution of Subpopulations and Habitat Areas by 2030:

- ≥3 large subpopulations (i.e., >50 pairs) in <626 ha (1,548 ac)/subpopulation
- ≥6 medium subpopulations (i.e., 25-50 pairs) in <794 ha (1,961 ac)/subpopulation

All Ecoregions:

- all of the habitat areas should be in secure conservation status (i.e., ownership or easements) and managed in ways compatible with suitable habitat
- ≤10% of the subpopulation habitat areas should be hostile habitat (i.e., urban, residential, high density rural)

Population Objectives (Sites)

Target Densities in Suitable Habitat:

Puget Lowlands:

South: >0.03 birds/ha (>0.01 birds/ac)

Willamette Valley:

North: >0.03 birds/ha (>0.01 birds/ac)

South: >0.10 birds/ha (>0.04 birds/ac)

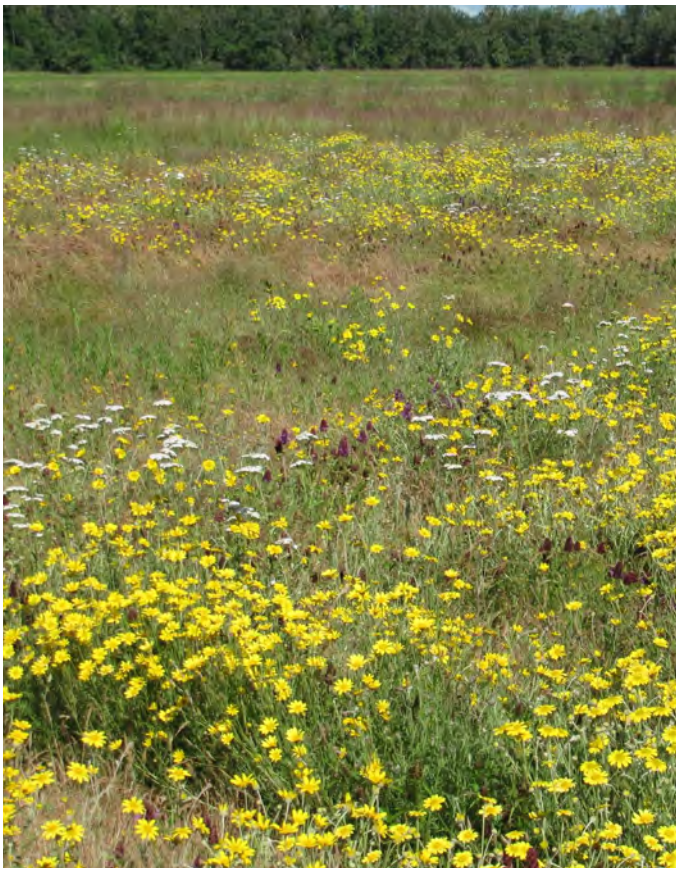
Habitat Objectives (Sites)

Open landscapes >35 ha (100 ac) dominated by herbaceous vegetation with all or part of the landscape in the following conditions:

- bare ground >15% and patchily distributed
- shrub cover <2%
- canopy cover = 0%
- >90% of the vegetation <0.3 m (13 in) tall in mid-May
- <1% of the landscape in tall herbaceous vegetation (i.e., >1.5 m [50 in] tall)

Data Sources, Assumptions, and Comments

- Ecoregional population estimates and objectives are based on USFWS (2019).
- There are no population objectives to reestablish a population in the Klamath Mountains ecoregion, where they were historically, because the Draft Recovery Plan did not set that objective for the near future (USFWS 2019).
- Ecoregional and subregional population and habitat objectives are based on the process described in Appendix B and the following:
- The subpopulation objective for the Puget Lowlands was based on three populations at Joint Base Lewis-McChord. The mean over eight years was 22 pairs over 223 ha (550 ac) or one pair/10 ha (25 ac) (A. Wolf pers. comm.).
- The subpopulation area objective for the Willamette Valley was based on a high-density population at the Corvallis Airport. It has supported approximately 70 pairs on 245 ha (600 ac) (R. Moore pers. comm.) within a suitable landscape and habitat conditions associated with the airport runways and adjacent agricultural fields. Thus, one pair/3.5 ha (8.6 ac) was used as the standard for a subpopulation.
- Site-level population objectives were based on A. Wolf (pers. comm.) for the Puget Lowlands and B. Altman (unpublished database) for the Willamette Valley.
- Site-level habitat objectives were based on multiple sources (e.g., Altman 1999 and 2000, ODFW 2010, Pearson and Altman 2005, Anderson and Pearson 2015, USFWS 2019).



Willamette Valley wet prairie by Bob Altman

WESTERN MEADOWLARK

(Sturnella neglecta)

Habitat: Prairie and Oak Savannah

Habitat Attribute: large areas with diverse herbaceous vegetative structure

Western Meadowlark by Frank Lospalluto

Status	Ecoregion/Subregion						Priority
	Puget Lowlands		Willamette Valley		Klamath Mountains		
	North	South	North	South	Umpqua Valley	Rogue Basin	
Imperiled	√	√					√

√ = Imperiled, Green = not imperiled, Dark Gray = extirpated, Black = outside of historic range

Current Population Estimates (Ecoregions)

- Puget Lowlands: 1,500
- Willamette Valley: 2,400
- Klamath Mountains: 41,600

Population Objectives (Ecoregions)

Puget Lowlands:

By 2030, increase the current estimated population of 1,000 birds by ≥31.9% (2.8% annual exponential growth) to ≥1,319 birds, with ≥660 birds in ≥22 subpopulations, and another ≥660 birds elsewhere throughout the ecoregion.

Habitat Objectives (Ecoregions)

Puget Lowlands:

By 2030, maintain ≥22 habitat areas as described below that include ≤3,592 ha (8,875 ac) with ≥70% habitat suitability/patch.

Population and Habitat Objectives (Subregions)

Puget Lowlands:

Size, Number, and Distribution of Subpopulations and Habitat Areas by 2030:

- ≥3 large subpopulations (i.e., >25 pairs) in <354 ha (875 ac)/subpopulation
- ≥6 medium subpopulations (i.e., 15-25 pairs) in <202 ha (500 ac)/subpopulation
  ≥13 small subpopulations (i.e., 5-15 pairs) in <101 ha (250 ac)/subpopulation
- ≥8 of the small habitat areas, ≥4 of the medium habitat areas, and ≥2 of the large habitat areas should have >90% of the area in secure conservation status (i.e., ownership or easements) and being managed in ways compatible with suitable habitat

All Ecoregions:

- ≤10% of the subpopulation habitat area should be hostile habitat (i.e., urban, residential, high density rural)

Area	Subpopulations				Habitat [up to X hectares (acres)]			
	Large	Medium	Small	Total	Large	Medium	Small	Total
North	1	2	5	8	354 (875)	405 (1,000)	506 (1,250)	1,265 (3,125)
South	2	4	8	14	708 (1,750)	809 (2,000)	809 (2,000)	2,327 (5,750)
Total	3	6	13	22	1,062 (2,625)	1,214 (3,000)	1,315 (3,250)	3,592 (8,875)

Population Objectives (Sites)

Target Densities in Suitable Habitat:

Puget Lowlands:

North: >0.02 birds ha

South: >0.05 birds/ha

Willamette Valley:

North: >0.02 birds/ha (>0.01 birds/ac)

South: >0.05 birds/ha (>0.02 birds/ac)

Klamath Mountains:

>0.26 birds/ha (>0.10 birds/ac)

Habitat Objectives (Sites)

Wet prairie, upland prairie, oak savannah, or appropriate agricultural types (e.g., light to moderately grazed pasture, fallow fields) in open landscapes >500 ha (200 ac) in the following conditions:

- canopy cover <15%
- shrub cover <20% and scattered (i.e., not contiguous as in fence rows, field buffers, etc.)
- bare ground 5-15%
- herbaceous cover that is structurally and compositionally diverse with:
  - mean graminoid height in mid- to late May of 30-61 cm (12-24 in) including <25% 15-30 cm (6-12 in), >50% 30-61 cm (12-24 in), and <25% >61 cm (24 in)
  - forb cover >15%

Data Sources, Assumptions, and Comments

- Population estimates for the Klamath Mountains are based on BBS data and ecoregional calculations using the process described in Blancher et al. (2013). The population estimate for the Puget Lowlands was based on professional expertise. The population objective for the Willamette Valley was based on Hallman (2018).
- Ecoregional and subregional population and habitat objectives were based on the process described in Appendix B and the following:
- The subpopulation area objective for the Puget Lowlands was based on known high density populations at Baskett Slough National Wildlife Refuge and the Willamette Floodplain Research Natural Area at Finley National Wildlife Refuge (Willamette Valley ecoregion). The former supports 15-20 territories on approximately 202 ha (500 ac) of mixed-quality upland prairie and agricultural fields (Altman et al. 2011). The latter supports 25-35 territories on approximately 243 ha (600 ac) of mostly high-quality wet prairie (Altman et al. 2011). Thus, one pair/10 ha (25 ac) was used as the standard for subpopulation area.
- Site-level population objectives were based on Altman et al. (2017), B. Altman (unpublished database), and Stephens and Alexander (2014) (grassland inventory data available from Avian Knowledge Northwest).
- Site-level habitat objectives were based on multiple sources (e.g., Altman 1999 and 2000, ODFW 2010, Altman et al. 2011, and Altman and Blakeley-Smith 2014).

LARK SPARROW

(Chondestes grammacus)

Habitat: Prairie

Habitat Attribute: low to moderate statured herbaceous vegetation and scattered woody cover

Lark Sparrow by James Livaudais

Status	Ecoregion/Subregion						Priority
	Puget Lowlands		Willamette Valley		Klamath Mountains		
	North	South	North	South	Umpqua Valley	Rogue Basin	
Imperiled					√	√	

√ = Imperiled, Green = not imperiled, Dark Gray = extirpated, Black = outside of historic range

Current Population Estimates (Ecoregions)

- Klamath Mountains: 600

Population Objectives (Ecoregions)

Klamath Mountains (Rogue Basin):

By 2030, increase the current estimated population of 600 birds by ≥66.5% (2.1% annual exponential growth rate) to 999 birds, with ≥500 birds in ≥17 subpopulations, and another ≥500 birds elsewhere throughout the ecoregion.

Klamath Mountains (Umpqua Valley)

By 2030, reestablish as a breeding species with ≥1 small subpopulation (5-15 pairs/ population).

Habitat Objectives (Ecoregions)

Klamath Mountains (Rogue Basin):

By 2030, maintain ≥17 suitable habitat areas as described below that include ≤2,009 ha (4,965 ac) with ≥70% habitat suitability/patch.

Klamath Mountains (Umpqua Valley):

By 2030, maintain ≥1 habitat area as described below that includes <90 ha (222 ac) with 70% habitat suitability/patch.

Population and Habitat Objectives (Subregions)

Klamath Mountains:

Size, Number, and Distribution of Subpopulations and Habitat Areas by 2030:

- ≥2 large subpopulations (i.e., ≥25 pairs) in <180 ha (445 ac)/subpopulation
- ≥5 medium subpopulations (i.e., 15-25 pairs) in <150 ha (371 ac)/subpopulation
- ≥10 small subpopulations (i.e., 5-15 pairs) in <90 ha (222 ac)/subpopulation
- ≥6 of the small habitat areas, ≥3 of the medium habitat areas, and ≥1 of the large habitat areas should have ≥90% of the area in secure conservation status (i.e., ownership or easements) and being managed in ways compatible with suitable habitat

Area	Subpopulations				Habitat [up to X hectares (acres)]			
	Large	Medium	Small	Total	Large	Medium	Small	Total
North	0	0	1	1	0	0	90 (222)	90 (222)
South	2	5	10	17	360 (890)	751 (1,855)	898 (2,220)	2,009 (4,965)
Total	2	5	11	18	360 (890)	751 (1,855)	988 (2,442)	2,099 (5,185)

- ≤10% of the subpopulation habitat area should be hostile habitat (i.e., urban, residential, high density rural)

Population Objectives (Sites)

Target Densities in Suitable Habitat:

Klamath Mountains: >0.03 birds/ha (>0.01 birds/ac)

Habitat Objectives (Sites)

Prairie or oak savannah in the following conditions:

- woody cover <25% and patchily distributed with tree cover <10% and shrub cover 5-25%
- herbaceous cover >50% and <46 cm (18 in) tall
- bare or sparsely vegetated ground 5-25% and patchily distributed
- areas of suitable habitat >8 ha (20 ac)
- maintain cowbird parasitism rates <10% within specific study sites

Data Sources, Assumptions, and Comments

- Population estimate is based on BBS data and ecoregional calculations using the process described in Blancher et al. (2013).
- Ecoregional and subregional population and habitat objectives were based on the process described in Appendix B and the following:
  - The subpopulation area objective was based on a mean use area of 6 ha (14.8 ac)/pair in Kansas (Martin and Parrish 2000).
- Site-level population objectives were based on J. Stephens (unpublished data) for the Klamath Mountains ecoregion.
- Site-level habitat objectives were based on Bock and Webb (1984), Martin and Parrish (2000), Marshall et al. (2003), and professional expertise.

WESTERN BLUEBIRD

(Sialia mexicana)

Habitat: Prairie, Oak Savannah, or Open Woodland

Habitat Attribute: cavities in trees with open access and low-statured herbaceous vegetation

Western Bluebird by James Livaudais

Status	Ecoregion/Subregion						Priority
	Puget Lowlands		Willamette Valley		Klamath Mountains		
	North	South	North	South	Umpqua Valley	Rogue Basin	
Imperiled	√	√					√

√ = Imperiled, Green = not imperiled, Dark Gray = extirpated, Black = outside of historic range

Current Population Estimates (Ecoregions)

- Puget Lowlands: 850
- Willamette Valley: 4,200
- Klamath Mountains: 33,900

Population Objectives (Ecoregions)

Puget Lowlands:

By 2030, increase the current estimated population of 850 birds by ≥40.8% to ≥1,197 birds (3.5% annual exponential growth rate), with ≥599 birds in ≥38 subpopulations, and another ≥599 birds elsewhere throughout the ecoregion.

Habitat Objectives (Ecoregions)

Puget Lowlands:

By 2030, maintain ≥38 suitable habitat areas as described below that include ≤ 2,375 ha (5,869 ac) with ≥70% habitat suitability/patch.

Population and Habitat Objectives (Subregions)

Puget Lowlands:

Size, Number, and Distribution of Subpopulations and Habitat Areas by 2030:

- ≥1 large subpopulations (i.e., ≥25 pairs) in <106 ha (263 ac)/subpopulation
- ≥4 medium subpopulations (i.e., 15-25 pairs) in <76 ha (188 ac)/subpopulation
- ≥8 small subpopulations (i.e., 5-15 pairs) in <46 ha (113 ac)/subpopulation
- ≥11 of the small habitat areas, ≥6 of the medium habitat areas, and ≥3 of the large habitat areas should have ≥90% of the area in secure conservation status (i.e., ownership or easements) and being managed in ways compatible with suitable habitat
- ≤10% of the subpopulation habitat area should be hostile habitat (i.e., urban, residential, high density rural)

Area	Subpopulations				Habitat [up to X hectares (acres)]			
	Large	Medium	Small	Total	Large	Medium	Small	Total
North	1	3	6	10	106 (263)	228 (564)	274 (678)	609 (1,505)
South	4	8	16	28	426 (1,052)	609 (1,504)	732 (1,808)	1,766 (4,364)
Total	5	11	22	38	532 (1,315)	837 (2,068)	1,006 (2,486)	2,375 (5,869)

Population Objectives (Sites)

Target Densities in Suitable Habitat:

Puget Lowlands:

North: >0.01 birds/ha (>0.004 birds/ac)

South: >0.04 birds/ha (>0.02 birds/ac)

Willamette Valley:

North: >0.01 birds/ha (>0.004 birds/ac)

South: >0.04 birds/ha (>0.02 birds/ac)

Klamath Mountains:

Umpqua: >0.03 birds/ha (>0.01 birds/ac)

Rogue: >0.05 birds/ha (>0.02 birds/ac)

Habitat Objectives (Sites)

Prairie, Oak Savannah or Open Woodland in the following conditions:

- canopy cover <35%
- shrub cover <15%
- ground cover dominated by grasses <30 cm (12 in) in height
- mean tree DBH >38 cm (15 in)
- >20% of the trees >53 cm (21 in) DBH

Data Sources, Assumptions, and Comments

- Population estimates are based on G. Slater (pers. comm.) for Puget Lowlands, and BBS data and ecoregional calculations using the process described in Blancher et al. (2013) for the Willamette Valley and Klamath Mountains. The BBS data calculation for the Puget Lowlands is 1,700 birds.
- Ecoregional and subregional population and habitat objectives were based on the process described in Appendix B and the following:
  - The subpopulation area objective for the Puget Lowlands based on one pair/3 ha (7.5 ac) in a typical population which is a 50% increase of approximate territory size of 2 ha (5 ac) in lieu of an example high density population (see Subpopulation Area for rationale).
- Site-level population objectives were based on Altman and Stephens (2012), Altman et al. (2017), and B. Altman (unpublished database). No target density was set for the north Puget Lowlands since it has only recently been reintroduced
- Site-level habitat objectives were based on Wilson et al. (1991), Stralberg and Williams (2002), and Altman and Lloyd (2012), as summarized in Altman and Stephens (2012).

SLENDER-BILLED WHITE-BREASTED NUTHATCH

(Sitta carolinensis aculeata)

Habitat: Oak Savannah, Woodland, or Forest

Habitat Attribute: mature oak trees or snags with cavities

Slender-billed White-breasted Nuthatch by James Livaudais

Status	Ecoregion/Subregion						Priority
	Puget Lowlands		Willamette Valley		Klamath Mountains		
	North	South	North	South	Umpqua Valley	Rogue Basin	
Imperiled		√					√

√ = Imperiled, Green = not imperiled, Dark Gray = extirpated, Black = outside of historic range

Current Population Estimates (Ecoregions)

- Puget Lowlands: 10
- Willamette Valley: 11,300
- Klamath Mountains: 21,100

Population Objectives (Ecoregions)

Puget Lowlands:

By 2030, increase the estimated population of <10 birds by 530% to 63 birds (20.2% annual exponential growth) with >32 birds in ≥2 subpopulations and another ≥32 birds elsewhere throughout the ecoregion.

Habitat Objectives (Ecoregions)

Puget Lowlands:

By 2030, maintain ≥2 suitable habitat areas as described below that include ≤73 ha (180 ac) with ≥70% habitat suitability/patch.

Population and Habitat Objectives (Subregions)

Puget Lowlands:

Size, Number, and Distribution of Subpopulations and Habitat Areas by 2030:

- ≥1 large subpopulations (i.e., ≥25 pairs) in <73 ha (180 ac)/subpopulation
- ≥2 medium subpopulations (i.e., 15-25 pairs) in <49 ha (120 ac)/subpopulation
- ≥4 small populations (i.e., 5-15 pairs) in <24 ha (60 ac)/subpopulation
- all the habitat areas should have ≥90% of the area in secure conservation status (i.e., ownership or easements) and managed in ways compatible with suitable habitat
- ≤10% of the subpopulation habitat area should be hostile habitat (i.e., urban, residential, high density rural)

Area	Subpopulations				Habitat [up to X hectares (acres)]			
	Large	Medium	Small	Total	Large	Medium	Small	Total
South	0	1	1	2	0	49 (120)	24 (60)	73 (180)
Total	0	1	1	2	0	49 (120)	24 (60)	73 (180)

Population Objectives (Sites)

Target Densities in Suitable Habitat:

Puget Lowlands:

the objective is to establish a population

Willamette Valley:

North: >0.46 birds/ha (>0.19 birds/ac)

South: >0.27 birds/ha (>0.11 birds/ac)

Klamath Mountains:

Umpqua: >0.10 birds/ha (>0.04 birds/ac)

Rogue: >0.24 birds/ha (>0.10 birds/ac)

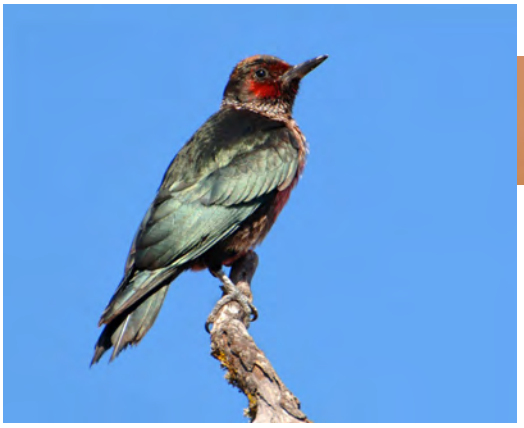
Habitat Objectives (Sites)

Oak Savannah, Woodland, or Forest in the following conditions:

- canopy cover 40-80%
- subcanopy cover <20%
- conifer cover in the canopy and subcanopy <10%
- mean DBH >53 cm (21 in)
- >20% of oak trees with >70 cm (28 in) DBH

Data Sources, Assumptions, and Comments

- Population estimates are based on B. Altman (unpublished data) for Puget Lowlands, and BBS data and ecoregional calculations using the process described in Blancher et al. (2013) for the Willamette Valley and Klamath Mountains.
- Ecoregional and subregional population and habitat objectives were based on the process described in Appendix B and the following:
  - The subpopulation area objective was based on one pair/38 ha (15 ac) in a typical population, which is a 50% increase of approximate territory size of 25 ha (10 ac) in lieu of an example high- density population (see Subpopulation Area for rationale).
- Site-level population objectives were based on Altman and Stephens (2012), Altman et al. (2017), and B. Altman (unpublished database).
- Site-level habitat objectives were based Hagar and Stern (1997), Viste-Sparkman (2005), and Altman and Lloyd (2012) as summarized in Altman and Stephens (2012).
- The objective for >20% of oak trees in stand with >70 cm (28 in) DBH is based on stand with highest abundance in Willamette Valley study (Hagar and Stern 1997).



Lewis's Woodpecker by James Livaudais

LEWIS'S WOODPECKER

(Melanerpes lewis)

Habitat: Mature Oak Savannah or Open Woodland

Habitat Attribute: large, old trees with cavities or soft areas for excavation

Status	Ecoregion/Subregion						Priority
	Puget Lowlands		Willamette Valley		Klamath Mountains		
	North	South	North	South	Umpqua Valley	Rogue Basin	
Imperiled	√	√	√	√	√	√	√

√ = Imperiled, Green = not imperiled, Dark Gray = extirpated, Black = outside of historic range

Current Population Estimates (Ecoregions)

- Puget Lowlands: 0
- Willamette Valley: 0
- Klamath Mountains: 0

Population Objectives (Ecoregions)

Puget Lowlands:

By 2030, reestablish as a breeding species with ≥1 small subpopulation (5-15 pairs/ population).

Willamette Valley:

By 2030, reestablish as a breeding species with ≥1 small subpopulation (5-15 pairs/ population).

Klamath Mountains:

By 2030, reestablish as a breeding species with ≥1 small subpopulation (5-15 pairs/ population).

Habitat Objectives (Ecoregions)

Puget Lowlands:

By 2030, maintain ≥1 habitat area as described below that includes ≤61 ha (150 ac).

Willamette Valley:

By 2030, maintain ≥1 habitat area as described below that includes ≤61 ha (150 ac).

Klamath Mountains:

By 2030, maintain ≥1 habitat area as described below that includes ≤61 ha (150 ac).

Population and Habitat Objectives (Subregions)

Puget Lowlands:

Size, Number, and Distribution of Subpopulations and Habitat Areas

- ≥1 small subpopulation (i.e., 5-15 pairs) in ≤61 ha (150 ac)/subpopulation

Willamette Valley:

Size, Number, and Distribution of Subpopulations and Habitat Areas

- ≥1 small subpopulation (i.e., 5-15 pairs) in ≤61 ha (150 ac)/subpopulation

Klamath Mountains:

- ≥1 small subpopulation (i.e., 5-15 pairs) in ≤61 ha (150 ac)/subpopulation

All Ecoregions:

- all subpopulations should have ≥90% of the area in secure conservation status (i.e., ownership or easements) and managed in ways compatible with suitable habitat

Population Objectives (Sites)

Target Densities in Suitable Habitat:

Puget Lowlands:

the objective is to establish a population

Willamette Valley:

the objective is to establish a population

Klamath Mountains:

the objective is to establish a population

Habitat Objectives (Sites)

Oak Savannah or Open Woodland in the following conditions:

- patches >250 ha (100 ac)
- 5 snags/ha (2/ac) >50 cm (20 in) DBH
- canopy cover 10-35%
- shrub cover 15-50%

Data Sources, Assumptions, and Comments

- Ecoregional and subregional population and habitat objectives were based on the process described in Appendix B and the following:
  - The subpopulation area objective for all ecoregions was based on a 50% increase of approximate territory size of 25 ha (10 ac) in lieu of an example high density population. Thus, the subpopulation objective was 38 ha (15 ac)/pair.
- Site-level habitat objectives were based on multiple sources (e.g., Sousa 1983, Abele 2004, Altman 2000, Marshall et al. 2003).
- The objective for reestablishing populations in each ecoregion was based on the relative amount of habitat, historic abundance, and recentness of extirpation.

Oak savannah with chaparral in the Rogue Basin by KBO

Oregon Vesper Sparrow by Frank Lospalluto

OREGON VESPER SPARROW

(Pooecetes gramineus affinis)

Habitat: Prairie and Oak Savannah

Habitat Attribute: low to moderate statured herbaceous vegetation and scattered woody cover

Status	Ecoregion/Subregion						Priority
	Puget Lowlands		Willamette Valley		Klamath Mountains		
	North	South	North	South	Umpqua Valley	Rogue Basin	
Imperiled	√	√	√	√		√	√

√ = Imperiled, Green = not imperiled, Dark Gray = extirpated, Black = outside of historic range

Current Population Estimates (Ecoregions)

- Puget Lowlands: 270
- Willamette Valley: 1,000
- Klamath Mountains: 1,700

Population Objectives (Ecoregions)

Puget Lowlands:

By 2030, increase the current estimated population of 270 birds by ≥69.3% (5.4% annual exponential growth rate) to ≥457 birds, with ≥229 birds in ≥8 subpopulations, and another ≥229 birds elsewhere throughout the ecoregion.

Willamette Valley:

By 2030, increase the current estimated population of 1,000 birds by ≥31.9% (2.8% annual exponential growth rate) to ≥1,319 birds, with ≥660 birds in ≥21 subpopulations, and another ≥660 birds elsewhere throughout the ecoregion.

Klamath Mountains (Rogue Basin):

By 2030, increase the current estimated population of 200 birds by ≥90.5% (6.7% annual exponential growth rate) to 381 birds, with ≥192 birds in ≥8 subpopulations, and another ≥192 birds elsewhere throughout the ecoregion.

Habitat Objectives (Ecoregions)

Puget Lowlands:

By 2030, maintain ≥8 suitable habitat areas as described below that include ≤ 1,204 ha (2,975 ac) with ≥70% habitat suitability/patch.

Willamette Valley:

By 2030, maintain ≥21 suitable habitat areas as described below that include ≤1,477 ha (3,650 ac) with ≥70% habitat suitability/patch.

Klamath Mountains (Rogue Basin):

By 2030, maintain ≥8 suitable habitat areas as described below that include ≤361 ha (891 ac) with ≥70% habitat suitability/patch.

Population and Habitat Objectives (Subregions)

Puget Lowlands: Size, Number, and Distribution of Subpopulations and Habitat Areas by 2030:

- ≥1 large subpopulations (i.e., ≥25 pairs) in <337 ha (833 ac)/subpopulation
- ≥2 medium subpopulations (i.e., 15-25 pairs) in < 193 ha (476 ac)/subpopulation
- ≥6 small subpopulations (i.e., 5-15 pairs) in <96 ha (238 ac)/subpopulation
- ≥3 of the small habitat areas, ≥1 of the medium habitat areas, and ≥1 of the large habitat areas should have ≥90% of the area in secure conservation status (i.e., ownership or easements) and being managed in ways compatible with suitable habitat

Willamette Valley: Size, Number, and Distribution of Subpopulations and Habitat Areas by 2030:

- ≥3 large subpopulations (i.e., ≥25 pairs) in <142 ha (350 ac)/subpopulation
- ≥6 medium subpopulations (i.e., 15-25 pairs) in <81 ha (200 ac)/subpopulation
- ≥12 small subpopulations (i.e., 5-15 pairs) in <41 ha (100 ac)/subpopulation
- ≥6 of the small habitat areas, ≥4 of the medium habitat areas, and ≥2 of the large habitat areas should have ≥90% of the area in secure conservation status (i.e., ownership or easements) and being managed in ways compatible with suitable habitat

Puget Lowlands:

Area	**Subpopulations**				**Habitat** [up to X hectares (acres)]			
	Large	Medium	Small	Total	Large	Medium	Small	Total
North	1	1	2	4	142 (350)	81 (200)	162 (400)	384 (950)
South	2	5	10	17	284 (700)	405 (1,000)	405 (1,000)	1,093 (2,700)
Total	3	6	12	21	425 (1,050)	487 (1,200)	567 (1,400)	1,477 (3,650)

Willamette Valley:

Area	**Subpopulations**				**Habitat** [up to X hectares (acres)]			
	Large	Medium	Small	Total	Large	Medium	Small	Total
North	0	0	1	1	0	0	96 (238)	96 (238)
South	1	2	4	7	337 (833)	385 (952)	385 (952)	1,108 (2,737)
Total	1	2	6	8	337 (833)	385 (952)	482 (1,190)	1,108 (2,975)

Klamath Mountains (Rogue Basin):

Area	**Subpopulations**				**Habitat** [up to X hectares (acres)]			
	Large	Medium	Small	Total	Large	Medium	Small	Total
Total	1	2	5	8	98 (243)	131 (324)	131 (324)	361 (891)

Klamath Mountains: Size, Number, and Distribution of Subpopulations and Habitat Areas by 2030:

- ≥1 large subpopulation (i.e., ≥25 pairs) in <98 ha (243 ac)/subpopulation (Rogue)
- ≥2 medium subpopulations (i.e., 15-25 pairs) in <66 ha (162 ac)/subpopulation (Rogue)
- ≥4 small subpopulations (i.e., 5-15 pairs) in <31 ha (81 ac)/subpopulation (Rogue)
- ≥10 of the small habitat areas, ≥5 of the medium habitat areas, and ≥3 of the large habitat areas should have ≥90% of the area in secure conservation status (i.e., ownership or easements) and being managed in ways compatible with suitable habitat

All Ecoregions:

- ≤10% of the subpopulation habitat area should be hostile habitat (i.e., urban, residential, high density rural)

Population Objectives (Sites)

Target Densities in Suitable Habitat:

Puget Lowlands:

South: >0.02 birds/ha (>0.01 birds/ac)

Willamette Valley:

North: >0.01 birds/ha (>0.004 birds/ac)
South: >0.03 birds/ha (>0.01 birds/ac)

Oregon Vesper Sparrow nest with eggs by Sarah Rockwell

Klamath Mountains:

Rogue: >0.04 birds/ha (>0.01 birds/ac)

Habitat Objectives (Sites)

Upland prairie, savannah, or appropriate agricultural types (i.e., light to moderately grazed pasture, fallow fields, Christmas tree farms) in areas >50 ha (20 ac) in the following conditions:

- tree cover <10%
- shrub cover <15% and scattered (i.e., not contiguous as in fence rows, field buffers, etc.)
- bare ground 5-15% and scattered (i.e., not in one or a few large spots)
- herbaceous cover that is structurally and compositionally diverse with:
    - mean graminoid height of 15-46 cm (6-18 in), including <20% <15 cm (6 in) tall, and <20% >46 cm (18 in) tall
    - forb cover >15%

Data Sources, Assumptions, and Comments

- Population estimates are based on the summation of intensive monitoring projects and presented in Altman et al. (2020) for the Puget Lowlands, Altman (2017) updated for the Willamette Valley (B. Altman, unpublished data), Altman (2017) for the Umpqua Valley, and Stephens and Rockwell (2019) and Rockwell and Stephens (unpublished data) for the Rogue Basin.
- Ecoregional and subregional population and habitat objectives were based on the process described in Appendix B and the following:
- The subpopulation area objective was based on known high density populations in each ecoregion. In the Puget Lowlands on Joint Base Lewis/McChord near Olympia, there are

approximately 21 pairs on 202 ha (500 ac) of restoration prairie or one pair/10 ha (23.8 ac) (G. Slater pers. comm.). In the Willamette Valley at the Oregon State University Beef Ranch near Corvallis, there are approximately 20 pairs on 81 ha (200 ac) of pastureland, or one pair/4 ha (10 ac) (B. Altman, unpublished data). In the Umpqua Valley at the Horton Ranch near Sutherlin there are approximately 27 pairs over 101 ha (250 ac) of pastureland or one pair /4 ha (9.3 ac) (B. Altman, unpublished data). In the Rogue Basin at Lily Glen County Park near Ashland, there are 48 and 40 territories over approximately 150 ha (370 acres) of montane meadow and 33 territories over 99 ha (245 ac) at Vesper Meadow or one pair/3 ha (8.1 ac) (S. Rockwell pers. comm.).

- The ecoregional population goal for the Puget Lowlands was set at only 1,000 birds to reflect the reduced historical occurrence of the bird in the north Puget Lowlands.
- Not considered imperiled in the Umpqua Valley of the Klamath Mountains ecoregion because abundance exceeds the subregion standard of 1,000 birds.
- Site-level population objectives were based on Altman et al. (2017), B. Altman (unpublished database), and Stephens and Alexander (2014) (grassland inventory data available from Avian Knowledge Northwest).
- Site-level habitat objectives were based on multiple sources (e.g., Altman 1999 and 2000, ODFW 2010, Altman 2014, Altman et al. 2020).

For a summary of habitat objectives for all imperiled species, see Appendix F.

Oregon Vesper Sparrow habitat in the Rogue Basin by Jaime Stephens

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 Puget Lowlands, Willamette Valley, and Klamath Mountains, conservation will require a complex array of conditions within variable landscape patterns. Implementation will require 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), including private lands.

Oak landowners attend a field tour in the Willamette Valley by Bob Altman

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) and Stephens et al. (2011). 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 strategically designated conservation areas and where opportunities exist (i.e., receptive landowners 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 habitat conditions. The emphasis is on setting habitat objectives for the most desirable habitat conditions for focal species in areas where those conditions are ecologically appropriate (Sidebar: *Avoiding Square Pegs and Round Holes: Be Ecologically Appropriate).* This is particularly pressing in landscapes where the oak trees remain healthy, and restoration can result in rapid recovery of oak woodland habitat attributes when the Douglas -fir trees are removed.

Diverse age classes of oaks by Jaime Stephens

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, climate, etc. Thus, knowing what is possible or ecologically appropriate is essential before any restoration 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 current (and projected future) native vegetation for the site is known, an evaluation can be conducted to determine the focal species or suites of species for which a site can reasonably meet habitat requirements.

A large-scale example of the importance of the concept of ecological appropriateness is current versus historic mixed oak-conifer forest. Some current mixed oak-conifer forest sites were historically dominated by oak woodland, where Douglas-fir has encroached and overtopped oak trees in the absence of fire. These sites, although potentially meeting habitat conditions for mixed oak-conifer forest focal species, are degraded and converted oak woodland. They should be targeted for management and restoration of oak woodland conditions and focal species, which have been reduced across the landscape, and are ecologically appropriate and desirable within natural or managed disturbance regimes. This is particularly pressing in landscapes where the oak trees remain healthy, and restoration can result in rapid recovery of oak woodland habitat attributes when the Douglas-fir trees are removed.

Scale and Landscape Considerations

Habitat objectives at the site-scale for one focal species or habitat attribute can conflict with those for another. Indeed, actions designed to manage for one focal species are often detrimental to other focal species. For example, the objective to provide more oak or shrub cover for Acorn Woodpecker and Oak Titmouse is in direct conflict with the objective of maintaining more open prairie for Savannah Sparrow and Horned Lark. 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, protecting and promoting large mature oak trees by removing encroaching smaller trees and shrubs within their canopy drip lines, but leaving the subcanopy and shrub layer largely intact across the site, will benefit Acorn Woodpecker while also maintaining subcanopy and shrub cover preferred by Oak Titmouse.

Prescribed fire in an open oak woodland by Bob Altman

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, connectivity may be particularly important for area-sensitive species such as Savannah Sparrow or Western Meadowlark 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 large or high-imperiled prairie, oak, and riparian sites;
- restoration of degraded habitats of all three types; and
- management that supports ecological processes that maintain these habitats (e.g., natural fire regimes, spring flooding).

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.

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., timing of crop harvest, prescribed fire, or spraying invasive species before going to seed). Thus, it is important to evaluate management actions for whether their timing is essential versus convenient and determine whether there are reasonable alternatives.

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 are a delivery mechanism for all-bird, all-habitat conservation. Because of the tremendous habitat diversity within the Pacific Northwest, the limited amount of resources available for bird and habitat conservation, and Pacific Birds's inclusion of the highly threatened avifauna of Hawai'i, the Pacific Birds partnership is focusing its current efforts for landbirds on the Hawaiian Islands as well as oak and prairie habitats.

Thus, riparian habitats are not a current focus of Pacific Birds. However, where riparian zones are embedded within oak woodlands, prairie, or near estuaries, there are opportunities to work with Pacific Birds and their conservation partners to provide added value by including adjacent riparian habitat management for landbirds.

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 in the adaptive management process. 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 likely a 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 multiple 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 (Ralph et al. 1993, 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. Importantly, data should be contributed to the 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 the Avian Knowledge Network, provides regionally specific data management and delivery resources (www.avianknowledgenorthwest.net) (Sidebar: *Avian Knowledge Northwest: A regional node of the Avian Knowledge Network [AKN]*).

Scientist completing a bird survey by Bob Altman

Avian Knowledge Northwest: A regional node of the Avian Knowledge Network (AKN)

Avian Knowledge Northwest (AKNW) is a data-driven decision support system for scientists, natural resource managers, and other individuals interested in advancing bird and habitat conservation in the northwestern United States. AKNW offers tools for collecting, entering, uploading, managing, accessing, and summarizing bird monitoring data. AKNW also provides science-based information about bird populations and habitats to inform natural resource management planning and to advance ecosystem conservation. Avian Knowledge Northwest is hosted by the Klamath Bird Observatory in partnership with Point Blue Conservation Science and represents a broad partnership.

Biological objectives in this document, in concert with resources available through Avian Knowledge Northwest, and combined with site-scale monitoring results, can inform the design of projects that meet land management objectives (e.g., fire hazard reduction) in concert with bird conservation objectives. Effectiveness monitoring can be used to evaluate the compatibility of projects designed to meet multiple objectives and serve as a catalyst for adaptive management to design future projects that fall within land manager priorities and funding mechanisms (Sidebar: *Focal Bird Species and Effectiveness Monitoring*).

Bewick's Wren by Frank Lospalluto

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 sole metric because of the potential for factors beyond habitat to affect bird 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 desired 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. Measuring a suite of focal species often provides the most robust metric especially when sample size is limited, which is often the case with site-scale monitoring. 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.

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Black-throated Gray Warbler by Frank Lospalluto

Appendices

Appendix A. Species to Benefit.

Species to benefit tables include focal, imperiled, and priority species that have a strong breeding season habitat association with the habitat type and/or habitat attribute, and would likely benefit from management or restoration 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 specific site due to range, habitat conditions, elevation, etc.

Prairie

Habitat Attribute	Open Prairie
	large habitat patches
Focal Species	SAVS
Species to Benefit	HOLA LASP VESP WEME coni grsp seow

Designations:

<u>CAPS, Bold, and Underline</u>	focal species for a different habitat attribute in the same habitat type;
CAPS and Bold	focal species in a different habitat type;
CAPS	imperiled species;
lower case	priority species not already designated as focal or imperiled species.

Species codes:

ACWO	Acorn Woodpecker
ATFL	Ash-throated Flycatcher
BAEA	Bald Eagle
BCCH	Black-capped Chickadee
BEWR	Bewick's Wren
BGGN	Blue-gray Gnatcatcher
BHGR	Black-headed Grosbeak
BTYW	Black-throated Gray Warbler
BUSH	Bushtit
CALT	California Towhee
CASJ	California Scrub-Jay
CAVI	Cassin's Vireo
CHSP	Chipping Sparrow
CONI	Common Nighthawk
DOWO	Downy Woodpecker
GRSP	Grasshopper Sparrow
HOLA	Horned Lark
HOWR	House Wren
HUVI	Hutton's Vireo
LASP	Lark Sparrow
LAZB	Lazuli Bunting
LEGO	Lesser Goldfinch
LEWO	Lewis's Woodpecker
OATI	Oak Titmouse
PUFI	Purple Finch
PUMA	Purple Martin
RBSA	Red-breasted Sapsucker
RUHU	Rufous Hummingbird
SAVS	Savannah Sparrow
SEOW	Short-eared Owl
SOSP	Song Sparrow
SPSA	Spotted Sandpiper
SPTO	Spotted Towhee
VESP	Vesper Sparrow
WBNU	White-breasted Nuthatch
WEBL	Western Bluebird
WEME	Western Meadowlark
WESO	Western Screech-Owl
WEWP	Western Wood-Pewee
WIFL	Willow Flycatcher
WREN	Wrentit
YBCH	Yellow-breasted Chat
YEWA	Yellow Warbler

Oak

Habitat Attribute	Oak Savannah or Open Woodland			Oak Closed Woodland or Forest						Oak-Pine	Oak-Hardwood	Oak-Chaparral	
	low-statured herbaceous ground cover	moderate and patchy shrub cover	large, mature trees	large mature trees	canopy edges and openings	moderate to high canopy and subcanopy cover	moderate shrub cover with open canopy trees	moderate sub-canopy or shrub cover	moderate sub-canopy or shrub cover	moderate to high canopy and subcanopy cover	moderate subcanopy or shrub cover	dense shrub cover with herbaceous openings	moderate to high shrub cover
Focal Species	CHSP	LAZB	CASJ	ACWO	WEWP	PUFI	HOWR	OATI	BUSH	CAVI	HUVI	CALT	BGGN
Species to Benefit	CASJ WEBL LASP VESP WEME	BGGN CALT HUVI LASP lego	CHSP WEWP LEWO WBNU WEBL puma atfl	CASJ WEWP DOWO LEWO WBNU btyw weso atfl	CASJ WBNU btyw atfl lego	CAVI HUVI OATI btyw	ACWO OATI BEWR DOWO WBNU	BGGN HOWR HUVI PUFI BCCH BEWR BHGR SPTO wren	BGGN HUVI BCCH BHGR SPTO wren	HUVI LAZB PUFI btyw	BUSH CAVI HOWR LAZB OATI PUFI SPTO	BGGN BUSH HOWR SPTO wren lego	BUSH HOWR LAZB SPTO wren lego

Riparian

Habitat Attribute	Open Floodplain	Riparian Shrubland			Riparian Open Woodland			Riparian Closed Woodland or Forest				
	interspersion of bare ground and herbaceous vegetation	early successional	moderate to high shrub cover	moderate to high shrub cover	scattered shrubs with herbaceous openings	large mature trees	cavities in snags or decadent limbs	moderate to high subcanopy and shrub cover	cavities in snags or decadent limbs	mixed hardwood and conifer trees	flowering plants	moderate to high shrub cover
Focal Species	SPSA	SOSP	WIFL	YBCH	SPTO	BUOR	BCCH	YEWA	DOWO	BHGR	RUHU	BEWR
Species to Benefit		SPTO WIFL lego	RUHU SPTO YEWA YBCH BUSH CALT LAZB wren	RUHU SPTO YEWA WIFL BUSH CALT LAZB wren	RUHU HOWR LAZB lego	YEWA baea	DOWO puma rbsa weso	BHGR CAVI HUVI PUFI btyw	BCCH HOWR rbsa weso	CAVI PUFI btyw rbsa	BEWR SPTO wren	RUHU SPTO YEWA BUSH HOWR HUVI wren

Appendix B. Methods for establishing population estimates, target densities, and population and habitat objectives for focal and imperiled species.

Population Estimates

Population estimates were established for focal species based on the process described in Blancher et al. (2013) using the most recent 10-year BBS relative abundance data (2009-2018). Only routes located predominantly within an ecoregion boundary, and that had at least two surveys completed in those 10 years, were used for the Puget Lowlands (n = 10), Willamette Valley (n = 9), and Klamath Mountains (n = 6). Population estimates are not based only on priority habitats, but rather used all species data within the ecoregion boundary. Many of the focal species also occur outside of the priority habitats.

Population estimates were established for imperiled species within the ecoregion where they are considered imperiled, based on published information (e.g., Altman 2011, USFWS 2019) supplemented with recent data, or based on the compilation and interpretation of available data from multiple sources (e.g., field surveys, eBird) and professional knowledge. The Blancher et al. (2013) method was not used for imperiled species because there are more precise population estimates available for some species (e.g., Streaked Horned Lark and Oregon Vesper Sparrow), and also because population estimates derived from BBS data were professionally judged to be artificially high for most imperiled species. This is likely due to the inherent problems of precision and accuracy of BBS data for species with small sample sizes like the imperiled species (Sauer et al. 2017). The only exception was Lark Sparrow, for which no species-specific studies were available. In this case, the Blancher et al. (2013) method using BBS data provided a reasonable population estimate (see Appendix C).

Target Densities

Target densities were established for focal and imperiled species based on the calculation of density estimates from numerous landbird monitoring efforts. These data are highly variable in terms of sample sizes at spatial scales (e.g., ecoregion, subregion, site), habitat types and conditions (e.g., oak savannah, riparian shrubland), and methods (e.g., fixed radius point counts, variable radius point counts). Thus, consistent rules for establishing target densities were problematic. We primarily used the mean results of the analyses when there were large sample sizes, but also made modifications based on professional judgment when the data were less robust or variable among methods. This approach, although not completely empirical, is consistent with the setting of population and habitat objectives throughout this document, which are best viewed as reference points representing desired results in moderate or good quality habitat.

Regional Population Objectives

Population status objectives were established for imperiled species at the ecoregional and subregional level to function as indicators of the health or viability of populations. However, population viability models do not exist for any of the imperiled species to provide analyses of demographic factors such as fecundity or survival that contribute to lambda (i.e., population growth rate). In the absence of these data, and the difficulty of assessing them at the ecoregional scale, a lambda objective of ≥1.0 was established only for sites within medium and large subpopulations. This was done to enhance the likelihood of some larger source populations for species persistence and potential expansion. Further, we provide two objectives for surrogate measures as indicators of population status with some assumed degree of correlation to lambda: one long-term ecoregional measure (i.e., positive BBS trend), and one short-term site/subregional measure (i.e., target density).

Population Abundance Objectives

Population abundance objectives were established for imperiled species at ecoregional and subregional scales to support a sense of conservation urgency for these species. They are based on an approach similar to that for recovery of endangered species, which emphasize increasing a species' likelihood of persistence in the short term (10 years) by putting it on a trajectory of "more secure than imperiled," and

in the longer term (25 years) to reach a status of "apparently secure." The latter is shorter than the 50-year time frame used in TNC ecoregional planning goals for populations of rare and imperiled species (Floberg et al. 2004), but is supported by the recent recovery goal of 25 years for Streaked Horned Lark (USFWS 2019).

Population abundance objectives utilized two meta-analyses of over 300 Population Viability Assessments which reported minimum viable population means of approximately 5,000 individuals (Traill et al. 2007) and 7,000 individuals (Reed et al. 2003). Based on the mean of these two meta-analyses, a standard of 6,000 birds was used as the long-term population abundance objective for each imperiled species at the scale of our three ecoregions. Thus, the population abundance objective for imperiled species is 2,000 birds per ecoregion. However, in the Puget Lowlands, where some imperiled species historically did not occur or were rare in the north Puget Lowlands (e.g., Streaked Horned Lark, Oregon Vesper Sparrow, and Slender-billed White-breasted Nuthatch), the population abundance objective was reduced to 1,000 birds to reflect approximately half of the ecoregion for their historic distribution. Similarly, in the Klamath Mountains ecoregion, population abundance objectives were established for 1,000 birds in each of the two subregions.

In ecoregions where an imperiled species has been extirpated, modest and practical 10-year objectives are presented to reestablish a breeding population, either passively or through a reintroduction program (Campbell et al. 2006). These objectives were used for Slender-billed White-breasted Nuthatch in the South Puget Lowlands, and for Lewis's Woodpecker in all three ecoregions.

Population growth objectives were established by calculating the percent increase in population needed to reach 2,000 birds in each ecoregion (or 1,000 where appropriate, as described above) in 25 years, and then prorated to determine the annual exponential growth rate and number of birds required to meet the interim 10-year objective. Population abundance objectives were further defined by establishing an objective for half the population to be in distinct subpopulations, and the remainder distributed elsewhere in the ecoregion. This was done to facilitate conservation goals for both distribution and concentration of birds.

Habitat Objectives

Habitat objectives were established for imperiled species at the ecoregional and subregional scales as the amount and distribution of habitat needed to achieve the population abundance objective at the same scale. They were based on the relationship between the number of birds desired (i.e., population objective) and the amount of habitat needed to support that number of birds. The latter was determined using examples of known high-density sites as representative of species' area requirements (see Subpopulation Area).

Subpopulation Size

Subpopulation size objectives were established for imperiled species to ensure the presence of some relatively large populations that have a greater potential to function as sources and be more resilient to extirpations. This included variable-sized subpopulations (i.e., large [>25 pairs], medium [15-25 pairs], and small [5-15 pairs]) to provide participation opportunities that recognize the local realities of habitat availability and land ownership, and the conservation value of smaller populations that may occur there. This contrasts with the TNC ecoregional plan "one size fits all" objectives of nine subpopulations and 100 breeding pairs per subpopulation per ecoregion for all species (Floberg et al. 2004). Our approach was especially important within the Willamette Valley, where the landscape is dominated by private lands, and 100 pairs per subpopulation for some bird species can be problematic to achieve unless the pairs are spread over a large area of private lands, which may compromise the functionality as a subpopulation.

The number of subpopulations in a subregion was established by distributing the number of subpopulations among the three subpopulation sizes using an approximate doubling between large, medium, and small subpopulations.

Subpopulation Area

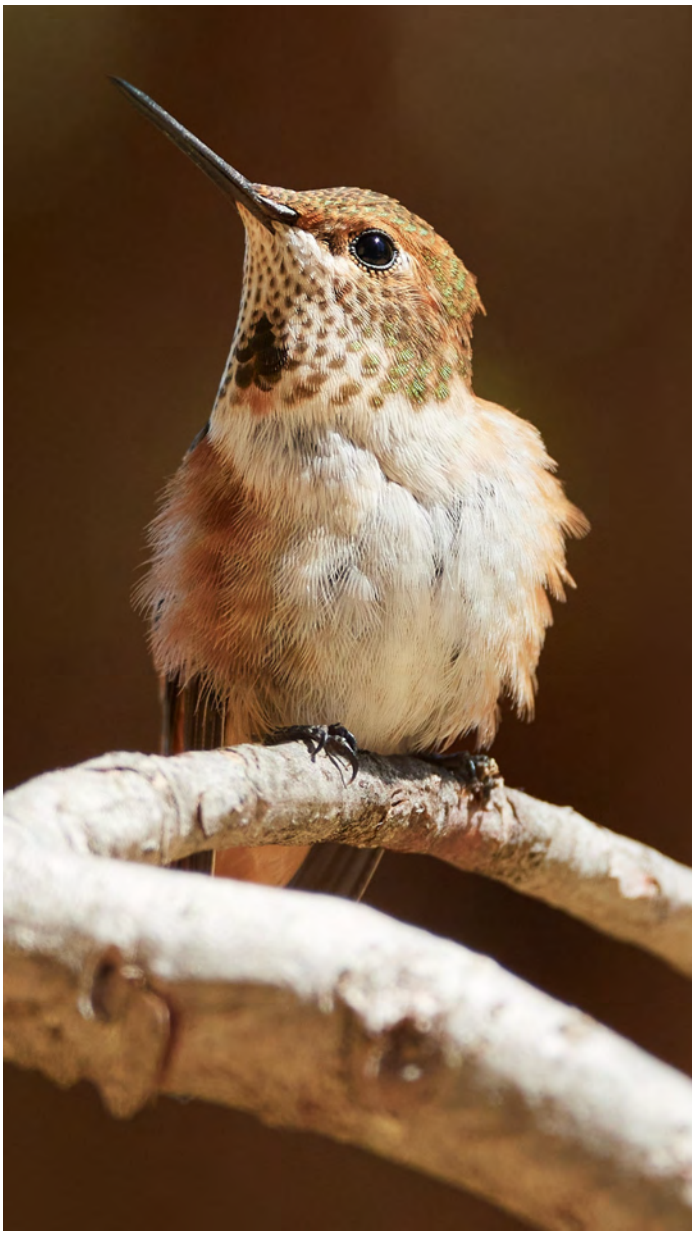
Subpopulation area objectives were established for imperiled species to maximize the amount and

contiguity of suitable habitat and minimize fragmentation of suitable habitat within the subpopulation area. The assumption is that this would ensure greater interaction and gene flow among individuals within a species, and potentially greater likelihood of persistence of the subpopulation. For three reasonably well-studied imperiled species (Oregon Vesper Sparrow, Streaked Horned Lark, Western Meadowlark), large and dense known subpopulation(s) of each species were used as the standard for the number of pairs per area. For the remaining imperiled species, the approximate mean territory size was increased by 50% as the standard subpopulation area for a pair. The reason for this increase is that the priority habitats are often in a landscape that is fragmented (naturally or man-made) and interspersed with some unsuitable habitat for each species. Thus, it was assumed that most habitat areas will require more acreage to support typical subpopulations than the mean territory size. For example, riparian forest is often embedded with areas of wetlands and riparian shrubland, and oak woodlands are often embedded with areas of prairie, oak savannah, or mixed oak-conifer forest. This concept was also used in the TNC ecoregional plan (Floberg et al. 2004), where an additional 25% of the species' mean area requirements was added to account for issues of habitat fragmentation and edge effects.

Within a subpopulation area, objectives were also set for <10% hostile habitat (e.g., urban, residential, high -density rural), and in ≥50% of the subpopulation areas to have ≥90% of the land area secured in conservation status. The former was done to minimize potential impacts on populations of already compromised imperiled species from factors such as disturbance from increased human activity, proximity to feral cats and dogs, nesting competition from European Starling and House Sparrow, and nest parasitism by Brown-headed Cowbird. The latter was done to ensure a primary conservation focus within most of the subpopulation area.

Subpopulation Distribution

Subpopulation distribution objectives were established for imperiled species to provide guidance on how to divide the geographic distribution of subpopulations within ecoregions. This was necessary to support the current and/or historic distribution of habitat and/or species occurrence, maintain multiple populations that are geographically separated to enhance the likelihood of regional population persistence, and manage the impact of local stochastic events on the overall population. Thus, the number and distribution of subpopulations was uniquely done for each species to reflect the variability of each species' ecology, population size, area requirements, and patterns of historic and current habitat distribution and fragmentation. For example, within the Willamette Valley, prairie habitat was historically and is currently unequally distributed north to south, so the subpopulation distribution objectives were adjusted accordingly.



Rufous Hummingbird by Frank Lospalluto

Appendix C. Population estimates and abundance objectives for imperiled species in each ecoregion.

Imperiled Species (subspecies)	Current Population Estimate [1]	Mean Annual Population Growth Objective Over 25 Years [1]	Population Objective in 10 Years (total % increase in 10 years) [1]	Population Objective in 25 Years [1]
PUGET LOWLANDS				
Vesper Sparrow (Oregon)	270	5.4%	456 (68.8%)	1,000
Horned Lark (Streaked)	252	4.2%	379 (50.5%)	700
Western Meadowlark	1,500	1.3%	1,712 (14.2%)	2,000
Western Bluebird	850	3.5%	1,197 (40.8%)	2,000
White-breasted Nuthatch (Slender-billed)	10	20.2%	63 (530%)	1,000
Lewis's Woodpecker [2]	0	31.8%	32 (1484%)	2,000
WILLAMETTE VALLEY				
Horned Lark (Streaked)	1,100	5.8%	1,933 (75.7%)	4,500
Vesper Sparrow (Oregon)	1,000	2.8%	1,320 (32%)	2,000
Lewis's Woodpecker [2]	0	31.8%	32 (1484%)	2,000
KLAMATH MOUNTAINS				
Vesper Sparrow (Oregon) [3]	200	6.6%	381 (90.4%)	1,000
Lark Sparrow	600	2.1%	736 (22.7%)	1,000
Lewis's Woodpecker [2]	0	31.8%	32 (1484%)	2,000

[1] See Appendix B for description of methods used to calculate these numbers.

[2] Lewis's Woodpecker has a current breeding population estimate of zero in all three ecoregions, which would require an infinite percent increase to reach the 10- and 25-year objectives. Instead, calculations were based on a current population size of two (i.e., a single breeding pair) to at least approximate the population growth objectives.

[3] Oregon Vesper Sparrow is not considered imperiled in the Umpqua Valley subregion of the Klamath Mountains (where its population is >1,000 birds). The current population estimate and population objectives presented here are for the Rogue Basin subregion only.

Appendix D. Ecoregional population estimates for focal species derived from BBS data.

Focal Species	Puget Lowlands	Willamette Valley	Klamath Mountains	Total
PRAIRIE				
Savannah Sparrow	284,700	235,900	67,400	588,000
OAK				
Chipping Sparrow	80,500	66,000	87,700	234,200
Lazuli Bunting	8,200	32,100	152,300	192,600
California Scrub-Jay	1,400	39,900	22,400	63,700
Acorn Woodpecker		3,900	30,900	34,800
Western Wood-Pewee	53,000	79,200	83,400	215,600
Purple Finch	135,100	53,500	38,400	227,000
House Wren	31,900	16,200	47,800	95,900
Oak Titmouse			3,400	3,400
Bushtit	19,900	34,500	10,400	64,800
Cassin's Vireo	2000	1,800	84,400	88,200
Hutton's Vireo	12,300	6,100	21,800	40,200
California Towhee			4,600	4,600
Blue-gray Gnatcatcher			3,300	3,300
RIPARIAN				
Bewick's Wren	34,900	31,000	15,300	81,200
Black-capped Chickadee	262,900	212,000	113,100	588,000
Spotted Towhee	973,100	645,600	531,000	2,149,700
Bullock's Oriole	7,600	13,700	51,000	72,300
Yellow Warbler	113,100	13,400	6,200	132,700
Downy Woodpecker	25,700	15,500	11,600	52,800
Black-headed Grosbeak	2,577,300	1,195,500	2,711,500	6,484,300
Rufous Hummingbird	197,300	58,400	97,100	352,800
Spotted Sandpiper*	1,600	1,000	0	2,600
Song Sparrow	722,500	451,000	157,200	1,330,700
Willow Flycatcher	241,300	51,100		292,400
Yellow-breasted Chat**	0	4,100	79,000	83,100

Light gray cells indicate that the species is present as a regularly breeding species in only one of the two subregions comprising that ecoregion, or breeding is limited and/or local. Dark gray cells indicate that the species either does not regularly breed in that ecoregion, and/or that the habitat type that they are a focal species for is absent or limited in that ecoregion, and thus no data or insufficient data are available for this estimate. Species are listed under their predominant breeding season priority habitat type, but they may occur in other habitats including ones not addressed in this document.

* Corrections for detection distance, likelihood of detecting the pair, and time of day are not available for this species from BBS. 200 m was used as the detection distance, and pair and time adjustments were given the mean value for all other focal and imperiled species in these habitat types to make the population estimate calculations. BBS routes do not adequately survey for this species; it does breed regularly in the Klamath Mountains.

** Yellow-breasted Chats regularly breed in parts of the Puget Lowlands, but BBS routes do not adequately reflect this.

Appendix E. Summary of habitat objectives for focal species in prairie, oak, and riparian habitats of the Puget Lowlands, Willamette Valley, and Klamath Mountains ecoregions of western Oregon and Washington.

Habitat Subtype	Habitat Attribute	Focal Species	Habitat Relationships/Biological Objectives			
			Vegetation Composition	Vegetation Structure	Patch Size	Special Considerations
PRAIRIE						
Dry and Wet Prairie	large habitat patches	Savannah Sparrow	mostly native grasses	<5% tree cover; <10% shrub cover; <10% forb cover; <10% bare ground	>16 ha	
OAK						
Oak Savannah or Open Woodland	low-statured herbaceous ground cover	Chipping Sparrow		canopy cover <50%; shrub cover <20% interspersed with herbaceous openings; herb cover >50% and <15 cm high		maintain cowbird parasitism rates <10%
	moderate and patchy shrub cover	Lazuli Bunting		canopy cover <40%; shrub cover 20-50% with an interspersion of herbaceous areas		
	large mature trees	California Scrub-Jay		canopy cover 20-60%; subcanopy cover <25%; shrub cover 20-60%; low-statured herbaceous ground cover <30 cm; mean tree DBH >38 cm		recently expanded range to North and South Puget Lowlands
Oak Closed Woodland or Forest	large mature trees	Acorn Woodpecker	primarily oak species in canopy with limited conifers	canopy cover >40%; subcanopy cover <15%; mean tree DBH >38 cm with >20% of trees >53 cm DBH		cavity-nester; objective for size of oak trees is to increase the likelihood of decadent limbs or snags for excavation
	canopy edges and openings	Western Wood-Pewee	<5% conifer cover in canopy	canopy cover 35-85%; mean tree DBH >38 cm; high edge to opening ratio		diverse shrub and herb layers to enhance insect productivity
	moderate to high canopy and subcanopy cover	Purple Finch		canopy cover >40%; subcanopy cover >20%; shrub cover <50%; mean tree DBH >30 cm	>10 ha	
	moderate shrub cover with open canopy trees	House Wren	native shrubs such as snowberry and poison oak; invasive blackberry cover <10%	canopy cover 25-70% with <10% conifer cover; shrub cover >30% with >50% of that cover in native species; herbaceous openings in the shrub layer <25% of the understory; mean tree DBH >38 cm with >20% of trees >53 cm		needs snags or decadent limbs for cavity nests
	moderate subcanopy or shrub cover	Oak Titmouse		canopy cover 20-70%; shrub cover 20-70%; >5 snags/ha that are >10 cm DBH; mean tree DBH >23 cm with >5 trees/ha that are >40 cm DBH		cavity-nester; objective for size of oak trees is to increase the likelihood of mature trees or snags with natural cavities
	moderate subcanopy or shrub cover	Bushtit		canopy cover 30-70%; subcanopy cover >25%; shrub cover 30-70%		
Oak-Pine	moderate to high canopy and subcanopy cover	Cassin's Vireo	mix of oaks and pines in canopy	canopy cover >65%; subcanopy cover >20%; shrub cover 30-70%; mean tree DBH >23 cm		

Oak-Hardwood	moderate subcanopy or shrub cover	Hutton's Vireo	mix of oaks and other hardwoods (madrone, bigleaf maple, etc.) in canopy	canopy cover >50%; subcanopy and/or shrub cover combined >60%		
Oak-Chaparral	dense shrub cover with herbaceous openings	California Towhee	chaparral shrubs include many Ceanothus and manzanita species; conifer cover in canopy and subcanopy <10%;	canopy cover <30%; shrub cover 40-70%; interspersion of shrub and herbaceous cover with each >30%	2-5 ha or more	
	moderate to high shrub cover	Blue-gray Gnatcatcher	chaparral shrubs include many Ceanothus and manzanita species	canopy cover <45%; shrub cover >40%	2-5 ha or more	maintain cowbird parasitism rates <10%
RIPARIAN						
Open Floodplain	interspersed bare ground and herbaceous vegetation	Spotted Sandpiper		immediate shoreline <10% vegetated for foraging; shoreline <100 m inland 10-50% patchy herbaceous cover for nesting		maintain natural processes (e.g., flooding) that maintain this habitat type
Riparian Shrubland	early successional	Song Sparrow		canopy cover <5%; shrub cover 40-70%; scattered herbaceous openings		
	moderate to high shrub cover	Willow Flycatcher		canopy cover <15%; shrub cover 50-80% with scattered herbaceous openings	>2 ha and riparian corri-dor >30 m wide	
	moderate to high shrub cover	Yellow-breasted Chat		canopy cover <20%; shrub cover 30-80% with scattered herbaceous openings	>4 ha and riparian corri-dor >30 m wide	maintain cowbird parasitism rates <10%
Riparian Open Woodland	cavities in snags or decadent limbs	Black-capped Chickadee		canopy cover 30-80%; subcanopy cover 20-40%; mean tree DBH >23 cm		needs snags or decadent limbs for cavity nests
	large mature trees	Bullock's Oriole	cottonwood-dominated canopy	canopy cover 30-60%; mean canopy tree height >15 m; subcanopy cover <20%		
	scattered shrubs with herbaceous openings	Spotted Towhee		subcanopy cover >20%; shrub cover >50%		
Riparian Closed Woodland or Forest	moderate to high sub-canopy and shrub cover	Yellow Warbler		canopy cover 25-50%; subcanopy and tall shrub cover >70%, with subcanopy cover contributing >40%; ≤10% of the habitat area should be hostile habitat (i.e., urban, residential, high density rural, agricultural); >1 km from urban/residential areas and >5 km from high-use cowbird areas	>4 ha and riparian corri-dor >40 m wide	maintain cowbird parasitism rates <10%
	cavities in snags or decadent limbs	Downy Woodpecker	canopy and subcanopy conifer cover <10%	canopy cover >50%; subcanopy cover >20%; >12 snags/ha >15 cm DBH and >1.8 m tall, of these >5/ha should be >25 cm DBH		needs snags or decadent limbs for cavity nests
	mixed hardwood and conifer trees	Black-headed Grosbeak	mix of conifers and hardwoods	>40% canopy cover; >20% subcanopy cover; mean tree DBH >23 cm		
	flowering plants	Rufous Hummingbird		shrub/herbaceous cover >20% in nectar-producing plants; increase abundance and diversity of native plants		
	moderate to high shrub cover	Bewick's Wren		patchy shrub layer with 30-80% cover; 16.4 snags/ha >15 cm DBH		needs snags or decadent limbs for cavity nests

Appendix F. Summary of habitat objectives for imperiled species in prairie, oak, and riparian habitats of the Puget Lowlands, Willamette Valley, and Klamath Mountains ecoregions of western Oregon and Washington.

Habitat Subtype(s)	Habitat Attribute	Imperiled Species	Habitat Relationships/Biological Objectives		
			Vegetation Composition	Vegetation Structure	Patch Size
Grassland	large, open landscapes with low-statured and sparse vegetation	Horned Lark (Streaked)	native herbaceous vegetation	0% canopy cover; <2% shrub cover; <1% herb cover >1.5 m tall; >90% herb cover <0.3 m tall in mid-May; >15% mixed bare ground and vegetation	>35 ha
Grassland and Oak Savannah	large areas with diverse herbaceous structure	Western Meadowlark		canopy cover <15%; shrub cover <20% and scattered; bare ground 5-15%; diverse herbaceous cover; forb cover >15%; mean grass height in mid-May 30-61 cm (<25% 15-30 cm, >50% 30-61 cm, and <25% >61 cm)	>500 ha
Grassland and Oak Savannah	low to moderate statured vegetation and scattered woody cover	Vesper Sparrow (Oregon)		canopy cover <10%; shrub cover <15% and scattered; bare ground 5-15% and scattered; diverse herbaceous cover; for cover >15%; mean grass height 15-46 cm (<20% <15 cm, and <20% >46 cm)	>50 ha
Grassland and Oak Savannah	low to moderate statured vegetation and scattered woody cover	Lark Sparrow		woody cover <25% and patchily distributed with canopy cover <10% and shrub cover 5-25%; herbaceous cover >50% and <46 cm tall; bare or sparsely vegetated ground 5-25% and patchily distributed	>8 ha
Grassland, Oak Savannah, and Open Woodland	cavities in trees with open access and low-statured herbaceous vegetation	Western Bluebird		canopy cover <35%; mean tree DBH >38 cm with >20% of trees >53 cm DBH; shrub cover <15%; ground cover dominated by grasses <30 cm tall	
Oak Savannah, Open or Closed Woodland, and Forest	mature oak trees or snags with cavities	White-breasted Nuthatch (Slender-billed)	conifer cover in the canopy and subcanopy <10%	canopy cover 40-80%; mean tree DBH >53 cm; >20% of oak trees with >70 cm DBH; subcanopy cover <20%	
Oak Savannah, Open Woodland, and Riparian	large, old trees with cavities or soft areas for excavation	Lewis's Woodpecker		5 snags/ha >50 cm DBH; canopy cover 10-35%; shrub cover 15-50%	>250 ha